STUDENT EXERCISES

MARINERS SKILLS

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Mariners Skills
Student exercises

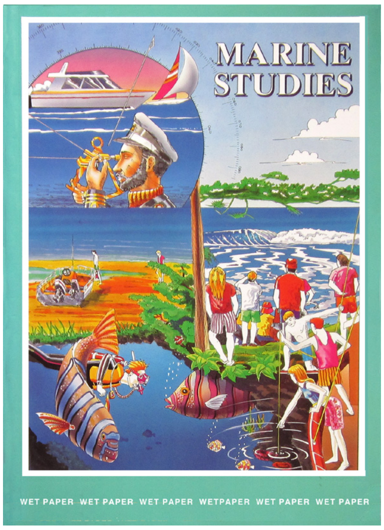
Suitable for syllabus in

Marine Studies and Marine Education (Queensland)
Marine Studies (New South Wales)
Maritime Studies (South Australia)
Senior Science Marine Studies and Nautical Studies (Western Australia)

and
companion to the textbook

Marine Studies

A course for senior students



by

Bob Moffatt
B Sc, Dip Ed, Grad Dip.Ed Admin, MACE

Wet Paper

To teachers

To ensure the best quality possible use of this book, Wet Paper offers the following services.

1. For schools who purchase single copies, a free telephone support service is available in office hours by simply telephoning Wet Paper on (075) 972 806 or by faxing your request or leaving a message on our answering machine on (075) 39 4187 any time.

2. For schools who use class sets of the book, an in-service program is available for staff wishing to implement any of the activities. A program can be arranged by contacting the manager.

3. Schools or teachers can write for our complimentary newsletter which outlines conference dates and other seminars where free workshop sessions are held explaining any activities in this book.

4. Equipment used in this book is available for training purposes at our Wet Paper Laboratory and Classroom during office hours. Our address is 14 Milbong Terrace, Queensland, Ashmore, 4214.

5. If we cannot answer your questions, Wet Paper has a team of highly qualified consultants who are willing to assist.

6. As this is the first edition, we welcome comments on any of the activities.

   In time, workbooks will be written to indicate the time each activity takes, its sequence and core questions relevant to national syllabus.

   As many exercises could take more than two hours, some selection of questions may be necessary before setting students homework.

   What's new in this book is the use of photographs for questions and cut and paste exercises; class discussions on safety issues; tables that can be photocopied and used in conjunction with handed in written work; speech bubbles in the radio section and safety information boxes. We welcome feedback on how effective these are in the classroom.

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Section 9 Body surfing

Section 10 Managing accidents

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Schools equipment and students

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SECTION 1
BOATING

EXERCISE 1
BOAT PARTS

For some of you, using a small boat will involve learning a new vocabulary. This exercise introduces you to some new words and terms.

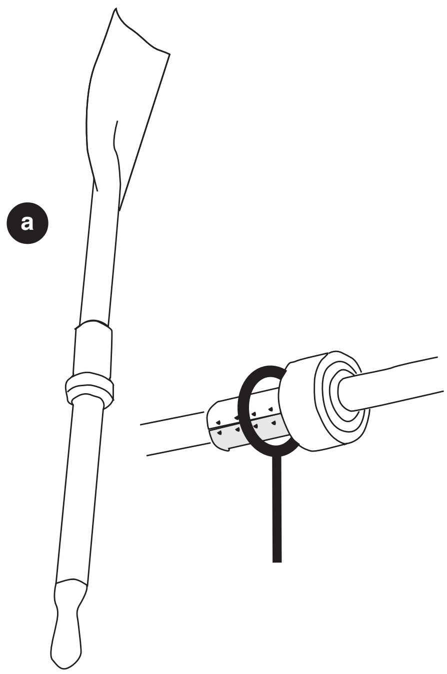
QUESTIONS

Use your textbook index to find the word *port*. Now turn to the page which discusses it in your textbook and answer the following questions.

1. Use your textbook to identify the following terms and mark their location on the drawings in Figure 1.1.a and Figure 1.1.b.

- Stern
- Bow
- Transom
- Keel
- Ribs
- Gunwale
- Seat (Thwart)
- Keelson

- Grip
- Shaft
- Oar stop
- Rowlock (crutch)
- Rowlock block
- Blade



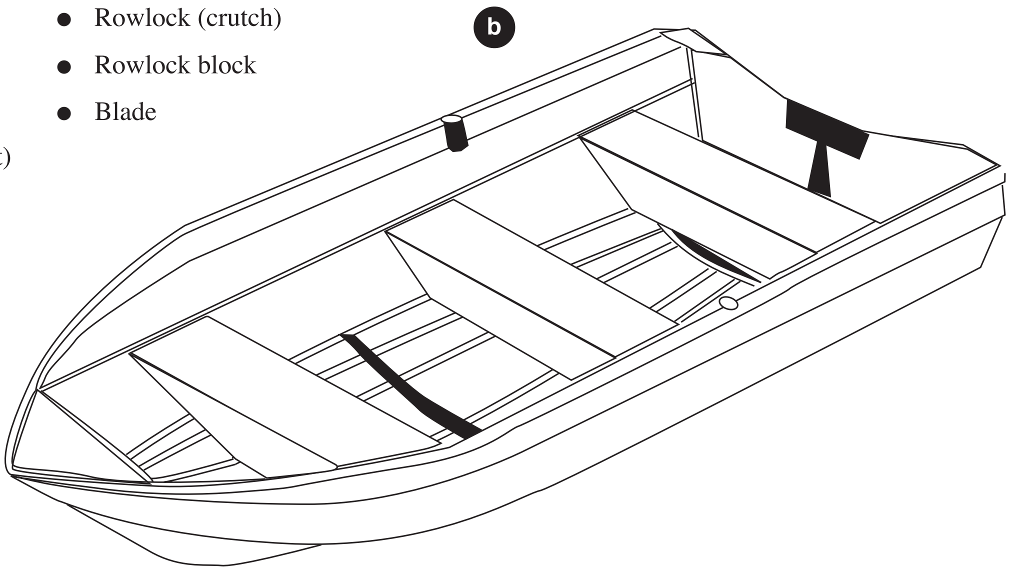


Figure 1.1 Students may make one copy of this page so that they can attach their answers before handing in for marking.
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2. Redraw the boat outlines in Figure 1.2 and use the list below to mark in the following places.
   - Ahead
   - Astern
   - Port bow
   - Starboard bow
   - Forward
   - Aft
   - Beam
   - Port quarter
   - Starboard quarter
   - Deck area
   - On the port bow
   - On the starboard bow
   - Athwartships
3. Read the information box in Figure 1.3 and complete definitions for the words listed in Figure 1.4

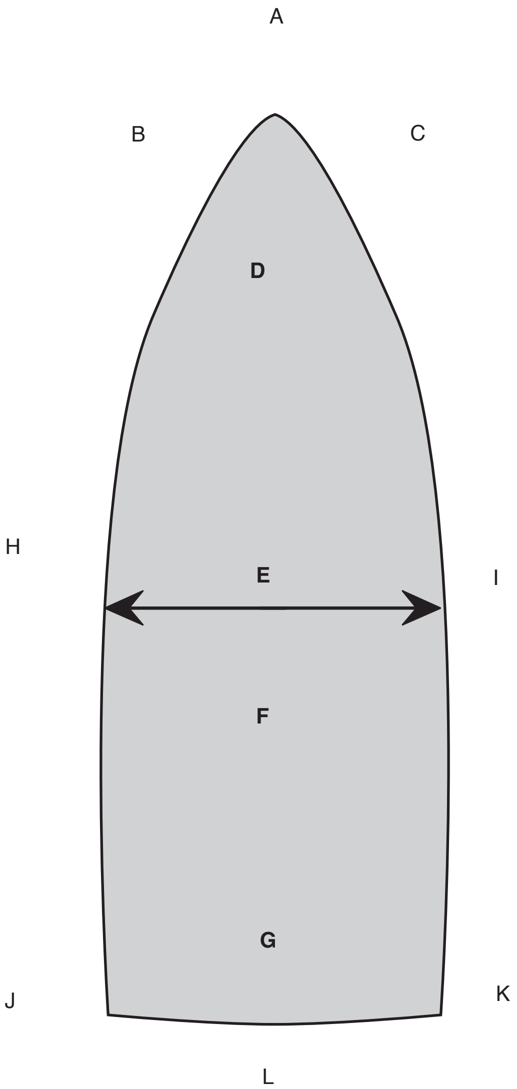

Figure 1.2 Places on a boat/ship/dinghy

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Writing definitions

In writing definitions, the following format could be used.

Item … class … distinguishing feature … example.

Example

1. The definition of the word, 'Runabout', could be written as follows:

   A runabout is an open vessel which has been fitted with either an outboard or inboard engine.

   Item … A runabout

   Class … is an open vessel

   Distinguishing feature … which has been fitted with either an outboard or inboard engine

2. Note that not all definitions require an example.

Task

Identify the parts of the following definition.

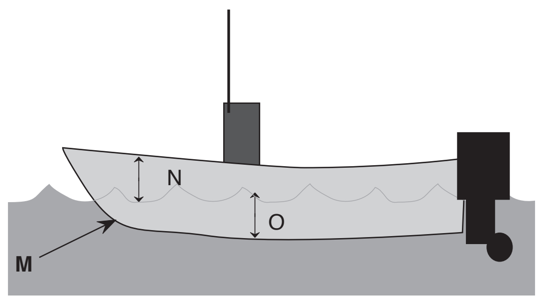
Motor cruisers are open vessels, ranging from 7 m to 18 m or more in length, and are designed for cruising, living and sleeping on board in comfort.

Item:

Class:

Distinguishing feature:

Figure 1.3 How to write definitions (based on an original activity by Gwen Connolly, St, Augustines College, Cairns).



Term	Definition
e.g. deck	The deck is the part on a boat which occupies the entire floor space such as the area inside a dinghy under the seats. Item / Class / Distinguishing feature / Example
Stem	
Stern	
Bow	
Transom	
Keel	
Ribs	
Gunwale	
Oarlock socket	
Seats	
Keelson	
Rowlock	
Shaft	
Oar stop	
Grip	
Blade	
Ahead	
Astern	
Port bow	
Starboard bow	
Forward	
Aft	
Beam	
Port quarter	
Starboard quarter	
Deck area	
On the port bow	
On the starboard bow	
Athwartships	

Figure 1.4 Students may make one copy of this page so that they can attach their answers before handing in for marking.

Exercise 2
Sailing terms

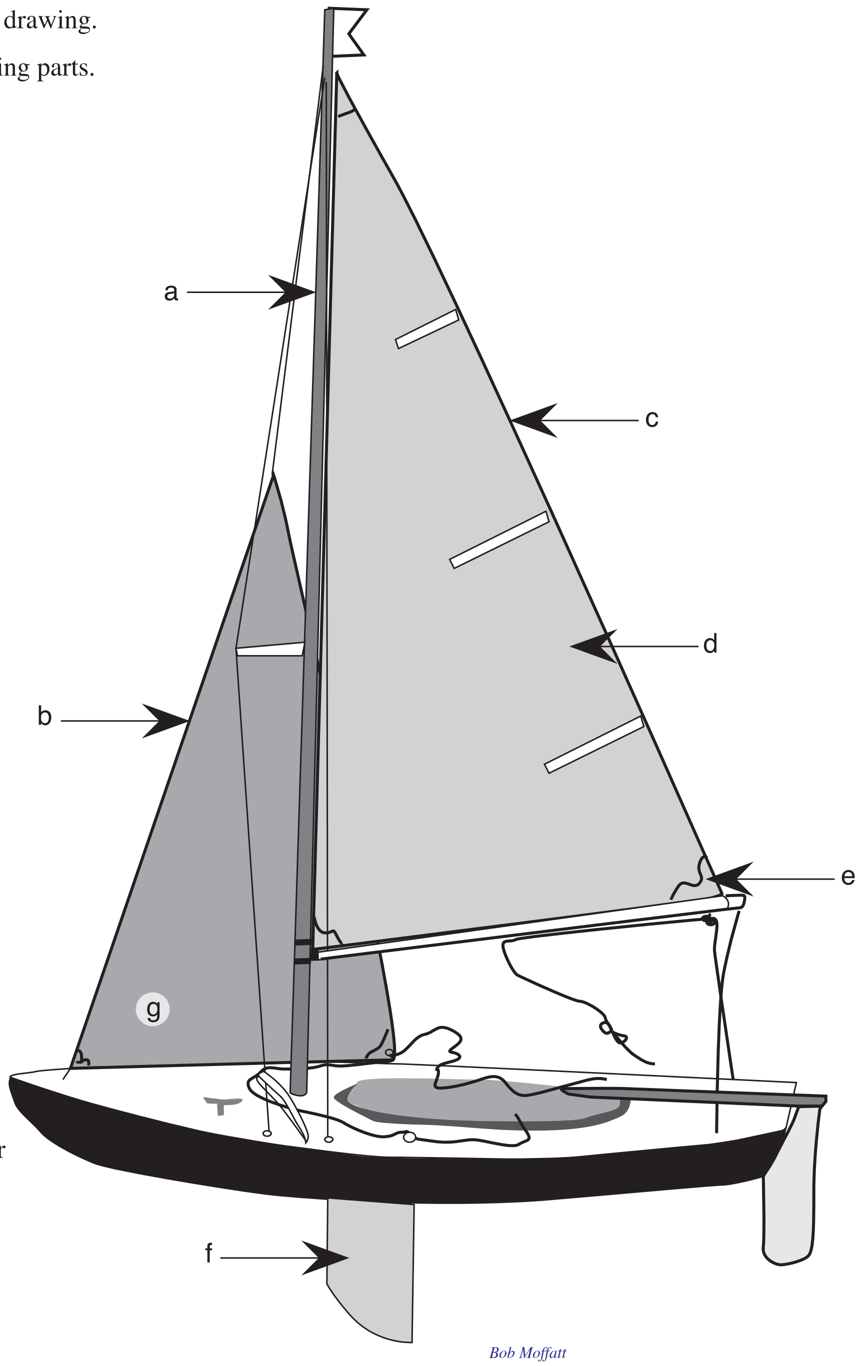
Questions

1. Select a new page in your notebook and redraw the illustration on this page.

   Draw in pencil first and then ink in the drawing.

2. Use the textbook to mark in the following parts.
   - Weather vane
   - Headboard
   - Mast
   - Batten
   - Leech
   - Luff
   - Shroud
   - Mainsail
   - Clew
   - Foot
   - Boom
   - Block
   - Mainsheet
   - Jib sheet
   - Figure of eight knot
   - Tiller
   - Rudder
   - Centreboard
   - Cleat
   - Jib
   - Gooseneck
   - Stays

3. Complete Figure 2.1 with the aid of your textbook.



Term	Connects to	Your explanation
e.g. Cleat	The deck or lines	Small metal structure to which lines (ropes) are tied
Weather vane		
Headboard		
Mast		
Batten		
Leech		
Luff		
Shroud		
Mainsail		
Clew		
Foot		
Boom		
Block		
Mainsheet		
Jib sheet		
Figure of eight knot		
Tiller		
Rudder		
Centreboard		
Cleat		
Jib		
Gooseneck		
Stays		

Adapted from an original layout by Geoff Jensen, Innisfail State High School

Figure 2.1 Students may make one copy of this page so that they can attach their answers before handing in for marking.

Exercise 3
EPIRBs

Questions

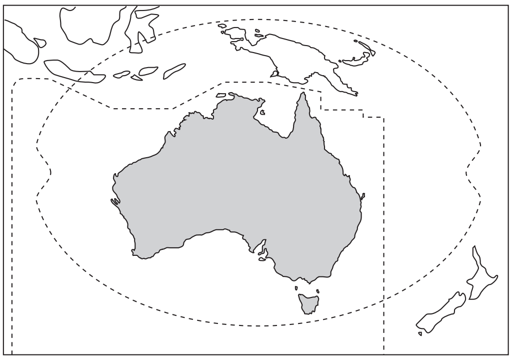
View the video, *Alive Via Satellite*, and answer the following questions (note that an additional safety equipment exercise is given in Exercise 47, page 82).

1. What are the responsibilities of the Maritime Rescue Co-ordination Cantre?
2. How many reported incidents does the centre deal with annually?
3. What development has made EPIRBs more effective as distress signals?
4. Where is Australia's local user terminal located?
5. Which beacon is recommended for boats operating beyond 900 km offshore?
6. What is the fundamental difference between EPIRB and Marine Radio transmissions?
7. Complete this table

Beacon	Time to relay signal accurately
121.5 MHz	
406 MHz	

8. Look up the abbreviation EPIRB in the index of your textbook. Now use the section in your textbook to locate the information necessary to answer the questions below.
    a. What does the term stand for?
    b. What happens when it is activated and what frequency does it transmit?
    c. How far away can the signals be detected?
9. Look at Figure 3.1 and answer the following questions.
    a. Forecast the result of an activated EPIRB off the Queensland coast as shown in the diagram.
    b. Identify two problems that may exist in this rescue situation.
    c. What do the terms, SAR, LUT, ELT and MRCC, stand for?
    d. If you were sailing to Singapore from Adelaide, when would your EPIRB be ineffective?
10. Read the article in Figure 3.2 on the page opposite about the adventures of Don Ling.

    Now use the arguments presented in the article to write a one page essay on the importance of carrying an EPIRB.



COSPAS /SARSAT	International Satellite Distress Alert and Locating System
ELT	Emergency locator transmitter
LUT	Local user terminal
RCC	Rescue Co-ordination Centre
SAR	Search and Rescue
MRRC	Maritime Rescue Co-ordination Centre

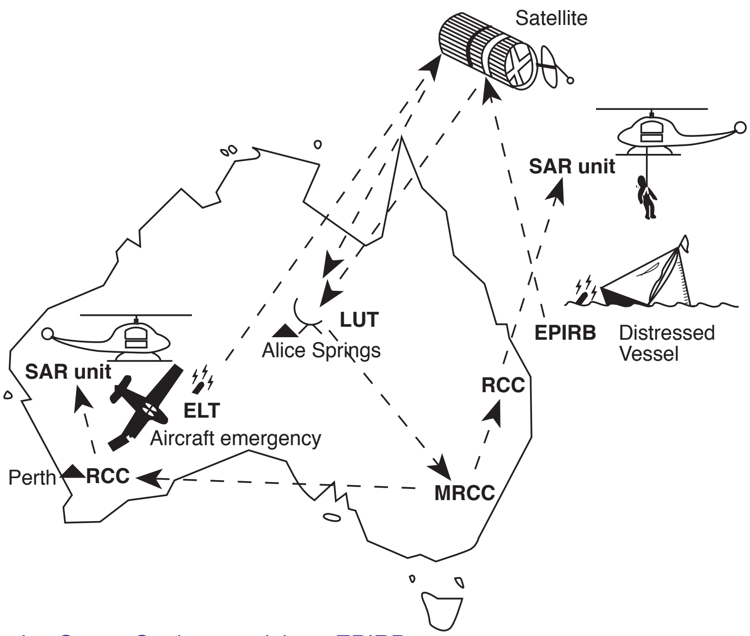


Figure 3.1 Adapted from Maritime Rescue Co-ordination Centre Canberra article on EPIRBs

Bob Moffatt

Saved by simple investment

By Dennis Watt

Lone English sailor Don Ling congratulated himself on "the best 400 quid I ever spent" when a rescue helicopter picked him from wild seas off Fraser Island yesterday.

During his ordeal 40km north-east of Sandy Cape, the shipwrecked former civil servant clutched a radio beacon which transmitted distress signals via satellite to Canberra.

Seven hours after his 12.5m catamaran sank following a collision with a bulk ore carrier, the signals led a Bureau of Emergency Service helicopter from Brisbane straight to Mr Ling.

The helicopter, after being alerted by the Marine Rescue Co-ordination Centre, was unable to leave Brisbane until 4 a.m. because of poor weather.

Clad only in his life jacket, waterproof coat, T-shirt and cotton shorts, Mr Ling, 59, battled cold, 3 m seas, driving rain and 35 knot winds.

Huge waves pummelled him throughout the night, leaving his lean frame with a mass of bruises.

The life saving EPIRB – emergency position indicating radio beacon – had cost Mr Ling four hundred pounds ($1000AUS) when he left England on his world sailing odyssey four years ago.

They now cost about $200.

A battered Mr Ling, speaking from his bed at the Maryborough Hospital where he is under observation, said: "When I bought the beacon, I thought it was a lot of money.

Now I reckon it's the best money I've ever spent in my life. Only a fool would go to sea without one."

Mr Ling said his boat sank about midnight, six hours after the collision with the freighter which stopped to provide assistance and offered to take him aboard.

But Mr Ling was confident *The Blue Goose of Arne* was seaworthy enough to continue his return trip from New Zealand to Gladstone.

Thirty minutes after the freighter departed, one of the hulls split and the boat began to sink.

Mr Ling told of his relief in seeing "a blue dot on the horizon" soon after 7 a.m.

Helicopter pilot Rob Rich and crewman Daren Parsons and Mal Aitken saw Mr Ling when they passed over him for the third time.

"On the third time they came around, I came out on top of a wave and they saw me waving," he said.

Mr Ling described all those involved in his rescue and hospital care as "angels of mercy."

All his possessions, other than the clothes he wore and a suitcase of clothes in England, were lost when the yacht sank.

The sailing grandfather's greatest regret was the loss of notes and photos recording his trip.

"But I've got my life and I've got some very good friends around the world," he said.

At times he was frightened when swamped by "waves of white water but I wasn't worried."

Mr Ling said he tried to conserve heat and energy during the night by pulling his body into a 'Z' shape.

When dawn broke, he "did a few exercises and started swimming around."

As soon as he gets a chance, Mr Ling will be back at sea again, probably as a crewman.

"I'm happy at sea," he said.

Figure 3.2 Article courtesy Gold Coast Bulletin

Exercise 4
Safety of boat and crew

Use your textbook index to locate the term *seaworthiness* and turn to the page which discusses safety of boat and crew.

Use the boxed section to complete the following sentences.

Note: A cloze exercise is where you are asked to locate a block of text from your textbook and fill in the missing words. The idea is that you get to learn new words by reading carefully selected sentences. You also learn how to use your index.

Figure 4.1 Courtesy of the Expedition Boat Shed in WA.
(thanks Paul Willison and Paul Boddington)

Questions

1. The vessel should be ________________ regularly for __________ , ____________ or ____________ pieces of superstructure.

2. __________

   If a certificate of survey is required, this should be kept up to date because the legal requirements for a boat hire have to be considered.

3. Equipment

   Back-up power supplies, an EPIRB, radio, ground and sea anchors carried. The ________________ should ensure that the engine is in good ________________ ______________, there is enough ________________ for the trip and there is sufficient ________________ on board to conform with safety or trip requirements.

4. Stability

   People on board should be made aware of the need to keep the boat ________________ and to move around and stow gear to minimise the chance of ________________ .

5. ________________

   Engines have been discussed in detail in Chapter 2, however the skipper should be reminded that before departure, the condition should be checked and fuel mixed in correct proportions. ________________ for the trip should be taken and should be safely stored for trailering making sure it does not leak creating a fire hazard.

6. ________________

   Safety regulations as outlined on in the safety chapter, state the amount of water to be taken for each person on board. ________________ and long life foods are a good idea. Army ration packs if available are also worth considering.

7. ________________

   Chapter 8 (of your textbook) discusses the radio as the vital link with shore. A ________________ should be made prior to leaving to ensure the radio is working correctly.

8. ________________

   The condition and number of PFDs (lifejackets) should match the maximum number of people the craft is licensed to carry as should ________________

9. Study Figure 4.1 and answer the questions below.
   a. What are the students practicing?
   b. What is the name of the craft they are in?
   c. When is such a craft used?
   d. Why is this type of drill necessary?
   e. Describe some of the problems that could exist if people were to spend 2 – 3 days in this craft.

10. You have a 12 m yacht and are sailing from Fremantle to Cairns around the Great Southern Ocean. You have a crew of five and plan to take two months.
    a. Fill out the form as shown in Figure 4.2 opposite. (You may make up parts of your yacht, e.g. colour, sails, etc.)
    b. If you were to undertake this voyage, where would you send the form?
    c. Why do mariners complete forms such as this?

Sea Safety - Small Craft Particulars
PLEASE PRINT CLEARLY

Description of Vessel -
Please include photograph if possible

Name of vessel			
Licenced radio call sign			
Reg. No.		Sail No.	
Type eg yacht, motor sailer, runabout, etc.			
Rig			
Length	*Metres*	Class	
Hull material			
Engine type(s)			

Colour

Hull			
Superstructure			
Sails			
Mast		Deck	

Distinctive features or markings

Fuel

Type			
Amount carried	*Litres*	Range on engine	

Average cruising speed

Power		Sail	

Other pertinent information

General Operating Pattern and Area

At discretion of owner, this section records additional information of potential use to SAR authorities, for example, "fishing trips about 2 weekends per month during summer months from ramps between Port Stephens and Batemans Bay", or "most events on WA ocean racing calendar and one cruise to northern waters per year", or return to Sydney from Hobart third week in January with following crew ..."

Safety and Emergency Equipment

Flares/smoke

Type (Para., hand held, other)	Colour (W,R,O)	Number

Ship's tender

Yes ☐ No ☐ — Type / Colour / Propulsion

Liferaft

Yes ☐ No ☐ — Type / Manufacturer / Capacity

Lifejackets

Yes ☐ No ☐ — Number / Colour

Lifebuoys

Yes ☐ No ☐ — Type / Colour / Distinguishing marks

Radio transceivers HF ☐ VHF ☐ 27MHz ☐ INMARSAT ☐ Digital selective calling ☐ Other (specify)

Transmitter frequencies

Frequencies most often monitored

Distress beacon (EPIRB)

Yes ☐ No ☐ Operating frequency(ies) 406.0 MHz ☐ 121.5 / 243.0 MHz ☐ INMARSAT E ☐ Hex ID Float free Yes ☐ No ☐

Signalling lights

Yes ☐ No ☐ Spotlight ☐ Strobe ☐ Torch ☐

Navigational aids

Radar ☐ GPS ☐ Other

Food		**Water**	
Number of person days		Amount	*Litres*

Owner and Contacts

Give names, addresses and phone numbers of owner and 24 hour contact, also other intermediate contacts with whom you would normally leave sailing plan details.

Owner

Name
Address
Phone

24 hour contact

Name
Address
Phone

Person/Authority holding a copy of this form

Name
Address
Phone

Form filled in by

Please give name, address and phone number if different from above

Name
Address
Phone

For sea safety's sake, leave a completed copy of this form with your sail plan contact as noted in Guideline A overleaf.

Sea Safety Reporting Guidelines

Skippers should be aware of three basic steps which should be used in giving notice of their vessel's activities when going out to sea.

A. Lodging a Sail Plan

Leave individual trip details with a responsible member of your family, a friend, or the local marine search and rescue group, on the understanding that they will institute follow-up action, ie inform local police or Rescue Coordination Centre Australia (02 6230 6880 or 1800 641 792), if you are overdue beyond a nominated time (SAR time).

B. Maintaining Radio Contact

Establish radio contact before proceeding to sea. When at sea report regularly, preferably by prearranged skeds, to a shore contact. Be clear in your mind whether the radio base can be relied upon to act if you do not come up "on sked" and be aware of the follow up procedure used. Use a short range or long range radio base, to suit your operation.

C. Sending a Small Craft Particulars Form

This form is very important for Search Planning. Its purpose is to provide a record of small craft details at the Rescue Coordination Centre Australia so that details are readily available. Small Craft particulars are not used for any other purpose without the consent of the boat owner.

Please send completed forms to:
Manager Operations
AusSAR
Australian Maritime Safety Authority
GPO Box 2181
Canberra ACT 2601
Fax: (02) 6230 6868

For a postage paid version of this form please call 1800 641 792

Notes on the Small Craft Particulars Form

Forms received will be regarded as current for a three year period and filed accordingly. Please update your reports as necessary. Updating can cover one or all sections, eg changes in basic description, changes in crew or operating area to cover particular cruise or race activities .

This form should not be used for a sail plan for individual voyages.
Step A above is appropriate for that purpose. The Rescue Coordination Centre Australia will respond immediately to alerts of actual distress situations.

Although the Commonwealth and State authorities concerned will take all steps which they consider are necessary where a vessel is reported missing or a distress/urgency call is received, it should not be assumed that they are undertaking liability for failing to initiate or undertake a search.

AusSAR Australian Search and Rescue
A division of the Australian Maritime Safety Authority

AMSA 80 (7/00)

Figure 4.2 Courtesy of the Maritime Rescue Co-ordination Centre.

Exercise 5
PFDs

Method

1. At the pool, select a PFD that is your size and put it on.
2. Ask your partner to help you adjust the straps.
3. Try out the following activities.
   - Person overboard. One person jumps into the pool and swims out from the side. Another person shouts 'Man overboard' and a third rushes to get a PFD and throws it to the person who fell overboard. The person in the water swims to the PFD, puts it on and swims to the shore where the two other members of the team pull them out of the pool.
   - The huddle. Jump into the pool with the PFD on and re-adjust it if necessary. Swim towards the rest of the class and form a huddle as shown in Figure 5.1.

Figure 5.1 Courtesy of the Expedition Boat Shed in WA.
(thanks Paul Willison and Paul Boddington)

Questions

Use your textbook index to locate the word *PFD* and turn to the page which discusses it.

1. Which type of PFD would you need in the following situations?
   a. You are the driver of a 12 ft tinny in smooth water The day is fine and there is no wind. Two 16-year-olds have decided to go scurfing with you.
   b. A woman is taking her husband and three children (ages 12 years, 6 years and 18 months) fishing. She has 20 years boating experience and is going offshore over a bar.

   What types of PFDs should she take and when should they be worn?

   c. A 22-year-old who has completed Marine Studies at school and a marine course at university wants to set up a sailing school. What type of PFDs should be purchased?
2. Figure 5.2 shows two symbols.
   a. What does the symbol with the series of ticks mean and what does the number under it mean?
   b. What does the circular symbol with the triangle inside mean?

Figure 5.2 Information for question 2

Materials and equipment (per group)

Equipment required

- PFDs
- swimming pool

Exercise 6
Flares

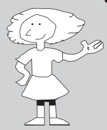
Questions

1. Examine the packet of flares from your boat safety kit.
   a. What types are there in the pack?
   b. What date do they expire?
   c. What methods of storage do you think are appropriate?
   d. When do you use flares?
   e. How much does a set of flares cost?
   f. Where do you buy them?
   g. What do your local government regulations say about when flares should be carried?
2. Use your textbook index to find the term *flares*. Now turn to the page which shows a series of colour photographs and complete the table below.

Safety

If demonstrating pyrotechnics, it is suggested that you:

1. make sure students are standing well back from the demonstration
2. have approval to ignite flares from the police
3. contact rescue associations and put a notice in the paper of your intentions
4. chose a large area on a calm day so that if you use parachute flares they don't end up starting a bushfire



5. discuss other possible safety issues with your school principal and school safety officer

Materials and equipment (per group)

Equipment required

- packet of hand flares

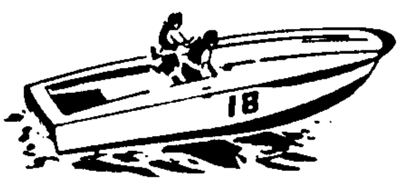
Type of flare	Description of how to use	When to use	Colour of flare
Red	1. ______ 2. ______ 3. ______ 4. ______ 5. ______ 6. ______		
Orange	1. ______ 2. ______ 3. ______ 4. ______ 5. ______ 6. ______		
Parachute	1. ______ 2. ______ 3. ______ 4. ______ 5. ______ 6. ______		

Exercise 7 Rules and regulations

Questions

Use your textbook index to find the section on *rules and regulations* and answer the following questions.

1. Give an example of State marine and harbour regulations.
2. What do water traffic regulations deal with?
3. Find the boating safety checklist brochure and outline what it details.
4. Give an example of management of waterside regulations. Why are these regulations important?
5. Give an example of an antipollution regulation.
6. The text lists seven common port regulations. Give these and state why each is important.
7. Locate an example of the Great Barrier Reef Marine Park zoning regulations and state the activities that are permissible in each of the following zones:
   a. General use A zone
   b. Scientific research zone
   c. Marine Park B zone
8. What is the difference between the Marine Park A and B zones?
9. Locate the sample map of the Whitsunday Group. How many zones are present on this zoning map?
10. Read the boxed section to the right and answer the following questions.
    a. What is the basic purpose of the regulations?
    b. What are the rules and standards set?
    c. How are the actions of a skipper of a vessel at sea judged in a collision situation?
    d. If you are driving a small craft, what is your responsibility with regard to larger vessels?



Why we have regulations

A system to avoid collisions at sea was adopted in Australia in 1977. Basically the rules determine, in a situation where a collision may occur or in overtaking or passing, which vessel has the right of way and which vessel is obliged to give way.

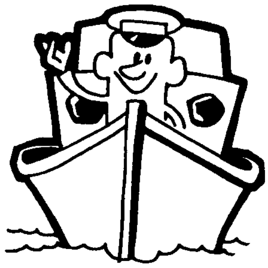
Rules set standards and procedures for visual signals, through the use of shapes, sounds and lights, for warning and distress.

In any dispute between the operators of vessels at sea, the actions of each skipper are judged on how they performed within these rules.

Skippers of small craft should keep out of the way of larger vessels because they have great difficulty manoeuvring.

It should always be remembered that the prime responsibility of skippers within these rules is to avoid collision.

Exercise 8
The skipper



Questions

Use your textbook index to find the term *skipper* and turn to the pages discussing the role of the skipper.

Use the information supplied to complete the table below.

Questions to crew	**Reporting accidents**
Hypothermia	**Safety of boat and comfort of crew**
Alcohol and boating	**Guests on board**
Salvage	**Seasickness** 

Figure 8.1 The role and responsibility of the skipper. Students may make one copy of this page so that they can attach their answers before handing in for marking.

Exercise 9
Fires and fire extinguishers

Questions

Use your textbook index to find the heading *Fire and extinguishers* and answer the following questions.

1. What are the three essential components of a fire?
2. What are three types of fire and how are they fuelled?
3. Why are halon fire extinguishers being phased out?
4. Redraw and complete Figure 9.1 in your notebook using colours to highlight your answer.

Materials and equipment (per group)

Equipment required

- coloured pencils

Option

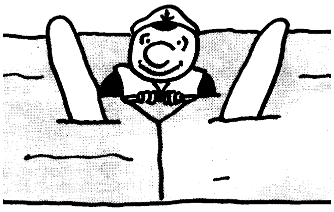
Your teacher may be able to arrange a fire fighting display by the local fire brigade at your school.

Illustration courtesy Queensland Transport

		Water	Foam	Dry chemical powder			CO_2
Fire extinguisher selection chart							
Indicator and colour							
Australian Standard							
Class	**Type of fire**	**Contents electrical conductive**		**Contents electrical non-conductive**			

Figure 9.1 Students may make one copy of this page so that they can attach their answers before handing in for marking.

Exercise 10
Water ski signals



All illustrations on this page are from Queensland Transport and are reproduced with permission and gratefully acknowledged.

Questions

Use your textbook index to find the section on water ski signals.

The signals on this page are common in the sport of water skiing.

Match each of the signals in the numbered list with one of the boxed illustrations. Then use the words from the textbook to write a description of the signal in the appropriate box.

1. Start
2. Faster
3. Slower
4. Speed required
5. Speed OK
6. Turns
7. Whip off
8. Stop
9. Back to dock
10. Cut motor
11. OK After fall

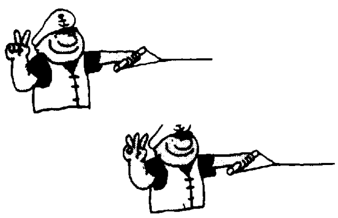
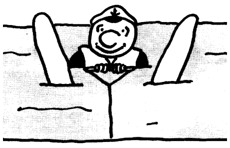
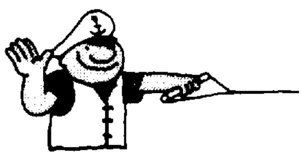
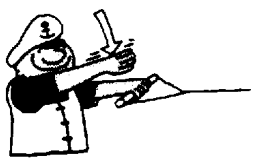
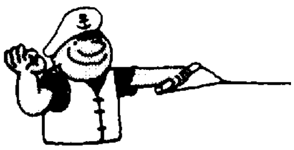
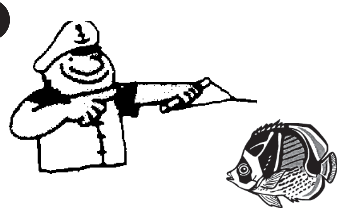
E.g. OK after fall. After a fall, skier should clasp hands over head if unhurt, until seen by boat driver 	A 	B 
C 	D 	E 
F 	G 	H 
I 	J 	K 

Figure 10.1 Students may make one copy of this page so that they can attach their answers before handing in for marking.

Exercise 11
Rope

Questions

Use your textbook index to find the heading *Rope* to complete this exercise.

1. Read the article written by Dan Cross in the box below and answer the following questions.
   a. Is the rope shown in Figure 11.2, laid, staple or braided?
   b. List four types of synthetic fibre.
   c. If you were given rope in a coil, how should you unwind it?
   d. What is the best practice when cutting a rope from a coil?
   e. How should ropes be stored?
2. The next four questions refer to diagrams a – e in Figure 11.1. Use your textbook to answer the questions.
   a. What type of finishing technique is shown in e? Describe the process.
   b. What type of finishing is shown in a – d ?
   c. Obtain a piece of rope and binding twine and finish off the rope as shown in a - d and hand it in with this exercise.

      Alternatively make a description of the steps involved in a – d as shown in Figure 11.1
3. In Figure 11.2, what are the names of the parts labelled a – e?

This information box was written by Dan Cross.

ROPE in use afloat today has usually been manufactured from synthetic fibres:

- Nylon (polyamide)
- Terylene (polyester)
- Polyprop (polypropylene)
- Silver (polyethylene)

These ropes have now almost replaced the natural fibres, manila, sisal and cotton.

There are three basic types of rope.

Laid rope is manufactured by first twisting fibres into yarns, which are then twisted (in the opposite direction) together into strands. Three strands are then twisted together (again reversing direction) to form.

Staple rope is where the fibres are shorter in length than the rope, in other words they are not 'continuous' running the full length of the rope. The 'hairy' appearance of natural fibre ropes and 'staple silver' is due to the ends of these shorter fibres sticking out.

Braided ropes may be either a solid plait or have a plaited outer sheath with a plaited or laid core.

Care of rope

This starts with the way it is drawn from a coil or unwound from a spool. Rope is manufactured by a series of twisting processes which causes it to develop a tendency to kink if not handled correctly. When taking rope from a spool always allow the spool to revolve and never take it from over the flanged ends.

Rope supplied in a coil should be drawn vertical from the centre of the coil in a manner which allows the rope (if right-hand lay) to unwind anticlockwise from the centre. A tip here is to run it through a block located somewhere above the centre of the coil.

After cutting off the length required it is good practice to prevent the ends from fraying by applying a sailmaker's (preferred) or common whipping. Natural fibre rope will always require to be whipped and although an alternative on synthetic rope is to simply melt the end, a proper whipping is more effective.

Rope requires protection from abrasion, chafe, and dirt, and while heat and UV rays will cause synthetic fibre ropes to deteriorate, water will cause natural fibre rope to rot. A piece of hose slid onto a rope to prevent the rope chafing against a hard surface makes an effective 'Scotchman'.

The best method of storage is, after removing any knots, to coil the rope and hang it in a light airy place away from any heat and not in direct sunlight.

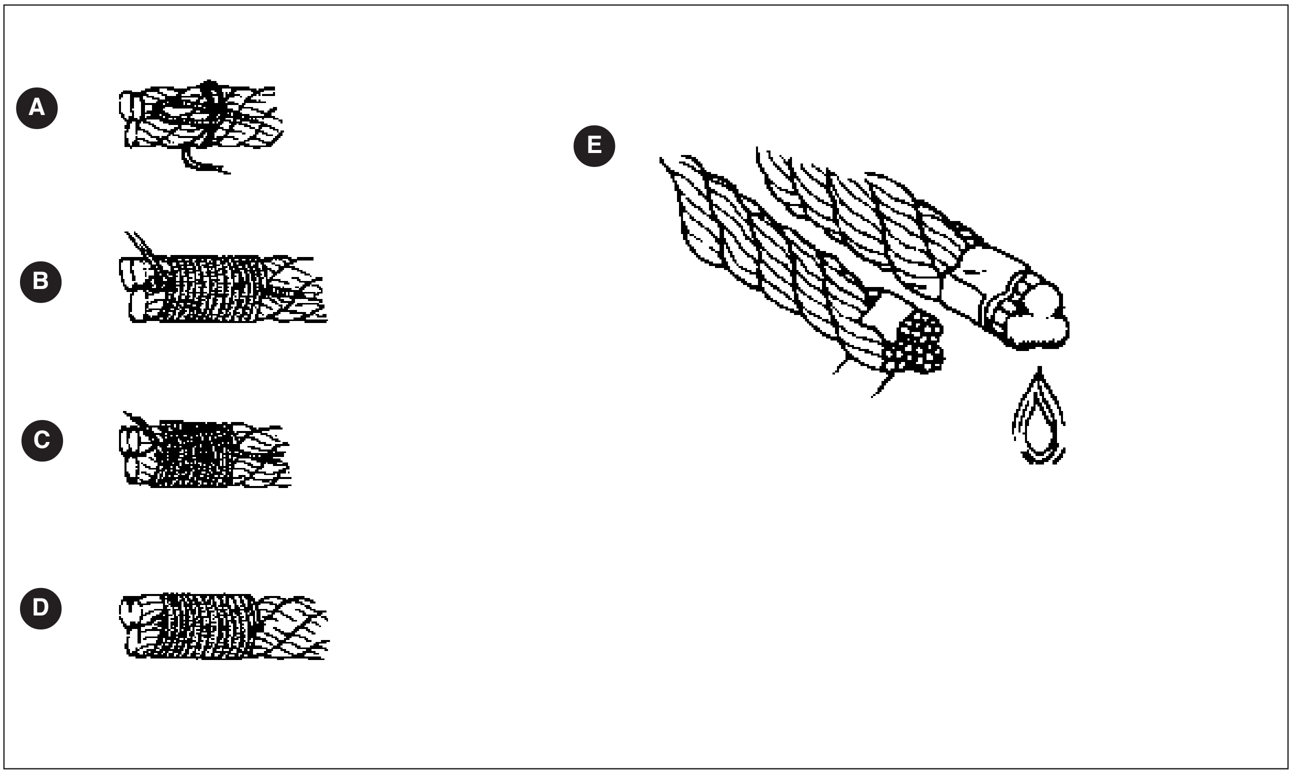


Figure 11.1 Diagrams for questions on page 16

Wet Paper

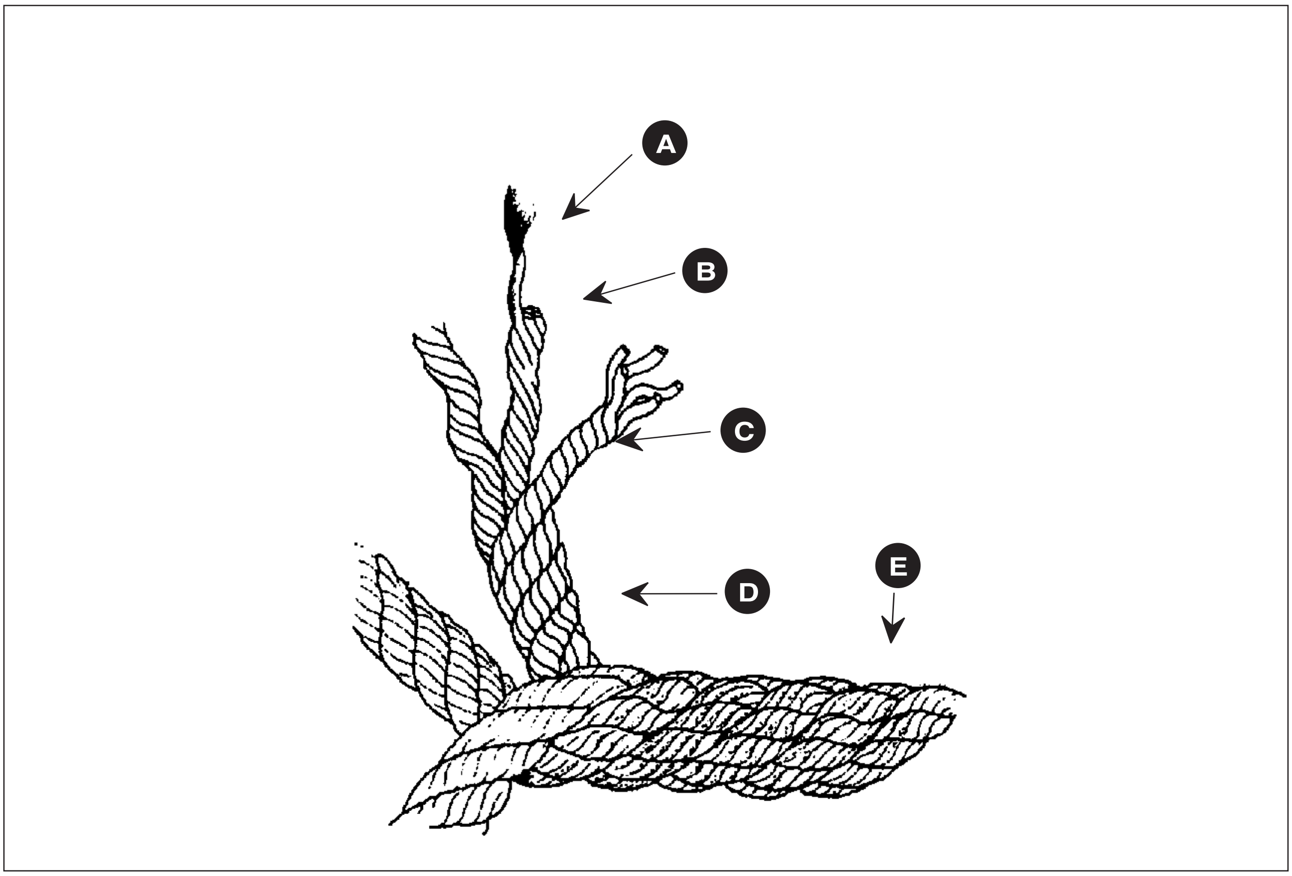


Figure 11.2 Diagrams for questions on page 16

Wet Paper

Exercise 12 Bowlines

Method

The bowline, definitely the most useful knot of all, is used to form a temporary loop in the end of a rope and may be used where a line is required to be secured through or around something.

1. Research the terms *bitter end*, *standing part* and *bight*.
2. Now follow the instructions below.
   a. Pass the bitter end, which is held in the right hand, across and over the top of the standing part, which is being held in the left hand, and while pressing down and in towards the bottom of the large bight with the right hand, lift the standing part held in the left hand so that it forms a small loop over the bitter end.
   b. The end is then passed around behind the standing part and back down through the small loop and all worked tight.

Alternatively

1. Imagine the knot as tree, a rabbit and a rabbit hole. The loop you make could be called the rabbit hole and the end of the rope as indicated in Figure 12.1, the tree, around which the rabbit runs.
2. Now follow Figures 12.2 and 12.3.
   1. Make a loop in the rope end (sometimes called *a rabbit hole*),
   2. Pass the free end up through the loop (sometimes called *up the rabbit hole*).
   3. Then pass the free end around the rope end (or *around the tree*)

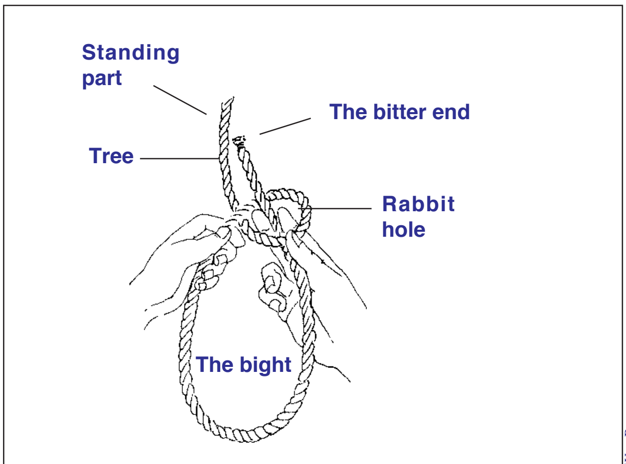


Figure 12.1 Imagine the knot as a tree and a rabbit hole

Materials and equipment (per pair)

Equipment required

- 1 m of rope

4. Bring the rope back through the loop (*back through the rabbit hole*).
5. Pull the knot tight.

Questions

This knot can be used for making a loop for a mooring, attaching warps to boats, tying equipment in a boat, or just for making a loop at the end of a rope that will not slip.

1. Name three places you could use this knot.
2. What is the great advantage of this knot?
3. What parts of tying this knot did you find most difficult?
4, Look at Figure 12.3. There is a section of the rope labelled a. Why is so much rope left over in tying the knot?

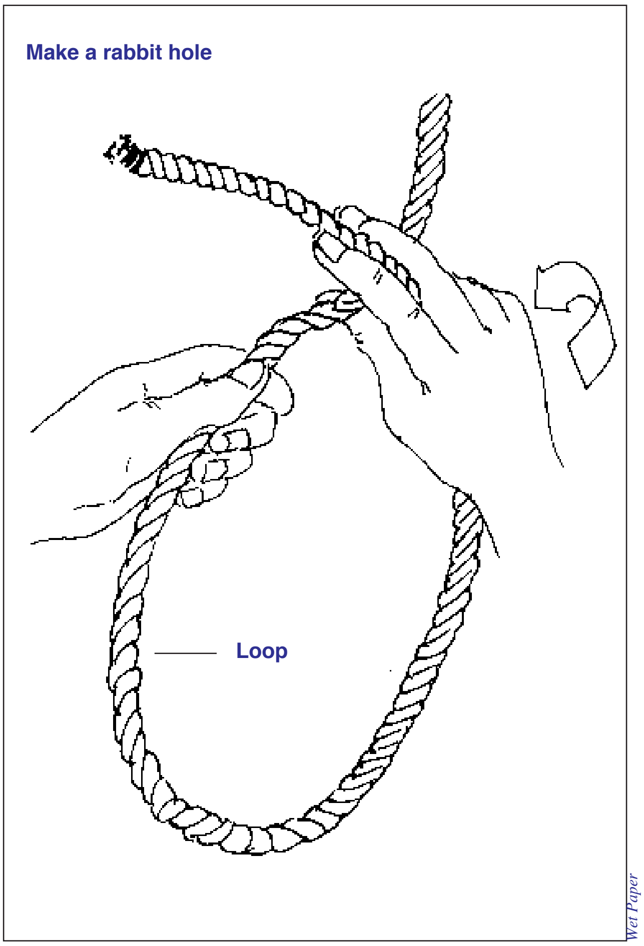


Figure 12.2 Make a rabbit hole

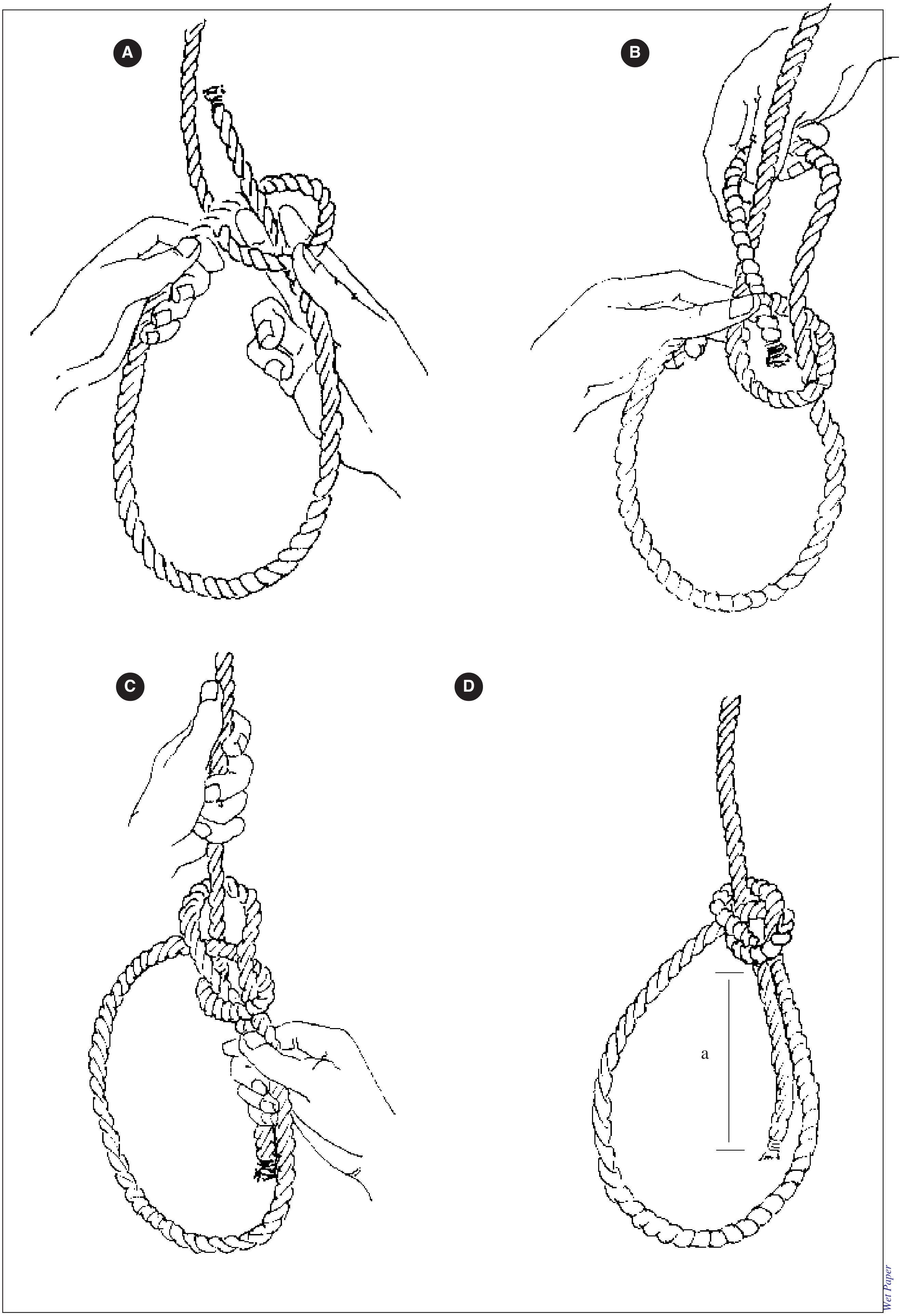


Figure 12.3 Up the rabbit hole, round the tree and back through the rabbit hole

Exercise 13 Round turn and two half hitches

This knot is used to tie a boat up to a spar, ring or jetty where no bollard or cleats exist.

Method

1. Wrap the rope around a spar as shown in Figure 13.1 a.
2. Bring one of the ends through as shown in b.
3. Repeat this process as shown in c.
4. Pull the knot tight as shown in d.

Advantages

It has the advantage of being able to partially undone yet giving the crew control over the boat while preparing to cast off.

Materials and equipment (per pair)

Equipment required

- 1 m of rope

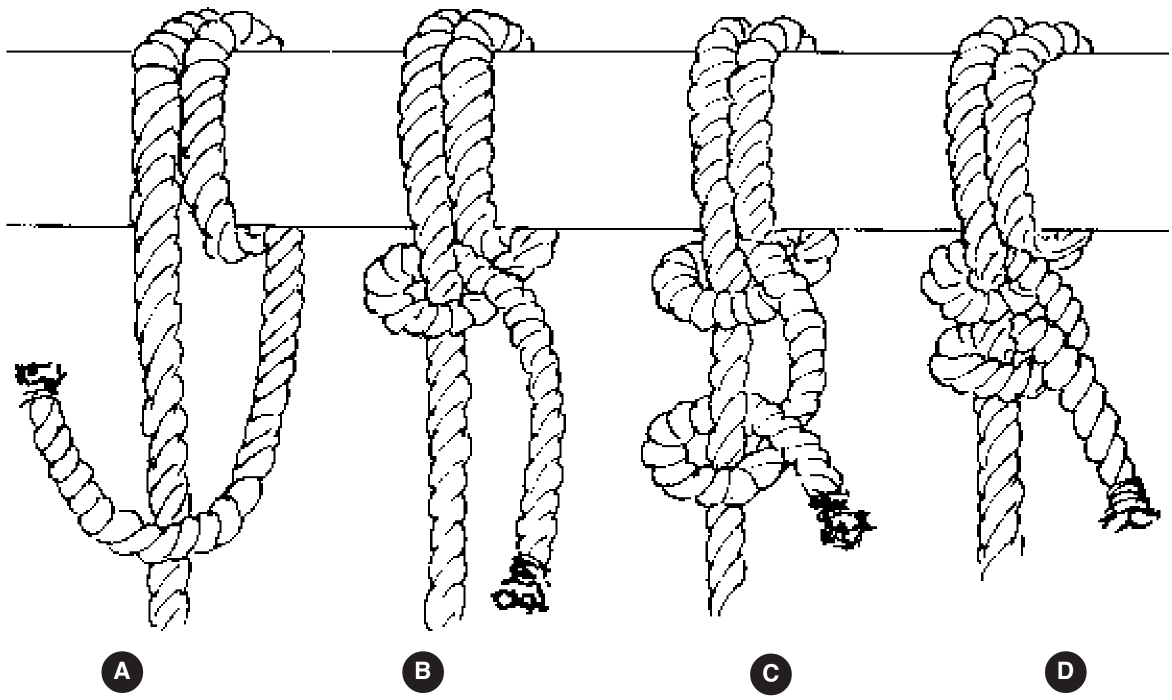


Figure 13.1 Round turn and two half hitches
Wet Paper

Exercise 14
Other knots

Method

The sheet bend

1. Follow the steps a – b in Figure 14.1.
2. Pull tight to complete the knot.

The double sheet bend

1. Select two ropes of unequal thickness.
2. Study Figure 14.2 to complete this knot.

The figure of eight

1. The figure of eight knot is the seaman-like stopper knot for preventing the end of a rope running through a block or fairlead. One other use is to make a knot that can act as a stopper when passed through a ring.
2. Study Figure 14.3 to complete this knot.

The rolling hitch

1. This knot is used for towing two or more boats.
2. Study Figure 14.4 to tie this knot.

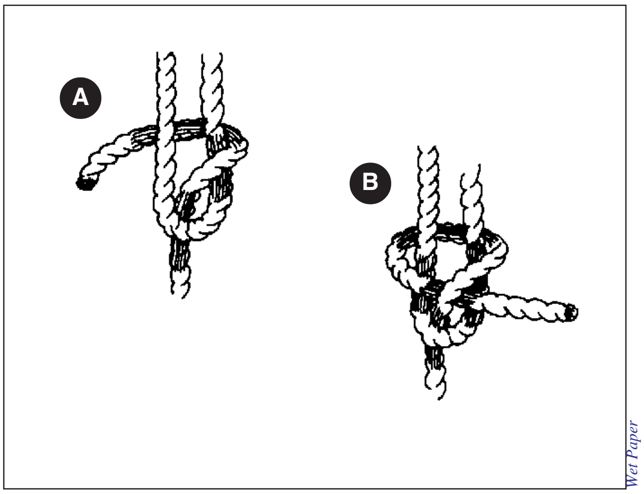


Figure 14.1 Sheet bend (Adapted from Californian Safety Handbook).

Materials and equipment (per pair)

Equipment required

- 2 x 1 m of rope

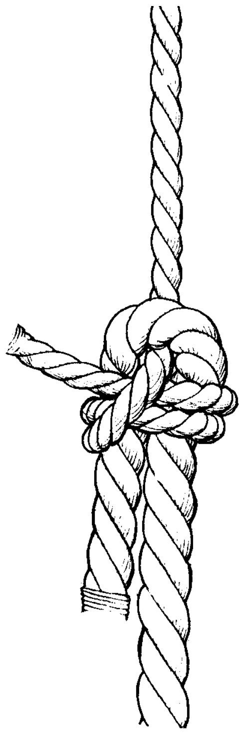


Figure 14.2 Double sheet bend
(Adapted from Californian Safety Handbook).

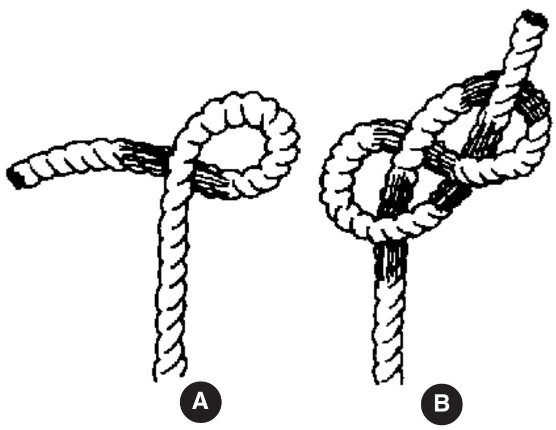


Figure 14.3 Figure of eight (
Adapted from Californian Safety Handbook).

Knots to careful of

The clove hitch and reef knot are two very common knots, however some caution should be exercised in deciding when and where to tie them.

Clove hitch

A clove hitch as shown in Figure 14.5, should only be used when there is load on both sides of the hitch, such as securing the tiller.

When used in the end of a line it may jam when wet or work loose if loads are intermittently applied.

It is preferable to use a round turn and two half hitches instead.

One good use is to secure small items in a boat.

Reef knot

The reef knot was originally intended for securing a sail when reefing using the small diameter reef pendants.

One use is to tie two ropes of equal thickness together. To tie this knot, take the right end over the left and under, and then the left end over the right and under as shown in Figure 14.6.

The problem arises when the knot is placed under strain and becomes difficult to undo.

One good use of a reef knot is to tie small pieces of string together that don't have to be undone.

Questions

1. When are each of the following knots used?
   a. A rolling hitch
   b. Round turn and two half hitches
   c. Figure of eight
   d. Reef knot
   e. Double sheet bend
   f. Sheet bend
   g. Bowline
2 Name one problem associated with using a reef knot.
3. Why is the bowline such an important knot to learn?

Projects

Select a project below and work as a group to make an oral presentation in class.

1. Make up a knot board to show your class your group knows how to tie knots.
2. Visit a yacht, ship, cruise boat or runabout and take photographs of different knots used in different situations.
3. What is a truckies hitch? Find a truckie and ask him or her how the knot is tied and the different uses it has. Ask if other truckies use other knots and learn these so you can demonstrate in class.
4. Find out about other knots used on board a boat or ship at sea. Take photos or make copies for your presentation
5. What is a blood knot and how is it tied? Research common knots used in fishing and make a knot board to show others in the class.

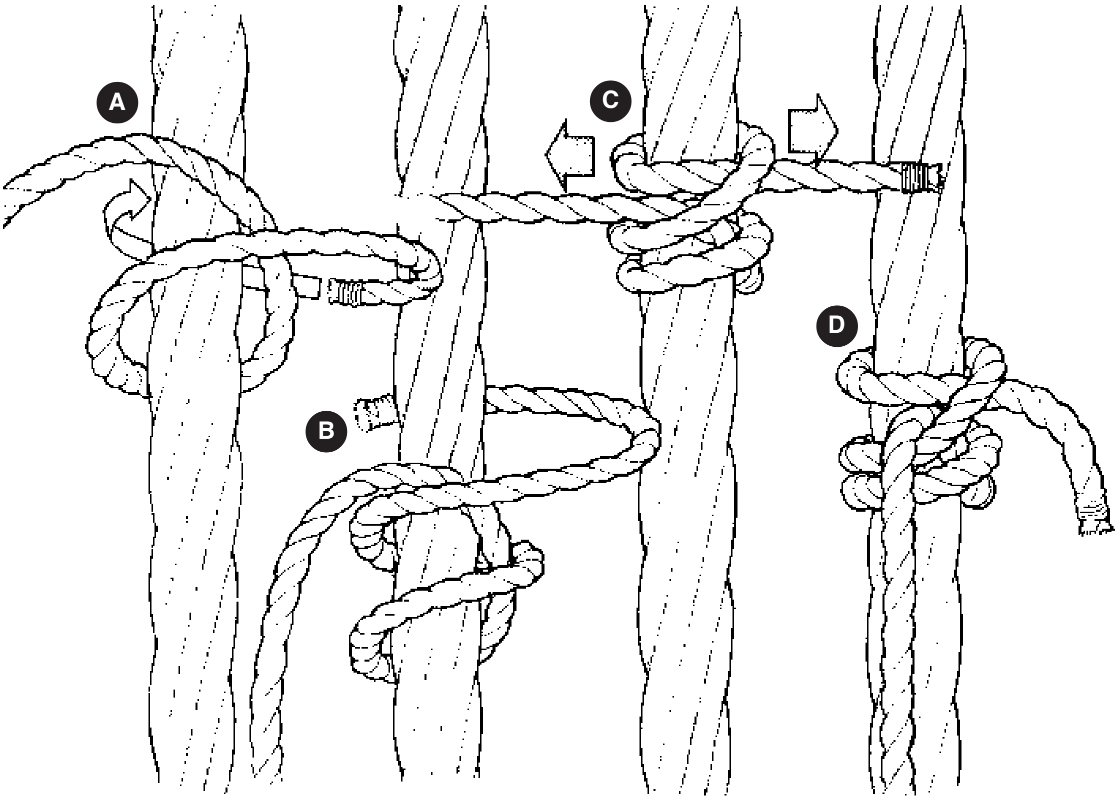


Figure 14.4 The rolling hitch

Wet Paper

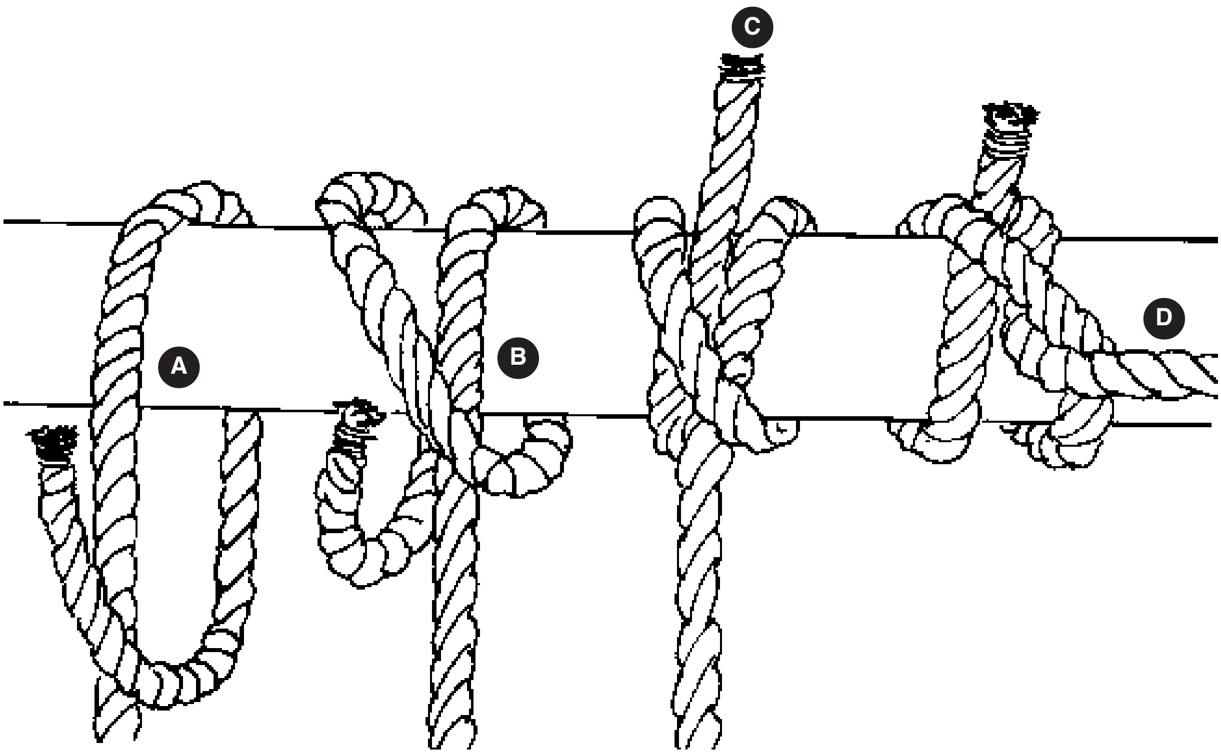


Figure 14.5 The clove hitch
Wet Paper

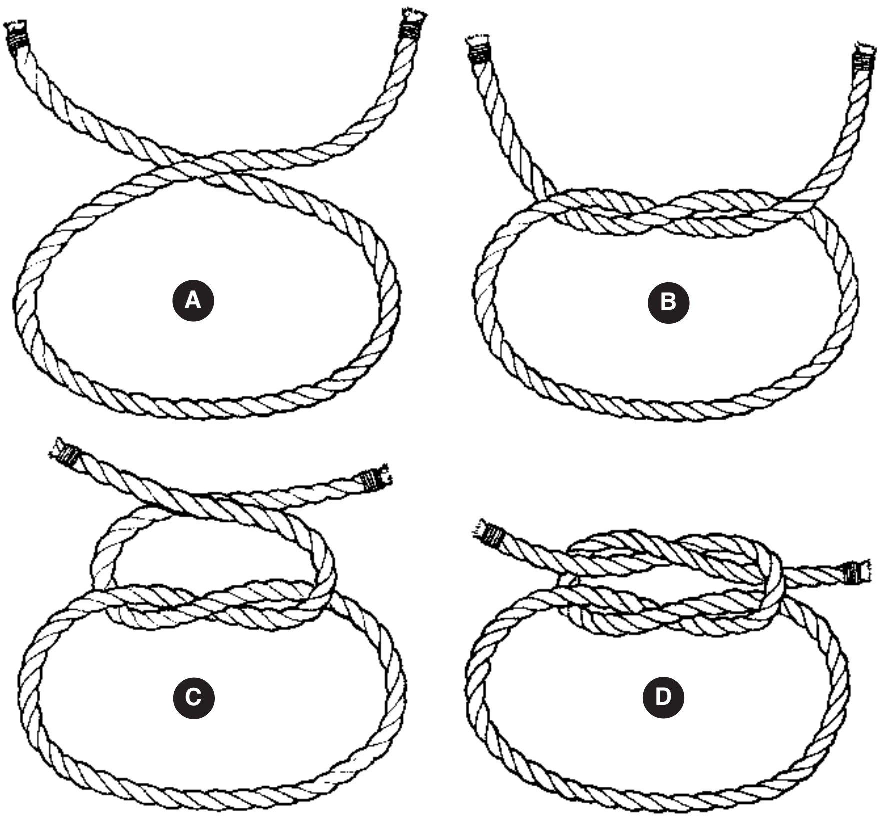


Figure 14.6 The reef knot
Wet Paper

Exercise 15 Coiling and throwing rope

Method

Rope is an expensive item and needs to be kept clean and coiled. When certain types of rope are made, there is always a direction of coil, called the lay, which the rope likes to follow.

Coiling a rope

1. Obtain a piece of rope and take it in you hands as shown in Figure 15.2.a.

   Look carefully at the rope and observe which direction the lay is. This is easy as the rope will fall in this direction, or you will feel that the rope wants to go a certain way in your hands as you pass the rope into a coil as shown in Figure 15.2.b.
2. Hold the end of the rope in your left hand.
3. Form loops in the rope as shown in Figure 15.2.a while twisting with the lay.
4. If the rope does not have a lay, don't try to twist it but coil it in figure eights as shown in Figure 15.2.b.
5. Finish off the coil by wrapping a few turns of the working end (see Figure 15.1) around the centre of the coil.
6. Pass the bight through the centre of the coil and make a loop over the top. Pull the loop tight to hold the coil together as shown in Figure 15.3.
7. Hang the coil using the remainder of the working end.

Throwing rope

Decide which hand you are going to use to throw the rope and how much rope needs to thrown to get to the other person.

It is very difficult to catch the end of a piece of rope, so the idea is to throw enough rope to pass over the head and shoulders of the person you are throwing the rope to.

This way if the rope lands over the deck of the boat, there will be enough rope to reach over to take hold. Never reach into the water to try to retrieve the rope as you could fall in or capsize the boat.

1. Make a coil of rope in your throwing hand as shown in Figure 15.3.

   Make sure there is sufficient to carry the distance and past the catcher by at least two m.

   Make sure the rope is not coiled around your feet and that there is rope left in your nonthrowing hand
2. Take careful aim and throw the rope well over the head and shoulders of the catcher so that it falls onto the catchers hands.

   If you are catching the rope, allow it to fall into your hands or over the deck of the boat.

Materials and equipment (per group)

Equipment required

- 10 m of rope
- partner

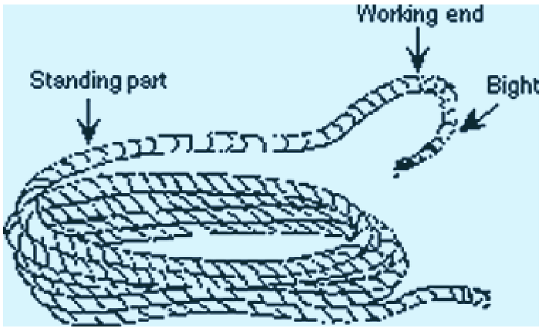


Figure 15.1 Parts of a coiled rope
Wet Paper

Questions

1. What is the lay of a rope?
2. What is braided rope and does it have a lay?
3. Write a paragraph or perform a demonstration in class showing how to coil a rope.
4. Why is more rope thrown to the catcher?
5. What are the dangers of a catcher leaning over the side of a boat to retrieve a rope that he or she has failed to catch?

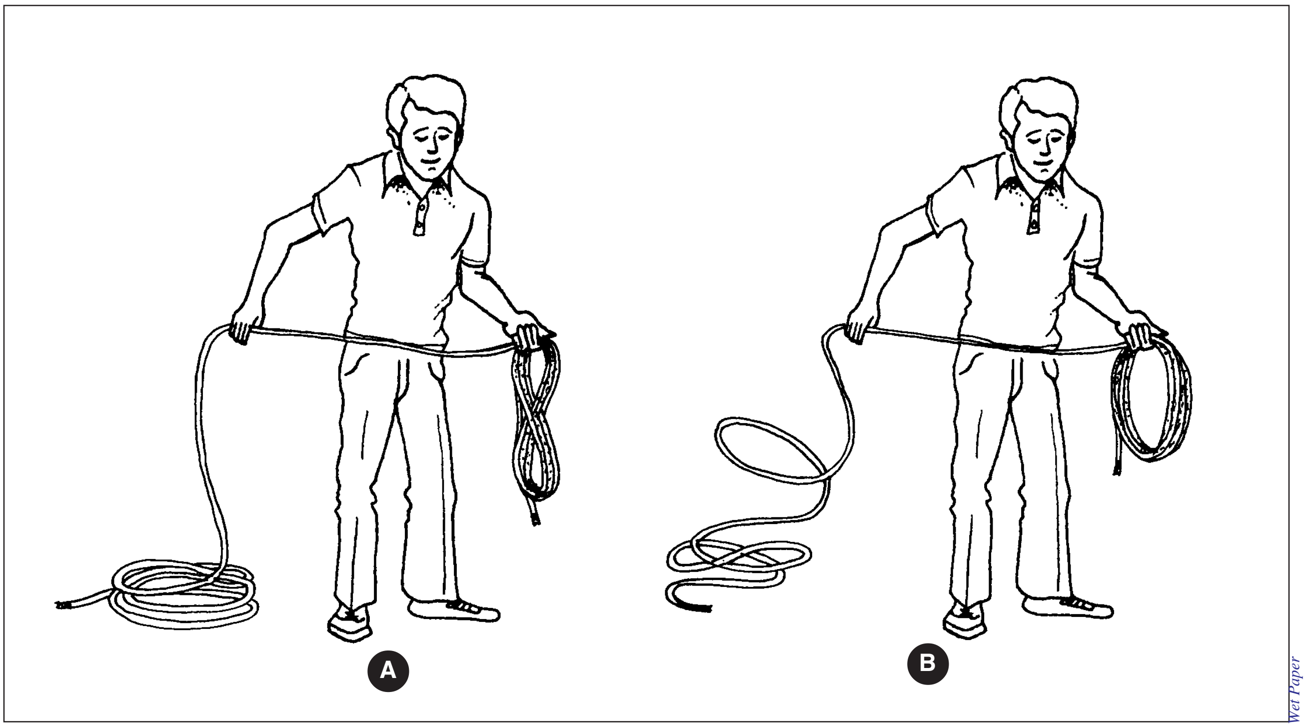


Figure 15.2 Coiling a rope with the lay (A) and without a lay (B)

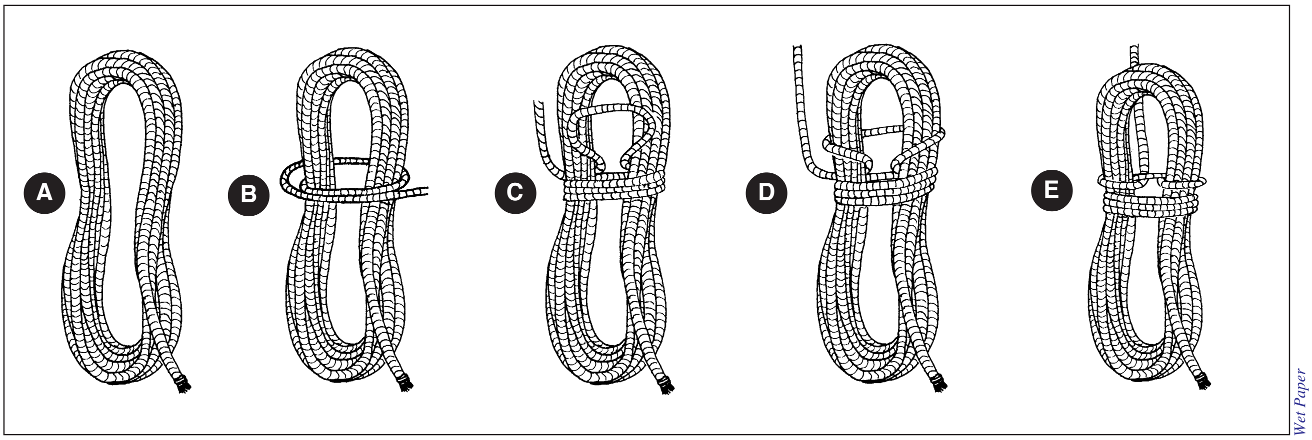


Figure 15.3 Finishing off the coil

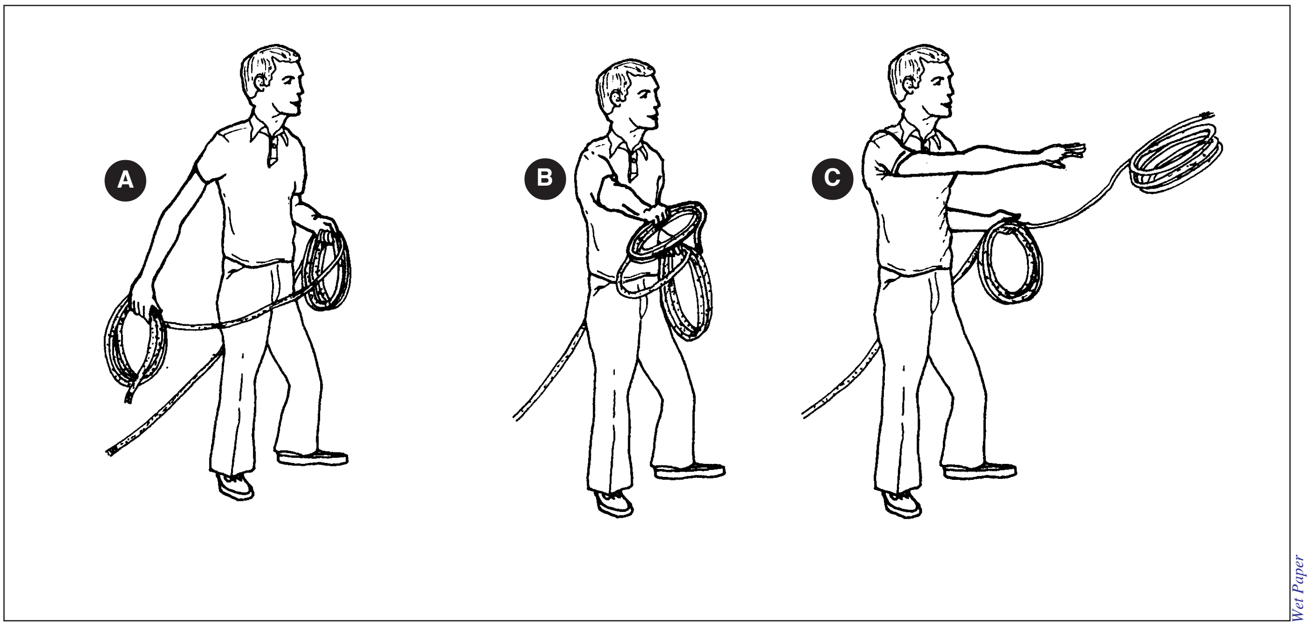


Figure 15.4 Throwing a rope

Exercise 16 Avoiding collisions

Use your textbook index to find the section on avoiding collisions.

Questions

Now use the information below and the copy of Figure 16.1 to answer the questions below.

1. In Figure 16.1.1, you are approaching a creek with a narrow channel. Mark in how you would travel up the channel.
2. In Figure 16.1.2, you wish to travel up the creek. Indicate which side of the channel you should use.
3. In Figure 16.1.3, two power boats A and B are approaching head on. Indicate how they should pass.
4. In Figure 16.1.4, Boat B comes out from a harbour. Who should give way and how should the boats pass?
5. In Figure 16.1.5, two sailing boats A and B are approaching each other. Indicate with arrows how this should be done.
6. In Figure 16.1.6, all boats are anchored. What coloured lights should they be displaying?
7. In Figure 16.1.7, the power boat B wishes to overtake A. Indicate how this should be done. What course of action should A take as B approaches to pass?
8. In Figure 16.1.8, A is about to tack. What indication should be given to B and can B pass A in this situation?
9. In Figure 16.1.9, three lights as shown are visible in the distance. What type of vessel is this? Is it moving and if so in what direction?
10. In Figure 16.1.10, A is towing B. What lights should be displayed by each vessel?

Box of terms for vocabulary exercise

Sailboard
Vessel engaged in fishing
Power driven
Vessel not under command
Air-cushioned vessel
Vessel restrained by her draft
Vessel underway
In sight of one another
Restricted visibility
Narrow channel
Traffic separation schemes
Stand on
Towing light
Side light
Masthead light
Stern light
All round light
Restricted visibility
Sound signal
At anchor
Not at anchor
Vessel restricted by her ability to manoeuvre

Vocabulary exercise

Redraw the table below in your note book and complete it using the terms in the box above.

Term	Page	Meaning as given in text	Your example
e.g. Vessel underway	66	the vessel is not at anchor, aground or tied up at the dock	When I go fishing with my Grandmother and we are leaving the harbour
a. Sailboard			

Based on an original exercise by Geoff Jensen, Innisfail State High School

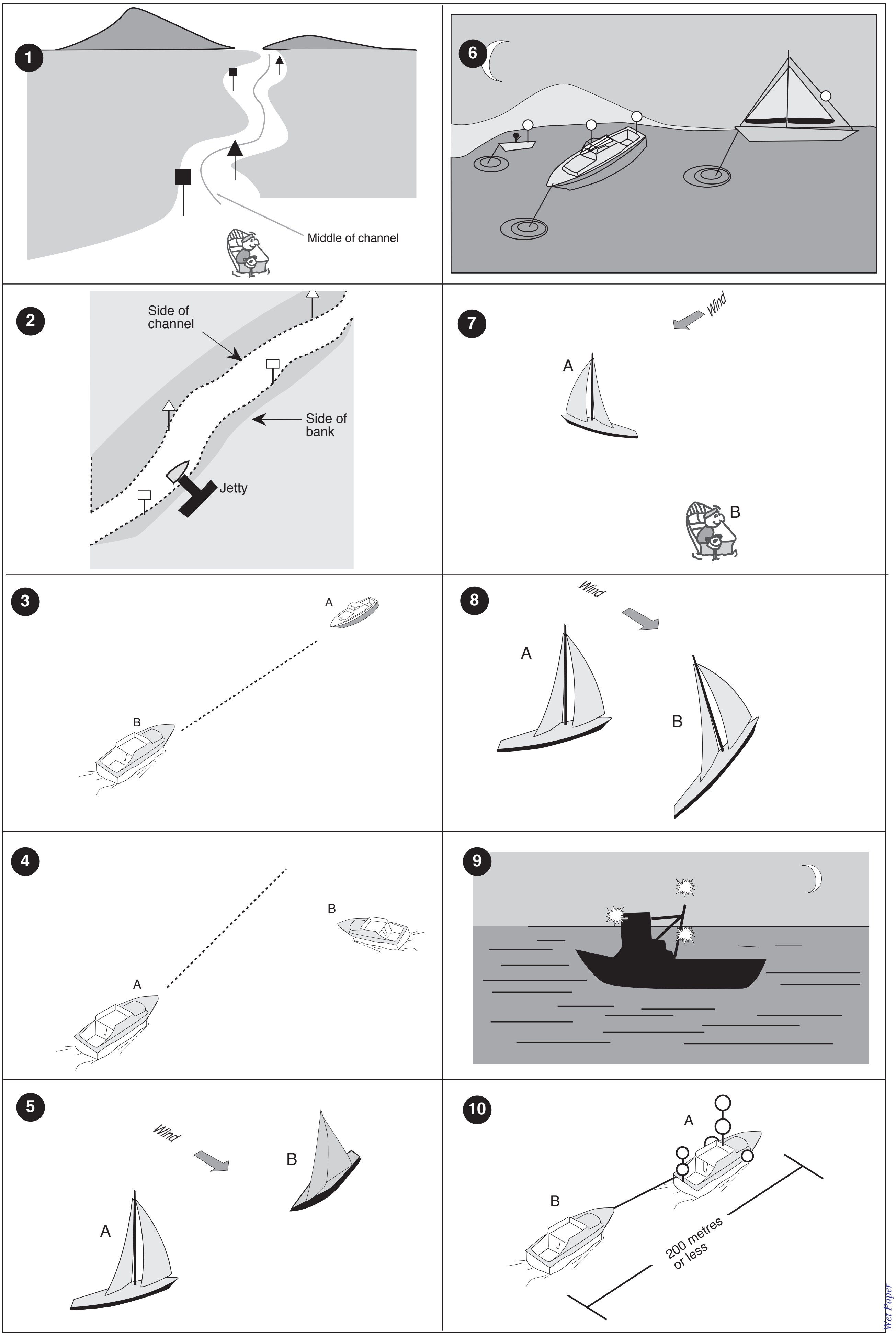


Figure 16.1 Students may make one copy of this page so that they can attach their answers before handing in for marking.

Exercise 17
Where to tie knots

Questions

Use your textbook index to find the section on *knots*. Now complete Figure 17.1

Situation	What knot you would use	Reason for using knot
1. You are standing at the dock beside a bollard and a yacht approaches. The mate throws you a line and asks you to make her fast.		
2. You have just packed your trailer and wish to cover it with a tarp. The ends of the tarp have a short rope. How will you use that rope?		
3. You are sitting in the front of a dinghy approaching a wharf. The only object to tie up to is a metal ring.		
4. Your motor breaks down and someone throws you a rope. You ask if he wants salvage rights and he says, No, but tie a knot around your bow and he will give you a tow.		
5. You are standing on a bridge and notice someone in difficulties in the water. You need to make a loop in a rope that you can throw to a person who is drowning.		
6. You are in a boat and someone throws you a rope that is much smaller than your painter. You wish to tie the two together.		
7. You are in a sailing boat and you want to make a knot that will stop a sheet from leaving a block.		
8. You have two ropes that need to be joined together to tow a boat you are about to rescue.		
9. You are part of a stranded party of boats and you and three other boats need to tie up to a line that has been thrown to you from the rescue boat.		
10. The oar in the boat keeps getting in your way and you want to tie it to the seat.		
11. Your car has broken down and you have to fix a tow rope to your axle.		
12. You land your boat at a jetty and wish to tie up to a railing.		

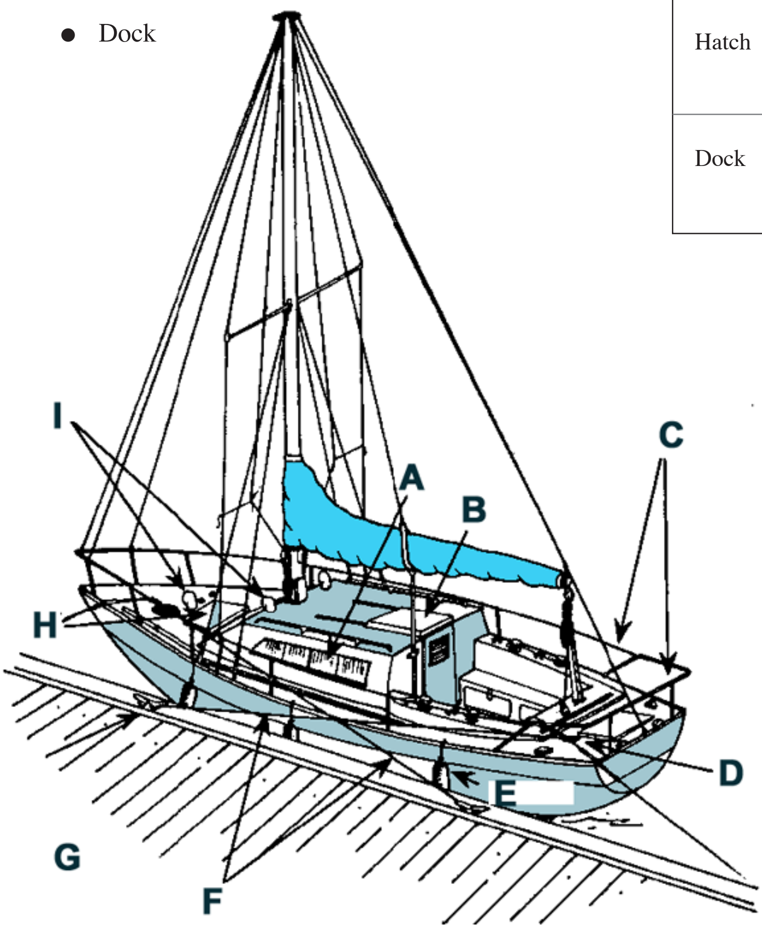
Figure 17.1 Students may make one copy of this page so that they can attach their answers before handing in for marking.

EXERCISE 18
PARTS OF A LARGER YACHT

QUESTIONS

Use your textbook index to find the section on *parts of a larger yacht* and answer the questions below.

1. Use your textbook to identify the following terms and mark their location on the drawing.
   - Ventilation points
   - Anchor well
   - Cabin
   - Cleat
   - Fender
   - Railings
   - Hatch
   - Dock



2. Complete the table below.

Term	Use
Ventilation points	
Anchor well	
Cabin	
Cleat	
Fender	
Railings	
Hatch	
Dock	

Figure 18.1 Students may make one copy of this page so that they can attach their answers before handing in for marking.
Wet Paper

Exercise 19 Glossary of sailing terms

Based on an original exercise by Graham Rogers, Clontarf Beach State High School

Questions

Copy the list of sailing terms below into your notebook. Using the glossary of sailing terms on the following pages, give a definition for each term.

- Batten
- Block
- Block rope
- Boom
- Brace
- Chainplates
- Cleat
- Clew
- Foot
- For'ard
- Forestay
- Furl
- Genoa
- Gooseneck
- Gybe
- Halyard
- Header
- Heading up
- Head
- Healing
- In stays
- Jib
- Jib hanks
- Keel
- Leech
- Leeward
- Line
- Lift
- List
- Luff
- Luffing
- Mainsail
- Mast
- Pinching
- Pointing
- Rudder
- Reef
- Sheet
- Shroud
- Spar
- Spinnaker
- Spreader
- Stay
- Tacking
- Tiller

Glossary

ABEAM
Alongside

AFT
Towards the stern

AMIDSHIPS
In the centre of the boat

BATTENS
Strips of wood, tin, plastic or fibreglass inserted in the pockets of the sail to help it hold shape

BEARING OFF
Altering course to leeward

BLOCK
A pully formed by sheaves, axles and body

BOLT ROPE
A strengthening rope sewn to the edge of the sail

BOOM
Horizontal spar at the foot of the sail

BRACE
Rope to control spinnaker tack

CARRY AWAY
To break

CAST OFF
To release a mooring line

CENTREBOARD
A metal or wooden fin passing through the centre of the hull to prevent sideways motion in the water

CHAINPLATES
Fitting on the side and bow of hull to which the shrouds and stays attach

CLEATS
Fitting of various designs to hold ropes

CLEW
The free moving corner of all sails

CLOSE HAULED
When a boat is sailing as close as possible towards the wind

FOOT
The bottom edge of the sail

FOR'ARD
Towards the bow

FORESTAY
Wire running from the upper part of the mast to the bow. Jibs and Genoa jibs are generally attached to it

FOULED
Tangled

FURL
To roll a sail, often on boom when reefing

GENOA
A design of jib, part of which overlaps the mast

GOOSENECK
A hinged fitting connecting the boom to the mast.

GUNWALE
The edge of the boat where the deck joins the sides. Often protrudes for strength and lifting purposes

GYBE
Change of tacks when running

HALYARD
A rope or wire used to hoist a sail

HEADER
A wind change towards the bow

HEADING UP
Steering towards the wind direction

HEAD
Top corner of sail. Also called **peak**

HEELING
When a boat leans on an angle

IN STAYS
Pointing directly into the wind

JIB
Triangular sail carried in front of the mast

JIB HANKS
Fitting to attach the jib to forestay

KEEL
The fin proportion of the hull of a yacht

LEAD
Eye for a rope to run through

LEECH
Trailing edge of a sail

LEEWARD
Side sheltered from the wind; opposite to windward

LINE
Rope

LIFT
Wind shift more to the side of the boat

LIST
To tip to one side

LUFF
Leading edge of a sail

LUFFING
Turning the boat into the wind until the sails start to flap

MAINSAIL
The sail carried behind the mast

MAST
Vertical wooden or aluminium pole to support the sails

PINCHING
Pointing too high into the wind

POINTING
Sailing as close to the wind as possible

PORT
Left side

RUDDER
The hinged blade at the stern which steers the boat

RUDDER PINTILES and CUDGEONS
The pin and loop hinges for the rudder

RUNNING
Sailing with the wind behind the boat

REEF
To reduce the sail area by gathering the sail

RATCHET BLOCK
A pulley with ratchet on the wheel to help hold ropes

SHEET
A rope used to adjust the angle of the sail

SHROUD
Sidestay to support the mast

SPAR
Term used to refer to masts, booms, etc.

SPINNAKER
The large curved sail carried instead of or in addition to the jib when reaching or running

SPINNAKER POLE
The spar holding the spinnaker tack in position

SPREADER
A support from mast to shrouds

STAY
Wires supporting the mast

STARBOARD
Right side

STEM
Bow or front of boat

STERN
Back of boat

TACKING
Alter direction by heading to wind and continuing to turn until the sail fills on the other side

TACK
A point of sailing e.g. port tack

THIMBLE
An eye piece to hold the shape of or protect a loop in rope or wire

TILLER
The steering arm of a rudder. Its action is in reverse - when moved to starboard, the boat will turn to port. Larger yachts have a steering wheel or helm

TILLER EXTENSION
A light extension arm attached to the tiller on a swivel to enable remote steering

TRAPEZE
A wire running from the shroud point on the mast, clipping onto a harness worn by a crew member. It enables the crew member to stand horizontally out from the gunwale, exerting more weight to hold the boat upright

WAKE
Path of disturbed water astern of a boat

WAY
Movement of a boat through the water

WINCH
A concave drum, ratcheting one way only. Two or three turns around it with a sheet will hold the most powerful pull, but will still allow the sheet to be pulled on

WINDWARD
Side on which wind is blowing: Opposite to leeward.

RIGHT OF WAY

There is a basic rule of the water that a power boat shall give way to a sailing craft, but this is a rule that should not be abused by the sailor. Use common-sense. All boats are bound to avoid the danger of a collision and no boat should have difficulty avoiding action.

OPPOSITE TACK RULE

A port tack yacht shall keep clear of a starboard tack yacht

SAME TACK RULE

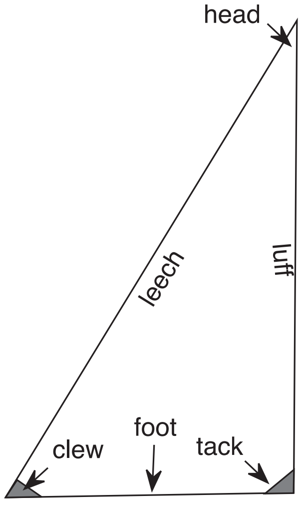
1. A windward yacht shall keep clear of a leeward yacht.
2. A yacht clear astern shall keep clear of a yacht clear ahead.
3. A yacht which establishes an overlap to leeward from clear astern shall allow the windward yacht ample room and opportunity to keep clear and, during the existence of that overlap, the leeward yacht shall not sail above her proper course.

KNOWING THE SAILS

The three corners and edges of a sail have specific names. The top corner of a sail is called a head or peak; the fixed corner is the tack and the free moving corner is called the clew.

The leading edge of the sail is called the luff; and the trailing edge the leech, and the bottom edge is the foot.

The amount of curve in the leech of a mainsail is called the reach.



Exercise 20 Materials used in boats

The marine environment contains salt which is extremely corrosive.

To prevent things falling apart in seawater, the marine industry has developed combinations of materials that will last a long time in salt water.

Method

1. Fill a series of bottles or test tubes with seawater like the ones shown in Figure 20.1
2. Pace a small amount of material in each bottle or tube and label each tube or bottle.
3. Draw up a data table like the one shown below and keep a record of the effects of seawater over time on the various materials.

Data table

Date	Material	Observations

Questions

1. Describe the effects of salt on the materials in each of the bottles.
2. Which materials would you not recommend for use in the marine environment?
3. Which materials seem to be the best?

Materials and equipment (per group)

Equipment required

- small pieces of the following materials: iron nail, stainless steel, chipboard, marine ply, plastic, nylon rope, hemp rope, galvanised iron or other materials, brass screw, stainless steel screw, iron screw, fibreglass
- bottles or test tubes as in Figure 20.1
- seawater
- labels and pencil

Research assignments

1. Try some combinations of materials in a jar. For example:
   a. Metal screw with particle board
   b. Brass screws with marine ply
   c. Stainless steel screws with galvanised iron. Study the effects over a two-week period and record observations.
2. Try different sealants between metal, such as silicone or barrier creams.
3. Make up a rivet plate with different types of rivets — stainless steel or mono.
4. Join two metals together or metal to wood and study the effects.
5. Visit a boat building yard or boat retail shop and record which materials are commonly used on boats and in what places.

   Which is the most expensive and where is it used?

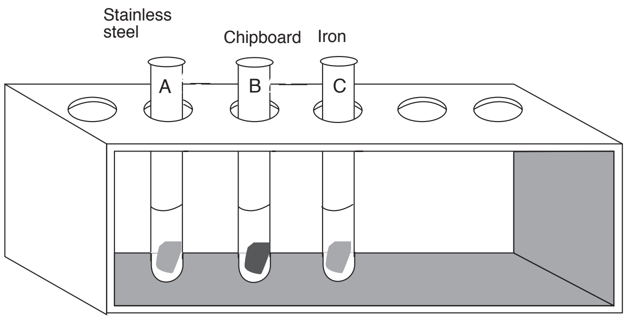


Figure 20.1 Experimental set up

Wet Paper

Exercise 21
Hull details

Questions

The type of hull on a vessel determines the use of that boat. Use your textbook index to find *hulls* and answer the questions below.

1. Draw diagrams in your notebook to show you know the meaning of the following terms. (Use Figure 21.1 as a guide.)

   - Round bilge hull
   - Hard chine hull
   - Free board
   - Transom
   - Draught
   - Length overall
   - Length at waterline
   - Displacement hull
   - Planing hull
   - Semi-displacement hull

2. The way a boat is built is reflected in the planking. Use your textbook to make detailed drawings in your notebook identifying the following boating terms.

   - Soft chine hull
   - Multichine hull
   - Hard chine
   - Chine
   - Gusset
   - Seat
   - Deck
   - Knee
   - Rubbing strip
   - Clinker planking
   - Keelson
   - Keel
   - Garboard plank
   - Sheer plank
   - Rib
   - Carvel planking

3. Identify the boat hulls shown as in A and B in Figure 21.1

4. Look at the illustrations in Figure 21.2 and identify the parts labelled C – I in your notebook.

5. Use your textbook to complete the table shown in Figure 21.3.

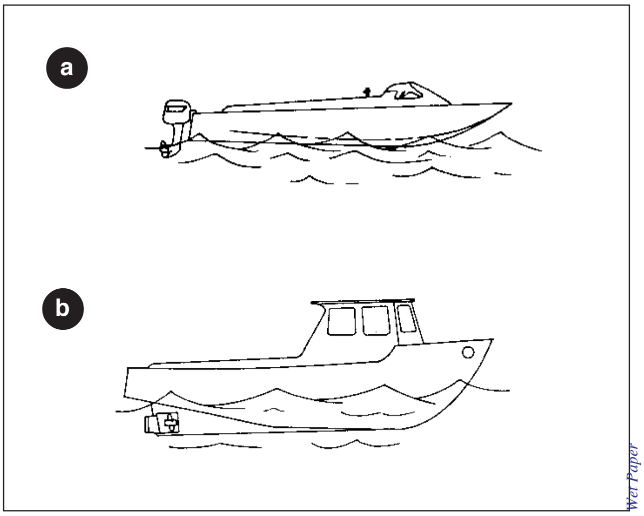


Figure 21.1 Types of boat hull

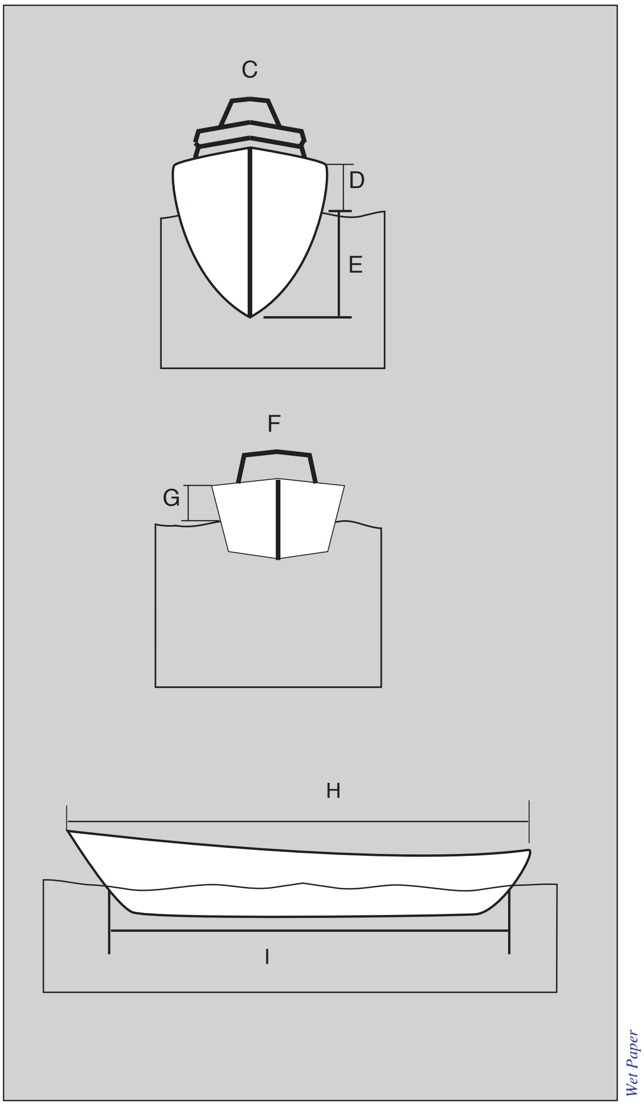


Figure 21.2 Parts of the hull

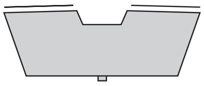
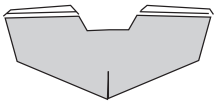
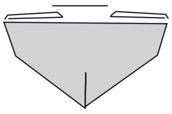
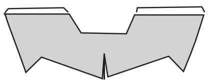
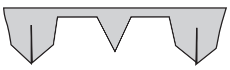
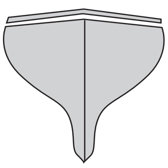
Design	Name of hull	Advantage of hull design
a. 		
b. 		
c. 		
d. 		
e. 		
f. 		
g. 		

Figure 21.3 Table for question 5. Students may make one copy of this page so that they can attach their answers before handing in for marking.

Exercise 22
At the dock

When a boat comes in, there are a number of things to do to prevent damage to other craft and the boat itself.

Method

1. Use the materials outlined in Figure 22.1 to make up practice bollards and cleats.
2. Practice throwing rope to one another and securing to these bollards and cleats.

Questions

Read the text in the box below and answer the following questions.

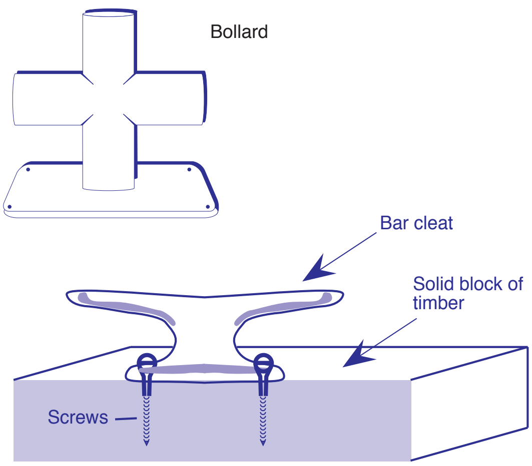
1. Figure 22.2 shows a boat tied up at the dock.

   Figure 22.3 shows a boat approaching the dock to perform a manoeuvre in which three people are involved:

   Person A standing on the jetty, person B standing on the bow of the boat and the skipper of the boat. The jetty has a large post and a bollard.

   Use the information from Figure 22.2, as well as the information in the box, to describe how A and B should successfully tie up the boat.
2. Redraw Figure 22.4 in your notebook and describe how you would tie a rope to this bollard.
3. Some moorings take account of tides.

   Describe how a jetty or pontoon could be designed to account for tides. Use diagrams to illustrate your answer (refer to Figure 22.5).



Adapted from seminar materials presented at AYF seminar

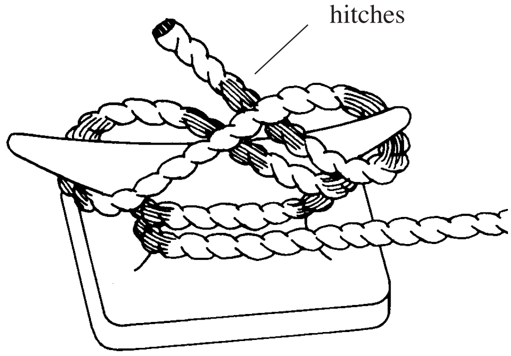
Figure 22.1 Details for making a practice cleat

Wet Paper

Making fast to a cleat

- Making fast is belaying the rope to a fitting such as a cleat.
- Take a turn right around the fitting, which gives control over any load on the line, then finish off with a series of figure eights around the horns.
- The round turn holds the load and the figure eights hold the round turn.

  Provided the fitting and the rope are correctly matched, locking half hitches should not be applied as they are prone to jam.
- Allow a longer line at the bow and stern to account for tides, as shown in Figure 22.5. This is why they are also called springs.



Wet Paper

Materials and equipment (per group)

Equipment required

- small cardboard boat (see Figure 22.1)
- copy of book *Marine Studies*
- pencil

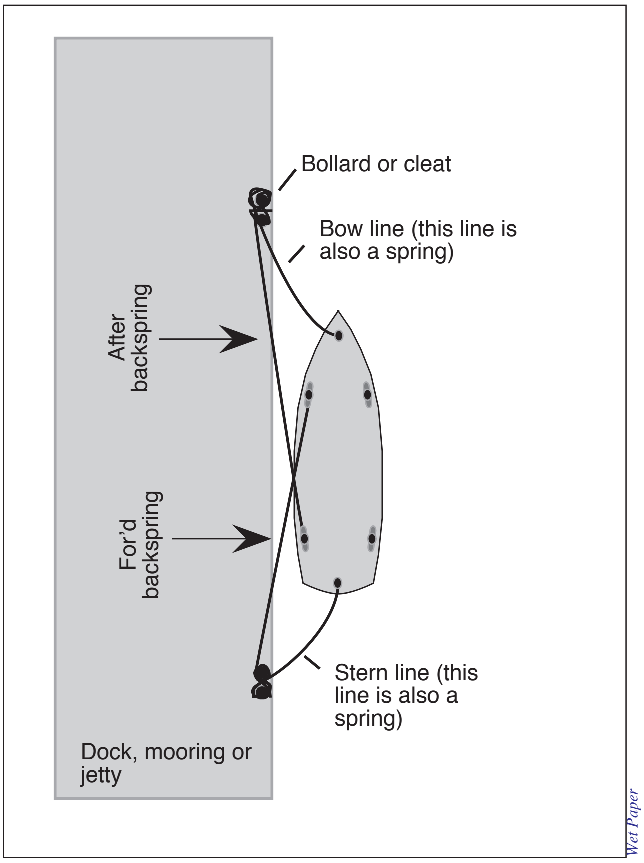


Figure 22.2 Boat tied up at a dock (Thanks Graeme and Peter)

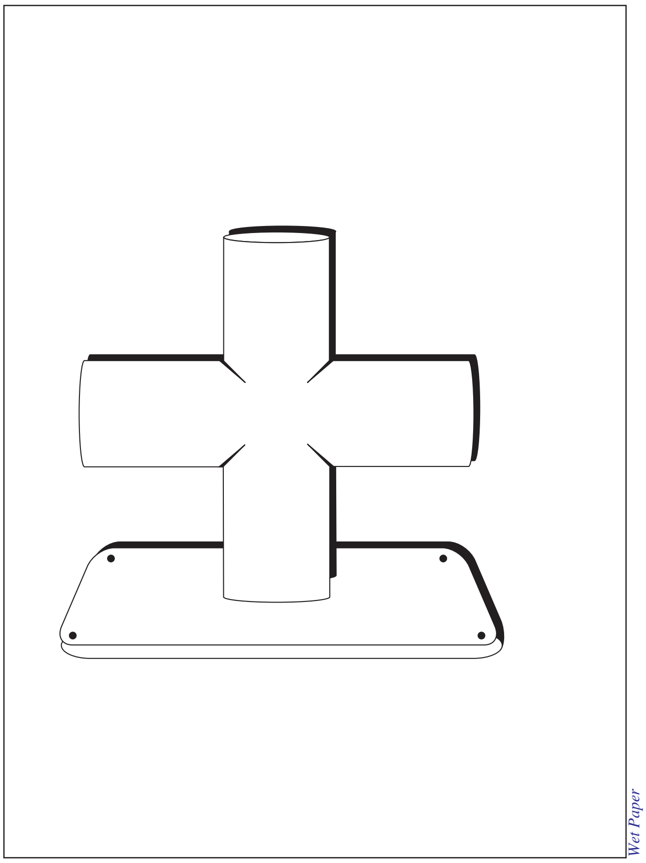


Figure 22.4 A cross bollard or T bollard

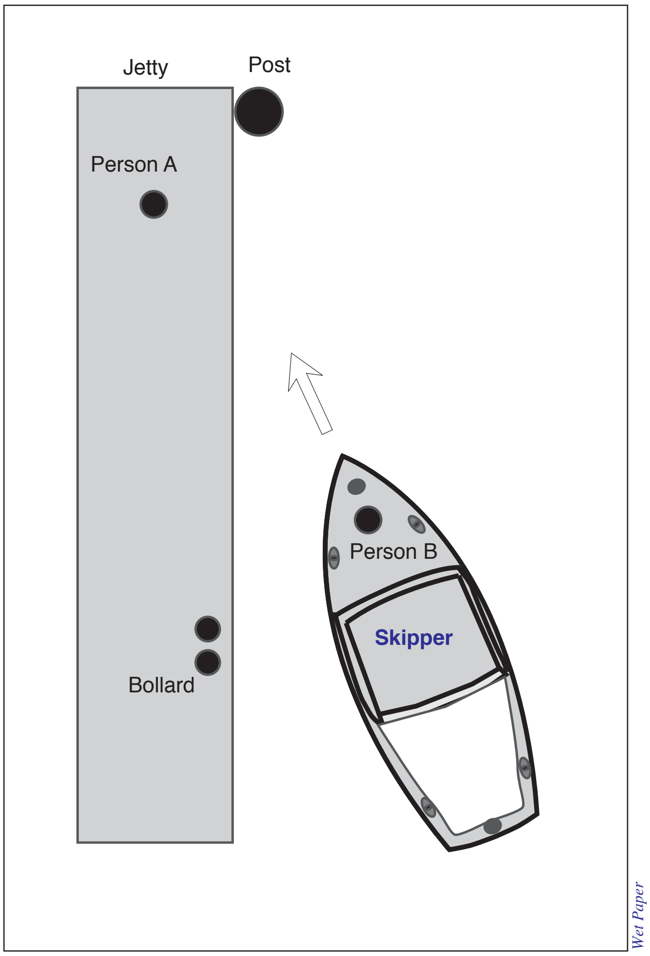


Figure 22.3 Boat approaching jetty

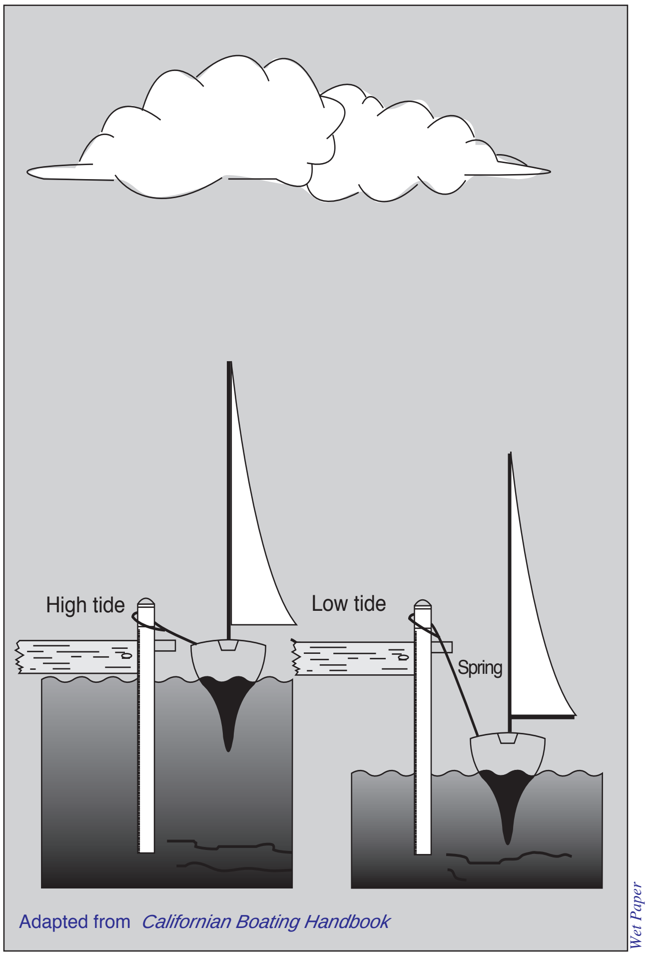


Figure 22.5 A longer line allows for tides

Exercise 23
Marine
insurance and registration

Illustration courtesy Mariner Outboards

Marine insurance is different to car insurance. When you pay your car registration, third party insurance is compulsory whereas your boat registration does not include a third party cover.

Questions

Use your textbook index to find *warranty* and *insurance* and turn to their respective pages.

1. What is a premium?
2. When are premiums normally paid?
3. What considerations apply to boats only?
4. What does the term *third party property damage* refer to?
5. What is the difference between a warranty and an insurance premium?
6. What happens after the warranty runs out on a car or boat?
7. Define the word *insurance*.
8. Do boats have to be registered in your State?
9. If so, how much does registration cost?
10. On a new boat, do identification numbers and letters have to be used on the side of the boat?
11. If so, how big and where do they have to be placed? Draw a diagram in your notebook to illustrate your answer.

Materials and equipment (per group)

Equipment required

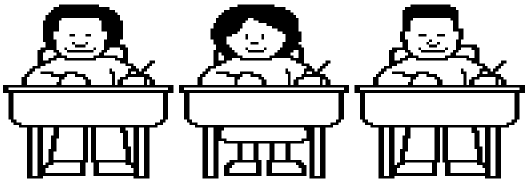
- telephone book
- telephone and money
- insurance application forms

Research assignment

1. Use the telephone book to locate an insurance company.
2. Ring the company up and ask it to send you brochures on car insurance and boat insurance.
3. When the brochures arrive, make up and complete a table similar to the one shown below.
4. Use the index of the telephone book to locate the State government section.
5. Locate the section which deals with boat registration, telephone and ask for to a brochure.

Considerations	Insurance cover	
	Motor car	Boat
Fire		
Theft		
Accidental damage		
Malicious damage		
Damage to the other person's property		
Damage to the other person's children		
Solicitors' fees if the other person sues you		
Motor breakdown		
Body structure faults		
Electrical breakdown		
Registration fees		
Trailer damage		

Exercise 24
Beat the buzzer



In this exercise, students set up a game show of their choice based on a popular TV game show.

The object of the game is to test the speed at which people can remember boating terms. This exercise could be used for revision before examinations, or as part of a marine challenge competition run by a sponsored community group or teachers' association.

A number of classes could compete for a school prize.

Method

1. Elect two game show hosts and six competitors. For maximum involvement you could devise teams with a delayed response answer. Questions could rotate between teams, with each team being given a time to agree on an answer, (e.g. the Family Feud game).
2. Devise a series of questions from the boating safety, and boating sections of your textbook. The questions need to be ones which require single answers
3. Decide on a time limit and how the winner will be determined.

Sample questions

1. On a boat the left hand side is called the ...?
2. A bowline is a ...?
3. If I am amidships, I am in the ... ?
4. What am I?

   I am found on a boat and powered by electricity.

   I am fixed in a position to show a light from right ahead to 22.5 degrees abaft the beam on either side of the vessel.
5. The standing part is what part of rope?
6. What term refers to an assurance that covers faults in workmanship in materials and goods under normal operating conditions?
7. What is freeboard?
8. What is a vessel's draught?
9. On a dinghy, where is the deck?
10. What does the abbreviation LOA, mean?
11. Who or what is the chine?
12. What is a premium?
13. Abeam refers to ... ?
14. If I was to cast off, I would ... ?
15. The centreboard is the ... ?
16. What is the foot in sailing terms?
17. If I was to move for'ard, I would go in which direction on a ship?
18. What is a genoa?
19. What does the term gybe mean?
20. A pulley formed by sheaves, axles and body is called what?
21. If I bear off, what am I doing?
22. Something has become fouled on board a ship. What has happened?
23. The edge of the boat where the deck joins the sides is called what?
24. What is a halyard?
25. You are thrown a line. What has happened?
26. What is the port side of a ship or vessel at sea?
27. The fin proportion of the hull of a yacht is called ... ?
28. A support from mast to shrouds is a ... ?
29. What is a ratchet block?
30. What am I?

    I am a wire running from the shroud point on the mast, clipping onto a harness worn by a crew member. I enable the crew member to stand horizontally out from the gunwale, exerting more weight to hold the boat upright.
31. The back of the boat is called the ...?
32. What is the wake?
33. A rope used to adjust the angle of the sail is called ... ?
34. The side on which wind is blowing is the ... ?
35. A light extension arm attached to the tiller on a swivel to enable remote steering is called the ... ?

Exercise 25 Trailers

Field report

1. Locate a friend with a boat and trailer and ask him or her to help you with completing a copy of the table below.
2. Interview them about the way they launch their boat. After this interview, write a short description of the launching procedure.

   Aspects of your report which you could consider are:

   a. a photograph of the boat and trailer

   b. the size of the boat and the trailer and a plan sketch of the trailer with the boat off it

   c. the relationship between the hull type and the rollers on the trailer

   d. the type of winch used on the trailer

   e. the electrical system and how it connects to the towing vehicle

   f. how the owner maintains the trailer – how bearings are re-packed, electrical components waterproofed tyre pressure, springs and axle, frame, couplings, etc.

   g. the securing mechanisms for the boat when being towed

   h. the coupling and uncoupling mechanisms

   i. the safety precautions the owner takes to prevent accidents

   j. the weight of the trailer and boat as compared to the weight of the towing vehicle

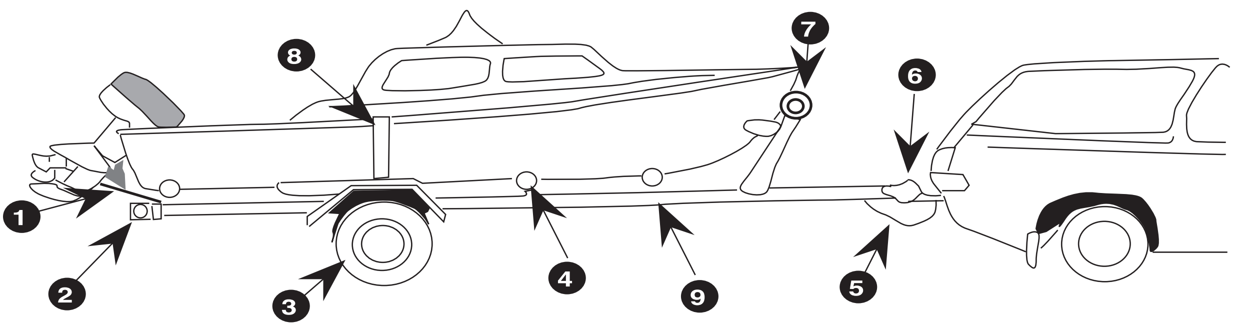
Safety

The boat ramp can be a unsafe place. Also the trailer and its load must not be greater in weight than the towing vehicle.

- Walk carefully on the boat ramp as it is often very slippery.
- Keep an eye on other vehicles and boats reversing as the driver may not be able to see you.
- When unwinding the winch, be very careful just after the safety is released as the wire is under great strain causing the handle to unwind very quickly.
- Take careful note of the condition of the winch and cable and make sure any frayed pieces of wire are trimmed as they can cause nasty wounds to the hand. Replace any cable that appears it may break.
- Work as a team and tell others what you intend to do. Don't just undo anything assuming others know what is happening.
- When coupling or uncoupling a small trailer from a towing vehicle make sure you squat down by bending your knees and lifting the trailer directly upwards so that you don't injure your back.

  Look at Figure 25.2 and notice the little wheel on the trailer. Bigger wheels with wind-up handles can be purchased and it is recommended for larger trailers that people use these to couple and uncouple trailers.
- If a wheel needs changing make sure you find a place where you can pull well off the road. Far too many people have been side swiped and killed while changing a wheel on an open highway.

- Correctly secure the load on the trailer so that it cannot fall off or move.



Letter	Name of part on trailer	Function
1		
9		

Figure 25.1 Boat and trailer

Questions

Use the index of your textbook to find the term *trailer safety* and complete the following vocabulary exercise.

1. Ramp etiquette

   ____________ is the consideration of others. There are many things that make for a pleasant day's boating and many of these start at the boat ramp.

   When launching make sure the ____________ are in.

   There is a rope attached to the boat so it doesn't float away when launched. The rope is called a

   ____

   Make sure you don't slip on the ramp. Be quick and efficient so others can get under way as soon as possible. Make sure everything you want is in the boat before you launch it.

   Make sure you wear protective ____________ because many ramps have broken glass or sharp stones or oysters.

   Check the ____________ and have a block to secure the towing vehicle when on the ramp.

2. Use and care of a. ____________

   Beware that a dangerous situation does not occur when the boat is being ____________ A lot of weight is controlled by a thin piece of wire which has to be maintained in good condition. The following are suggestions for safe practice.

   Keep the winch cable and components ____________

   Make sure the boat is moving up and down the trailer on the rollers and guides.

   Don't let the boat move too fast down the trailer. If the boat is heavy, get someone to help you.

   Avoid leaving the ____________ cable connected as the boat is being launched.

   Make sure you have a rope attached to the boat as it is ____________ .

   Unwind the ____________ ____________ so that it is ready when you return.

3 Securing boat to trailer for towing

   Here are some suggestions for a safe trip home:

   Make sure the motor is secured behind the boat.

   A ____________ between the ____________ and the trailer can be made or purchased if you are travelling home over bumpy roads. This stops the motor breaking off from the transom.

   Have some one check the ____________ and check the ____________ on the trailer.

   Make sure the boat sits on all the trailer supports and that gear in the boat will not fall out.

4. Study Figure 25.2. The teacher is holding a safety chain and shackle in his hand and giving instructions for its use.

   There is also a plug and socket to be connected from the electrical system on the trailer.

   Write a paragraph on how these would be connected to the towing vehicle and what safety precautions should be taken before driving off.

5. In Figure 25.3, the students are loading two boats.

   Write a paragraph explaining what has to be done, before the towing vehicle drives off.

6. Write a paragraph on how your school boats are unloaded and the safety points your teacher wants you to follow.

Figure 25.2 Photograph for question 4

Wet Paper

Figure 25.3 Photography for question 5

EXERCISE 26 TRAILER MAINTENANCE

QUESTIONS

Read the article below by Rod Forrest of the Raby Bay Sea Rescue Association, and answer the following questions

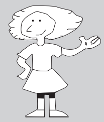
1. What suggestions are made about the transom and the rear rollers?
2. Complete the sentence: Check that rollers or supports fit the ________ .
3. What is a safety chain and what are the recommendations of the writer?
4. What are tie downs and where are they located?
5. Where should lights be placed to avoid corrosion?
6. List six hints if travelling over longer distances with your boat.
7. Why should the trailer be larger than that recommended for the boat alone?
8. What could happen if too large a boat was put onto a small trailer?
9. Predict what could happen to the towing vehicle if the trailer got a flat tyre.
10. Predict two effects of failing to wash down a trailer after use.

SAFETY

Make sure the following are checked regularly.

Bearings are re-packed, electrical components waterproofed and in working order, tyre pressure correct, tyres with legal thread, springs, axle and frame inspected, couplings and winch handle in good working order.

If wheels are to be changed, the trailer must be correctly supported and no one to move under the trailer other than the teacher in charge or mechanic on duty.



Regular maintenance of trailers is essential

by Rod Forrest
Raby Bay Sea Rescue

DON'T let a day's boating be spoiled by a trailer breakdown.

If choosing a trailer for your boat, it is far better to err on the side of a larger one than a smaller model.

The weight of your boat fully loaded with fuel, fishing gear, esky, etc. is considerably higher than the weight stated by the manufacturer, hence the need for a sturdier trailer.

Make sure the transom is directly over the rear rollers or supports.

If the transom overhangs the rear roller, it is most likely that the hull will develop a permanent 'sag' or 'hook'.

This will adversely affect the boat's speed and handling ability. Check that rollers or supports fit the contours of the hull.

Weight should be supported evenly by all keel rollers. Make a habit of checking the condition of rollers after each launch.

Any rollers not moving freely should be removed, cleaned and lubricated.

Correct balance

It is essential to have the correct balance of the load on the trailer.

The weight on the hitch should be five percent - 10 percent of the gross weight (seven percent is ideal).

For a small to medium size boat, one man should be able to lift the hutch. Unless the balance is correct, the trailer will not tow properly and could cause a road hazard.

A safety chain is a must - two are desirable. The minimum breaking strain should be one and a half times the gross weight of the trailer. Brakes are required for rigs of 1500 pound gross weight.

Any braking system immersed in salt water needs regular maintenance. Seek advice from your local mechanic if you are unsure of maintenance procedures.

Tie downs are needed at the bow and on each side of the transom.

Lights also need regular checking. Lights on a board placed across the transom will certainly last a lot longer than those that are immersed during launching.

Wheels and bearings

Regular checks are a must. Check that tyres are properly inflated and in good condition.

Carry a spare wheel. Wheel bearings need to be checked regularly and re-packed with a suitable grease.

When you arrive at the ramp, check your wheel bearings before launching.

If they are warm, that's okay but if they are hot, you are close to trouble.

Always allow time for bearings to cool down before you back into the water.

When towing over long distances make regular stops to check:

- Hitch and safety chains are secure;
- Tyres are properly inflated - no damage;
- Wheel bearings are not too hot;
- Tie downs are still tight;
- Lights are working (traffic indicators); and
- Gear loaded in boat is in place and secure

Courtesy Redland Bay Times

Exercise 27
Buying a boat

Adapted from an original exercise by John Wiley, Maroochydore State High School.

Questions

Study the list of boats for sale in Figure 27.1 to the right and answer the questions below

1. You would like to buy a 10 ft (3 m) to 14 ft (4.2 m) boat for fishing in your local river. You need a motor and trailer and have $2 500 to spend.
   a. Which boats may be suitable?
   b. Which is the most suitable?
   c. Explain why you think this boat is suitable.
   d. State two questions you would like to ask the owner.
2. You select the boat you want to buy, ring the owner and go to inspect the boat.

   Your grandmother has given you a checklist of what to look out for, shown in Figure 27.2 .

   a. Rewrite the checklist and for each of grandma's checkpoints, give a reason for her wisdom.
   b. The owner cannot prove ownership but can show a current certificate of registration. Should you buy the boat? Give reasons for your answer.
   c. How should you pay for the boat? Give reasons for your answer.
      - cash
      - personal cheque
      - bank cheque
      - credit card

1. Hull
2. Safety buckets, flares, mirrors, PFDs
3. Anchor
4. Transom
5. Welds around keelson
6. Lines
7. Colour of hull
8. Proof of ownership, registration

Figure 27.2 Grandmother's checklist

1. **FIBREGLASS** dingy 12ft. $450 ono. Ph. 43 4199
2. **FISH** or Ski, 3.5 aluminium, near new trailer, registered, 25 Evinrude, $1950. Ph. 43 9306
3. **F'GLASS** 8ft dingy and motor, $550, 94 7457
4. **FIBREGLASS** 17' Swiftcraft Viking, exc cond. $4500 Ph 43 5104
5. **FIBREGLASS** 12ft, 20 hp Mercury, full covers, ideal family boat $2000 Ph 435104
6. **FIBREGLASS** 4.2m runabout, back to back seats, boat/trailer exc. cond. no motor $1950 Ph 45 3001
7. **FIBREGLASS** boat 12ft, forward steering 25hp electric start Mercury, reg'd, $1750 ono. Ph 92 1216
8. **FISHING** Lic. FLN plus 4 line Tenders for sale or lease (071) 28 1457
9. **ALUM** 10'6 9.5 Evinrude all access $1150 ono 43 7168
10. **ALUM** 12 ft. plus excellent trailer $850 Ph 91 4733
11. **ALUM** 10ft 7.5 Mercury on stand reg $1000 442460
12. **ATTENTION**: Must sell 30hp Tohatsu motor, vgc, little use $1750 ono, Ph Nev b/h 439733 a/h 018 710461
13. **BOAT** Quintrex 16ft alum, 50 hp Johnson, many top quality extras, excellent condition $7000 Ph 91 8517
14. **BOAT** roofrack h/d alum with rollers, storage section, $285, Poly–trolley gc $120, 2hp o/board $385, 432450
15. **RUNABOUT** 12ft, fwd control, 20hp Chrysler, galv trailer, both reg. $1150 ono, Ph 94 2061
16. **RUN**–about 14' f/glass 55hp a/start tilt $1350, 439888
17. **SAILING** Dingy "125", ideal family or competition boat, excellent cond, $1300 ono. Ph 1/h 49 7756
18. **STESSL** Boats, factory direct prices, 10' $950; 12 $1095, Sample of our prices. Sunshine Coast sole distributor–Suncoast Marine 49 7553
19. **SWIFTCRAFT** 15½ ft, 70hp vro Johnson, sounder, radio, all safety equip, gc, $4950. Ph 47 3702
20. **TINNY** 10ft reg trailer, all as new $1400, Ph 47 5591
21. **STESSL** HD 3.7 20hp Johnson trailer all registered and nicely maintained, bargain $2600 ono 47 5118
22. **TIKI** 10 f/glass, vgc with 2 x 2.5 motors 41 2248
23. **PUNT** flat bottom, 12 ft, and trailer, 9.9 Mariner motor, excellent condition, just serviced, plus a lot of extras, Top crabbing boat $1650. Ph 92 5656 before 3pm
24. **QUALIFIED** o/board repair Caloundra Marine 92 1944
25. **QUINTREX** 5m, 40hp Merc, 7.5 Johnson, radio, sounder, log book, excellent cond, $4900 Ph 49 0588
26. **HIRE** 3.8 alum dinghy, outboard mtr and trailer, $30 for 24 hours ($150 pw). Kawana Hire, 290 Nicklin Way, Kawana Industrial Estate 93 5777 (7 days).

Figure 27.1 List of boats for sale

EXERCISE 28
BOAT SHOW
ASSIGNMENT AND
HULL PROJECT

Based on original ideas by Graham Rogers, Clontarf Beach State High School, John Wiley, Maroochydore State High School and Peter Hamlyn, Mackay North State High School.

BOAT SHOW ASSIGNMENT

This is an assignment to do when your class goes to the boat show. You have been given the task of choosing a boat for an agreed sum of money.

1. Visit all the stalls to find a boat in your price range.
2. Having selected a boat type e.g. runabout, 14 ft, 35 hp outboard, fibreglass or aluminium, collect as many brochures as you can on this boat type.
3. Narrow the brochures down to the five most promising, returning the ones you don't want to the display site.
4. Make up a table of pros and cons for a number of headings, such as the following:
   - Where do you want to go boating?
   - How often?
   - For how long?
   - How many passengers do you want to take?

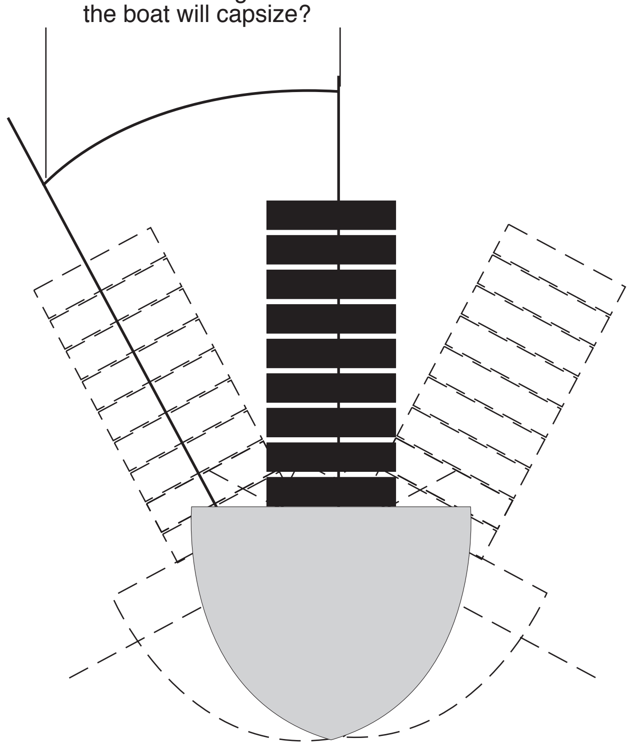
   Add as many more criteria as you can think of.
5. On the basis of the pros and cons and the criteria, select the boat you wish to buy.
6. Now study hard, be good to your teachers, get a part-time job, save your money and go out and buy it.

HULL RESEARCH PROJECT

This is an assignment for those who may not be able to go to the boat show.

1. Test the stability of designs as shown in Exercise 21. This could be achieved by using plastic model boats or balsa wood as shown in Figure 28.1.

   The stability test is determined by either how high you can stack blocks of equal size and weight, before the hull becomes unstable or at what angle the boat capsizes.
2. Tabulate and graph your results and present a 2 – 3 minute report to class.



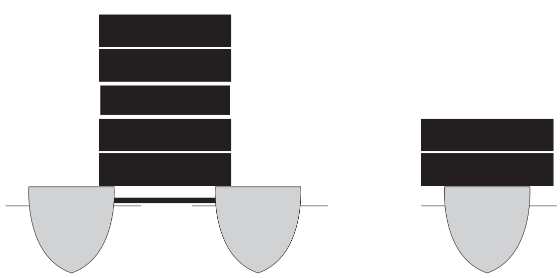


Figure 28.1 Hull stability

Wet Paper

EXERCISE 29
BOAT BUILDING ASSIGNMENT

Based on an original idea by Tim Ryan, Maryborough State High School.

MODEL

1. Use any material you think appropriate to construct one of the following models.
   a. Ancient Egyptian vessel
   b. Ancient Roman vessel
   c. Viking Ship
   d. Early sailing vessel
   e. Modern naval vessel
   f. Hovercraft
   g. Any other craft which you have negotiated with your teacher.
2. The model does not need to be a working version.

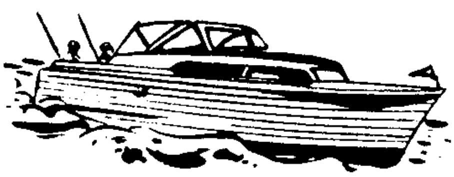
POSTER

1. Produce a poster which contains the following information.
   a. A sketch of a vessel which may highlight how it was constructed.
   b. A discussion of the type of materials used in the construction. Discuss the relative advantages and disadvantages of such materials.
   c. An outline of the purpose of the craft and how the design fits that purpose.
2. Present a 2 – 3 minute report to the class which could include the brief history of the vessel, its purpose and points of interest.

Assessment

Your overall mark or grade will be based on your ability to:

a. Collect and organise information in a variety of formats e.g. tabulating, sketching etc.
b. Access and utilize information by relating causes of design and their effects.
c. Evaluate the selected design.
d. Communicate this information both orally and in writing.



EXERCISE 30 NAVIGATION LIGHTS ON A BOAT

QUESTIONS

Lights are constructed and positioned on the boat at definite angles so that an observer can determine which direction the vessel is travelling.

Use your textbook index to find the term, *Definitions of lights (Rule 20)*, then turn to the page in your textbook to complete the following sentences.

1. The _____________ light is a white light placed over the fore and aft centreline of the vessel showing an _____________ over an arc of the horizon of 225 degrees and so fixed as to show the light from right ahead to 22.5 degrees abaft the beam on either side of the vessel.

   ____________ mean a _____________ on the ____________ side and a red light on the port side each showing an unbroken light over the arc of the horizon of 112.5 degrees and so fixed as to show the light from right ahead to 22.5 degrees __________.

   In a vessel of less than 20 m in length the sidelights may be combined into one lantern carried on the fore and aft centreline of the vessel.

   The _____________ means a white light placed as nearly as practical to the stern showing an unbroken light over an arc of 135 degrees and so fixed to show the light 67.5 degrees from right aft on each side of the vessel.

   A __________ is similar to the stern light except it is *yellow*.

   An all round light is made so that it can be seen all round the vessel. A ___________ means a light that is flashing at regular intervals.

2. Trace out a copy of the model boat as shown in Figure 30.2 and use it to colour in the definitions of lights.

   Sit in a group as shown in Figure 30.1 and push the boat around the group. Ask each member to say what lights they can see and write answers to the following questions.

   a. How do you know that the boat you have made is coming directly towards you?

   b. How do you know the boat is passing you on its port side and which way is the boat moving?

   c. How do you know the boat is passing you on its starboard side and which way is the boat moving?

   d. How do you know the boat is moving away from you?

MATERIALS AND EQUIPMENT (PER GROUP)

Equipment required

- model boat (see opposite) using
  - cardboard
  - scissors
  - sticky tape
  - coloured pencils

GROUP PRESENTATION

Make up similar models of the following boats using the information in your textbook.

a. Power driven vessel less than 7 m whose speed does not exceed 7 knots

b. Power driven vessel of less than 12 m in length

c. Power driven vessel less than 20 m but more than 12 m

d. Sailing vessel less than 7 m or vessel under oars

e. Sailing vessel more than 7 m but less than 20 m

f. Sailing vessel more than 20 m

g. Vessel less than 50 m at anchor

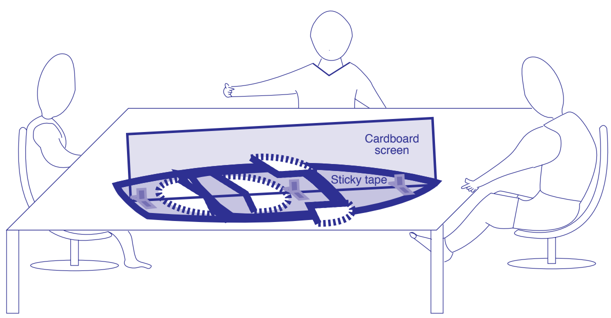


Figure 30.1 Sit in a group and push your model boat around the table asking each member to tell others what coloured lights they can see.

Wet Paper

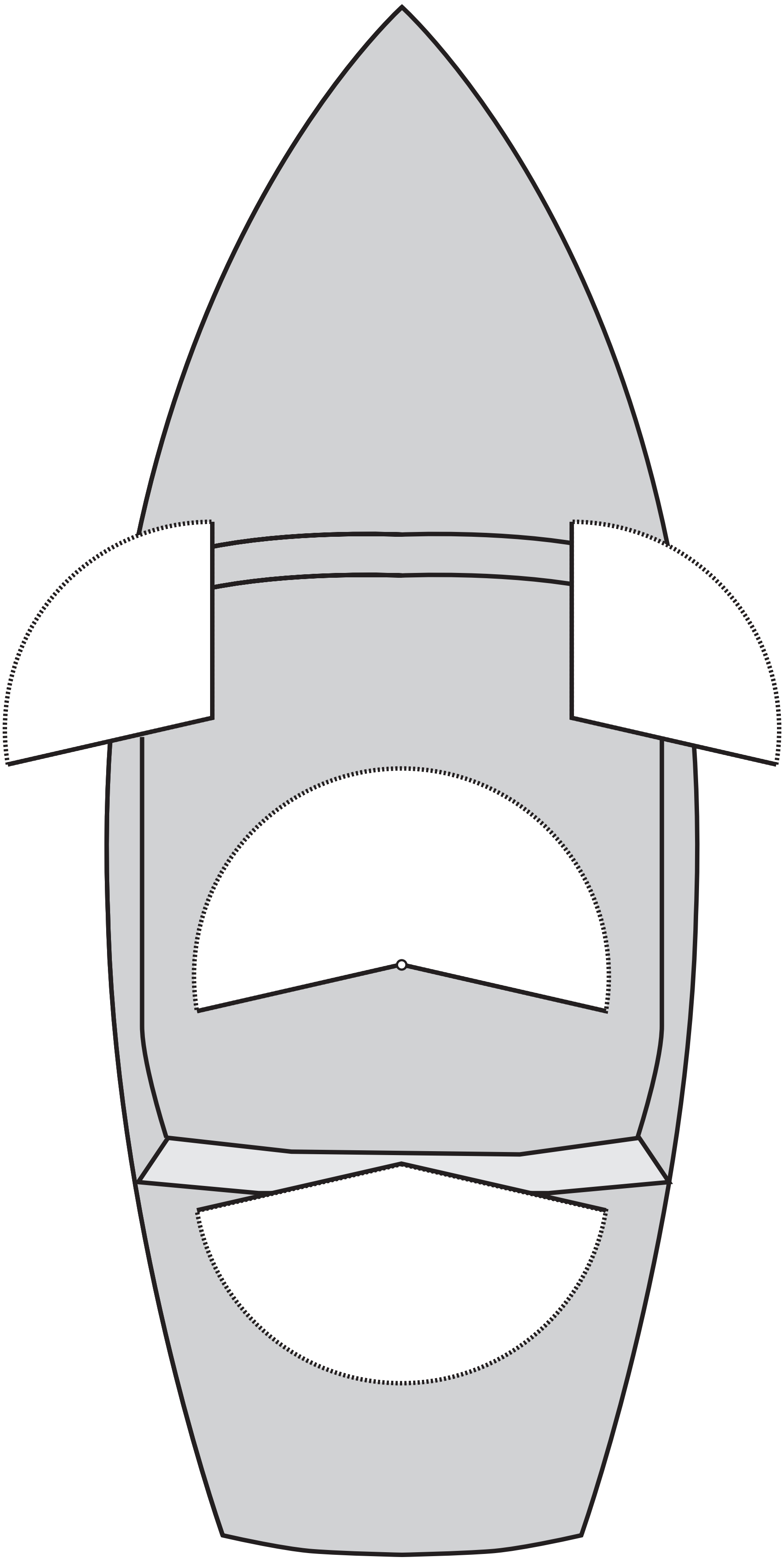


Figure 30.2 Model boat. Students may make one copy of this page so that they can attach their answers before handing in for marking.
Wet Paper

Exercise 31
Marine
BATTERIES

Safety

The acid in a battery is very strong.

- When carrying a battery make sure the liquid in it does not spill.

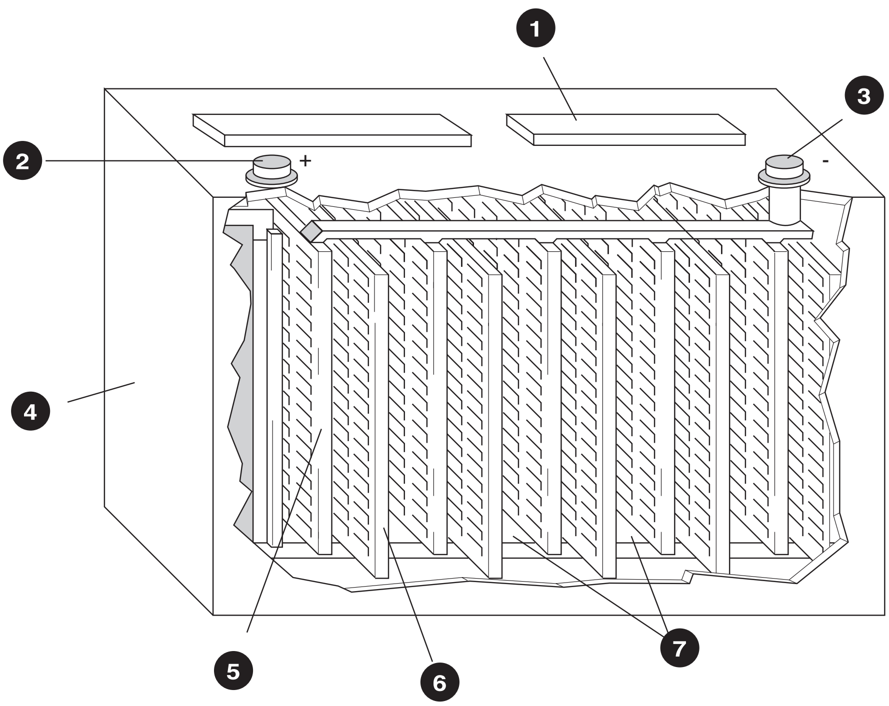
The gas in a battery is explosive

- When charging a battery remove the covers over the cells to allow the explosive gas to escape.

Questions

1. Look at Figure 31.1 and find out the names for the parts labelled 1 – 7.
2. When you charge a battery, what precautions should you take?
3. When you carry a battery what precautions should you take?
4. What voltages are marine batteries?
5. What is the rule when using jumper leads with batteries?
6. Modern motor cars have electronic computer systems. What precautions need to be taken when using modern electronics and jumper leads?
7. What is a sacrificial anode and how does it work?
8. Find the word *batteries* in your textbook index, locate where it is discussed in your text and complete the following sentence.

   Batteries are an essential part of the _________ system of a larger boat with a ___________ used to crank the engine.
9. What are eight simple rules to follow when using a battery?
10. Find out what a hydrometer is and how it is used to test a battery. Make a drawing of one.



Wet Paper

Figure 31.1 After Wilbraham (1993)

Exercise 32
Larger vessel deckwork

Find the diagram as shown in Figure 32.1 in your textbook and answer the questions below.

1. What is a winch and how is it used?
2. Two types of sails are shown. What are their names?
3. The wind is blowing at 20 knots in the direction of the arrow and the mainsail needs to be pulled in.

   Describe how this can be achieved by redrawing the blocks and line in your notebook and describing the method you would use.
4. The pulley system is under great strain. Locate the track and describe what type of construction it is.
5. Describe how the traveller would work.
6. Locate the winch. Describe how it would work to move the sails under great forces.
7. Why is the boat on an angle?
8. What stops the boat from tipping over?
9. What is the function of the boom?
10. What are clam cleats?

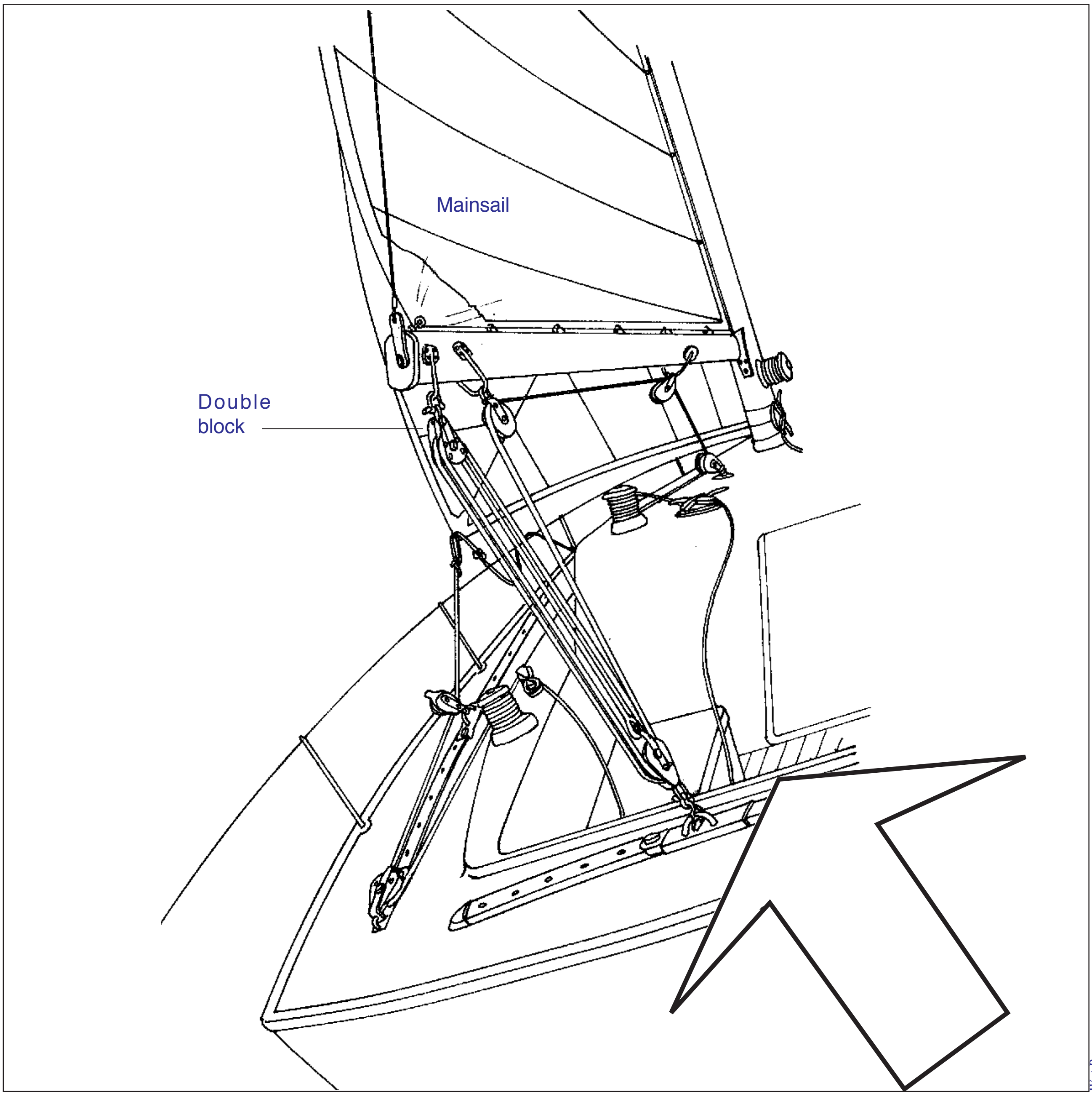
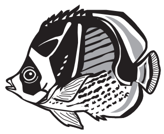


Figure 32.1 Part of the deck of a larger vessel

Exercise 33
Revision test

Time 30 minutes

24 Marks



Knowledge and understanding

1. Modern sailing craft can be identified by the type of sail rig they carry. Which of the boats below is a ketch?

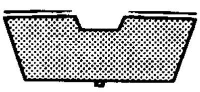
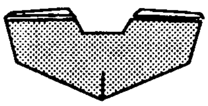
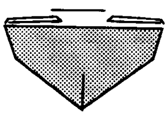
a.

b.

c

d.

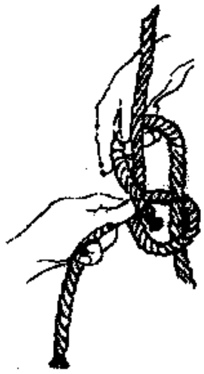

2. The shape of a hull relates to the purpose for which the craft is required. Which of the following hull types is cathedral ?

a.

b.

c.

d.


3. The maximum speed attainable by a displacement hull is governed by its length on the waterline and is calculated by the formula: max speed = $1.4 \times \sqrt{\text{L.WL}}$. The maximum speed of a 45 ft vessel with a water line length of 36 ft is
   a. 8.4 knots
   b. 9.4 knots
   c. 7 knots
   d. 5 knots

4. The freeboard is
   a. the area between the waterline and the gunnel
   b. the depth of water at which the vessel floats
   c. the height of the hull above the water line
   d. the length from the rudder to tiller

5. The knot being tied below is a

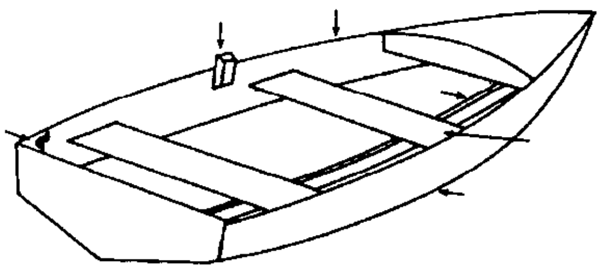


   a. sheet bend
   b. sheep bend
   c. bowline
   d. reverse Spanish bowline

6. Which of the following is **not** an advantage of using glass reinforced plastics or fibreglass?
   a. no corrosion problems
   b. complex shapes can be made
   c. colour can be added in final coat
   d. is not subject to osmosis

7. The centre of buoyancy is
   a. a point above the centre of gravity
   b. that point in the vessel at which the whole weight of the vessel is assumed to act
   c. the centre of the underwater volume and the point through which the force due to buoyancy acts
   d. a constant point in the centre of a vessel

8. Label the diagram of the boat below, using the following word list.
   a. knee
   b. transom
   c. rowlock block
   d. gunwale
   e. chine
   f. thwart



9. Which of the following statements are **true** and which are **false**?
   a. The greatest width of the boat is called the beam
   b. The shrouds keep the mast in place
   c. The sheer is the curve of the deck athwart ship
   d. Laid ropes are made from yarns that are plaited together

(2 marks)

10. From the following list of knots, choose the one that best suits the following situations.

- clove hitch
- sheet bend
- figure of eight
- reef knot
- bowline
- round turn and two half hitches

a. You want to tie your boat up to the jetty.

b. You have two ropes of unequal lengths to join.

c. You want to tie a rope onto the transom to tow another boat.

d. You wish to secure small items in a boat.

(2 marks)

11. Which is the strongest type of rope and how should it be cared for?

(2 marks)

12. Identify a – g in Figure 33.1.

(4 marks)

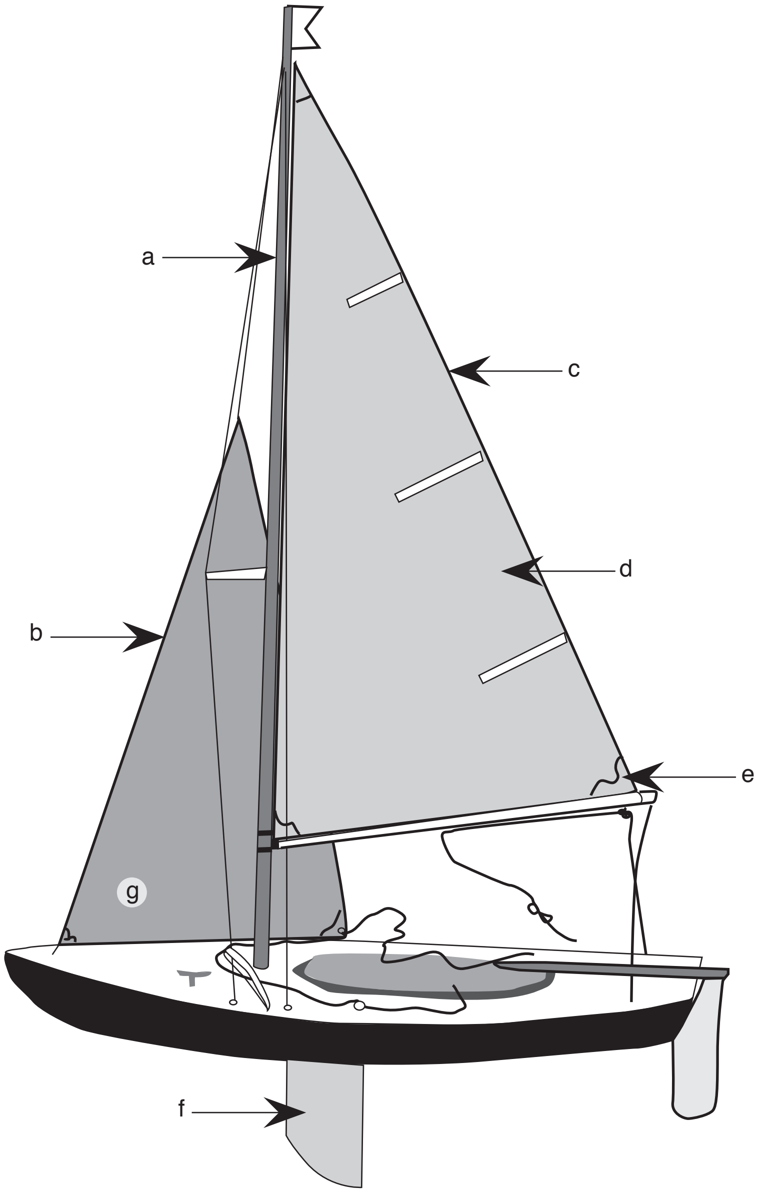


Figure 33.1 Sailing dinghy

Wet Paper

13. When overtaking another vessel, which of the following statements is correct?

   a. You must pass to the left and the other vessel has right of way.

   b. You may pass either side and you have right of way.

   c. You may pass either side but the vessel being passed has right of way and you must always keep clear.

   d. You can only overtake in areas of a defined channel.

14. Fundamental to all activities associated with working in the sea is basic safety. Which of the following activities is not a safe procedure?

   a. When in a narrow channel, keep to starboard.

   b. When a vessel is crossing your bow from port to starboard, you should maintain course and speed.

   c. Anchoring in narrow channels.

   d. Having respect for the prevailing condition.

15. At night you can see a boat's lights ahead of you showing a white all-round light and a green light. What is it doing ?

   a. Moving across your bow from port to starboard.

   b. Moving across your bow from starboard to port.

   c. Coming directly towards you.

   d. Moving away from you in the same direction.

16 A power boat is crossing your bow from port to starboard. There is a risk of collision. What do you do?

   a. Stand on. Maintain course and speed.

   b. Steer to starboard and pass it on your port side.

   c. Give it right of way and pass it astern.

   d. Accelerate and pass it first.

   e. Blow your horn and tell it to get out of the way.

17. When vessels using sound signals are in sight of one another, what is indicated when a power driven vessel under way makes a short sharp whistle or siren blast?

   a. Get out of my way!!

   b. I am altering my course to starboard.

   c. I am altering my course to port.

   d. My engines are going astern.

   e. Have a nice day!

18. If vessels in narrow channels wish to pass each other then sound signals are also used. If a vessel makes two long blasts followed by two short blasts this indicates

   a. I agree to be overtaken.

   b. I intend to overtake you on your starboard side.

   c. I intend to overtake on your port side.

   d. I have doubt as to your intentions.

19. A vessel displays the following light pattern.

   RED

   WHITE

   RED

   WHITE

   This indicates:

   a. a vessel engaged in pilotage.

   b. a vessel constrained by her draught.

   c. a vessel restricted in her ability to manoeuvre.

   d. a vessel engaged in fishing.

20. A vessel displays the following light pattern:

   RED

   WHITE

   GREEN

   This indicates:

   a. a vessel engaged in fishing going across your bow from port to starboard.

   b. a vessel engaged in fishing other than trawling.

   c. a sailing vessel under way heading to starboard.

   d. a vessel constrained by her draught.

Answers

1. a
2. d
3. a
4. c
5. c
6. d
7. c

8-12. see textbook

13. c
14. c
15. a
16. a
17. c
18. c
19. c
20. a

Information processing and reasoning

30 minutes

1. Use the information in the description below and in the tables to answer the following questions.

   Description

   A 4.5 m fibreglass single hull vessel with a 70 hp Johnston outboard motor. The unit is valued at $9500. It has a maximum speed of 25 knots. The vessel is fully owned by a 20-year-old carpenter. The vessel is kept on the street. The owner has not made a claim for 2 years.

   a. Calculate the insurance premium for the vessel described. Show working.

   b. Will the policy continue to protect the person even if the boat is used for voluntary sea rescue work ?

   c. What might be some advantages of having the policy ?

Note: The final percentage loading or discount is calculated by adding and/or subtracting the percentages.

(6 marks)

Underwriting criteria

1. Loadings

   10% If any form of lease or finance is involved

   10% If owners or users under the age of 25 years

   10% If maximum designed speed (MDS) exceeds 22 knots to maximum 50 knots

   15% To include racing risks extension (RRE) for sailing crafts

   30% Multi hulls (catamarans, trimarans)

   20% If vessel kept on the street

   Additional premium $30 per annum to include liability of water skiers

2. Discounts

   10% If vessel fully owned

   10% If vessel kept in locked-up garage

   15% TRAILER SAILER fibreglass cruisers, sterndrive inboard diesels

   25% Fibreglass yachts moored

THE FEATURES OF YOUR BOAT POLICY

* Up to 40% No Claim Discount
* Cover up to 50 nautical miles out to sea Australia-wide
* Damage to your Boat

  Payment will be made to repair, replace or reinstate a damaged or stolen boat
* Towing or Moving Costs

  The reasonable costs of moving or towing your boat to a repairer or place of safety, is covered
* Salvage Costs

  Costs of salvage and the cost of minimising further damage, after an accident, are covered
* Stranding

  If your boat becomes stranded, you can claim the cost of sighting the bottom to see if damage has been done
* Equipment and Accessories Cover

  Equipment and accessories are covered for up to $250 any one item (or more if you list them individually in the policy)
* Clothing and Personal Effects Cover

  Clothing and Personal Effects are insured whilst in your boat for up to $250, and $50 any one item
* Voluntary Sea Rescue Work

  Your policy continues to protect you even if your boat is used for voluntary sea rescue work
* Compensation for Death of Insured

  $2000 compensation, payable for death of the named insured due to a boating accident

Sum insured	Nil NCB	After 1 year 25% NCB	After 2 years 33% NCB	After 3 years 40% NCB
Up to $2 000	$102	$76	$68	$61
2 500	$111	$83	$74	$67
3 000	$118	$89	$79	$71
3 500	$123	$92	$82	$74
4 000	$135	$101	$91	$81
4 500	$148	$111	$99	$89
5 000	$157	$118	$105	$94
6 000	$173	$130	$116	$104
7 000	$182	$137	$122	$109
8 000	$192	$144	$129	$115
9 000	$208	$156	$139	$125
10 000	$217	$163	$145	$130
11 000	$229	$172	$153	$137
12 000	$243	$182	$163	$146
13 000	$260	$195	$174	$156
14 000	$273	$205	$183	$164
15 000	$284	$213	$190	$171
20 000	$352	$264	$236	$211
22 500	$407	$305	$273	$244
25 000	$437	$328	$293	$262
30 000	$477	$358	$320	$286
35 000	$517	$388	$346	$310
40 000	$561	$421	$376	$337
50 000	$606	$455	$406	$364

Figure 33.2

For questions 2 – 5 you will need your current State boating regulations brochure.

2. List the minimum safety requirements for a 14 m vessel in open waters.

   (5 marks)

3. Suggest why oars/paddles are not needed by 8 m vessels in open waters.

   (1 mark)

4. Suggest why parachute flares are not needed by 7 m vessels in open waters but are needed by 8 m vessels. (3 marks)

5. a. What other safety equipment would you advise the skipper to take on board ?

   b. Do you believe that carrying this should become law?

   (3 marks)

6. The government intends to reevaluate the schedule of safety equipment. What recommendation might you make?

   (3 marks)

7. Use the information in Figure 33.3 about the capabilities and limitations of a boat to calculate the maximum Beaufort scale under which a vessel of 5 m with an experienced skipper could cope.

   (3 marks)

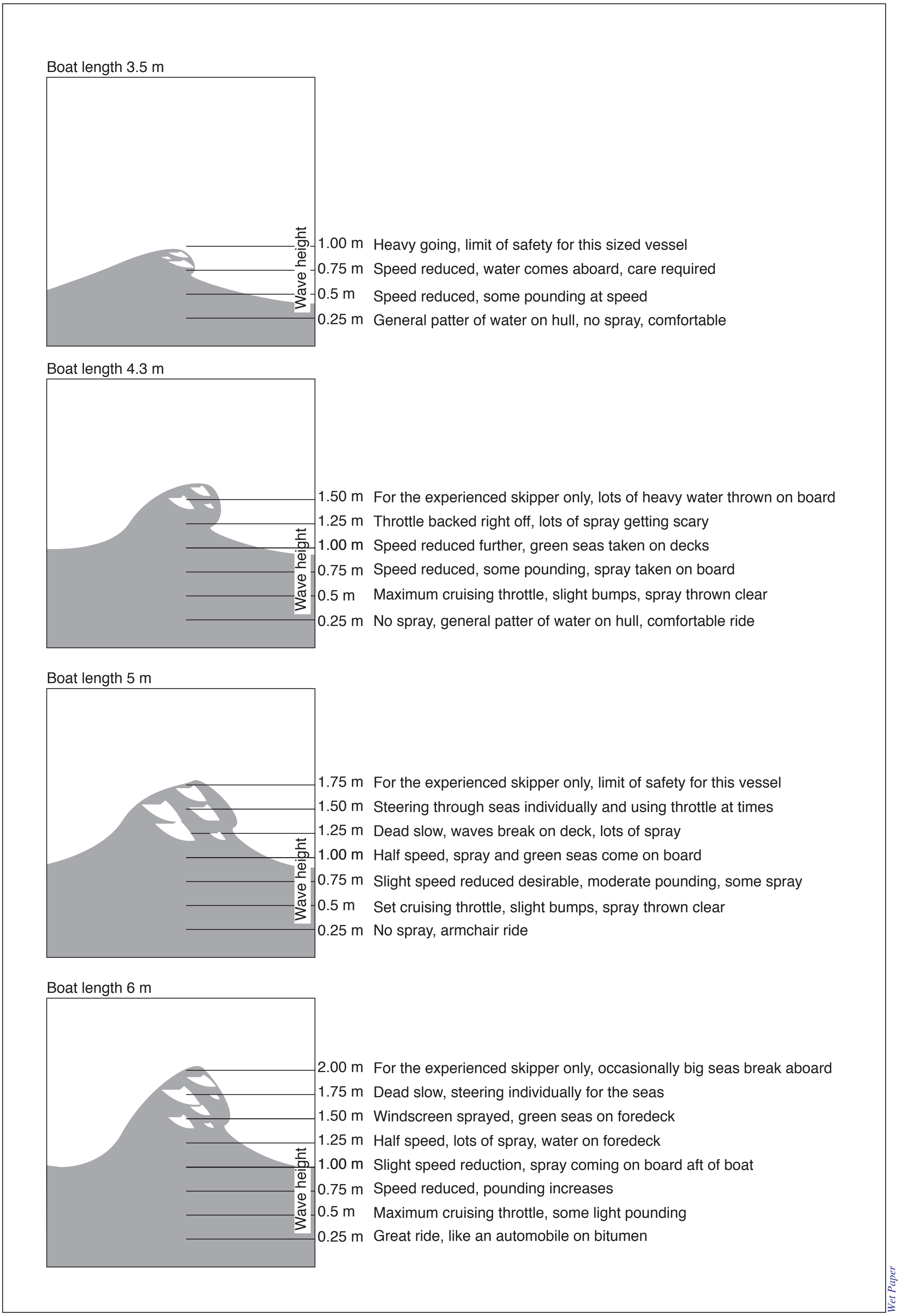


Figure 33.3 Capabilities and limitations of a boats 3.5 m – 6 m

Beaufort force	Mean wind			Explanatory titles	Open sea international code	Probable wave heights	Max wave heights
0	0	-	calm		mirror-like	_	_
1	1	->	5 km/hr	light air	calm	0.75m	_
2	6	->	11 km/hr	slight breeze	calm	0.15	0.3
3	12	->	19 km/hr	gentle breeze	calm	0.6	0.9
4	20	->	28 km/hr	moderate breeze	smooth	1.2	1.5
5	29	->	38 km/hr	fresh breeze	slight	1.8	2.6
6	39	->	49 km/hr	strong breeze	moderate	3.0	3.9
7	50	->	61 km/hr	high wind	rough	4.2	5.8
8	62	->	64 km/hr	gale	very rough	5.5	7.6
9	75	->	88 km/hr	strong gale	high	7.0	9.7
10	89	->	103 km/hr	storm	very high	8.8	12.5
11	104	->	117 km/hr	violent storm	exceptionally high	11.3	15.8
12	118	->	132 km/hr	cyclone, hurricane	air filled with foam	137.0	_

Figure 33.4 Beaufort scale

8. If the wind speed is 6 on the Beaufort scale, what will the condition be like at sea ? Include wind and wave heights expected.

(3 marks)

9. Study Figure 33.5.

The circumference of a manila rope (natural fibre) is 6 inches (15.25 cm). Calculate the safe working load of this rope.

(Use the approximate formula for breaking strength.)

(3 marks)

10. Study Figure 33.6.

a. Make a careful comparison between nylon rope and wire rope for strength, elasticity and shock absorption.

b) Make a statement which summarises the benefits of each type of rope (wire and nylon only).

(3 marks)

2. CORDAGE

NATURAL FIBRE ROPE

Approximate formula $\quad$ B.S. = $\frac{C^2}{3}$ tons

More accurate formulae

Ropes of 6-in and under: $\quad$ B.S. = $\frac{C^2}{2.5}$ tons

Ropes of over 6-in: $\quad$ B.S. = $\frac{C^2}{2.6}$ tons

General purposes: $\quad$ S.W.L. = $\frac{B.S.}{6}$

Weight of a fathom: $\quad$ O.19 C^2

Weight of a coil of rope:

manila or sisal: $\quad$ $\frac{C^2}{5}$ cwt

coir: $\quad$ $\frac{C^2}{5}$ cwt

The following abbreviations will be used in this appendix:

B.S. - Breaking strength (breaking load)
P.L. - Proof load
S.W.L. - Safe working load
F.S. - Factor of safety
C - Circumference, in inches
D or d - diameter, in inches

Figure 33.5 Cordage, natural fibre rope

Rope and its usage

Table of comparison between ropes

Wire rope	Manila rope	Nylon rope
Strength and weight From 4 to 7 times as strong as manila of equal size, and from 1.5 to 2 times the strength of manila of equal weight	About the same as sisal of equal size, and five times stronger and twice the weight of coir of equal size	About three times as strong as manila of equal size. Slightly lighter in weight than manila and sisal, and about 10 percent the weight of wire rope of equal size. (Terylene has approximately 65 percent the strength of Nylon).
Elasticity For practical purposes it is not elastic	When used within its safe working load approximately 15 percent of its length	When used within its Safe Working Load approximately 30 percent of its length, and, before parting, nearly 50 percent of its length. (Terylene approximately 15 percent of its length)).
Loss of strength when wet None. But prolonged immersion will corrode the wire rapidly, with a corresponding reduction in strength.	Approximately 45 percent when saturated	5 to 10 percent when saturated (Terylene rope is unaffected).
Shock absorption None, because of its lack of elasticity.	Fair. Suddenly applied loads tend to destroy the common friction of the individual fibres.	Extension and ultimate recovery to its original length result in tremendous capacity for shock absorption and prevent the sudden build-up of a high peak load.
Flexibility Much less than that of cordage.	Fairly good when dry, but poor when saturated.	Good at all times.
Resistance to Rot and Mildew Very good if properly maintained and lubricated	Poor.	Complete.
Anticipated Life Long if used with care and properly maintained, but slightly less than that of man-made fibre rope.	Manila is 30% and sisal is 25 percent that of Nylon	Longer-lived than wire and much longer-lived than natural fibre rope if properly handled. (Terylene has a life 90 percent that of Nylon).

Figure 33.6 Rope and its usage (Data supplied by Kinneas Ropes).

Section 2

Outboard motors

Exercise 34
Major components

A small outboard motor has many features which help it start and work properly.

Questions

Redraw the diagram opposite in your notebook. Now use your textbook index to find the term *outboard engine* and turn to the page which discusses it .

Use the diagram in your textbook to label your diagram with the following words:

- Top cowling
- Shift lever (indicate forward, neutral and reverse)
- Starter handle
- Throttle
- Steering handle
- Attachment point to transom
- Exhaust housing
- Fin
- Propeller
- Water outlet
- Water intake
- Clamp brackets
- Engine controls
- Clamp handles
- Tilt pin
- Anti cavitation

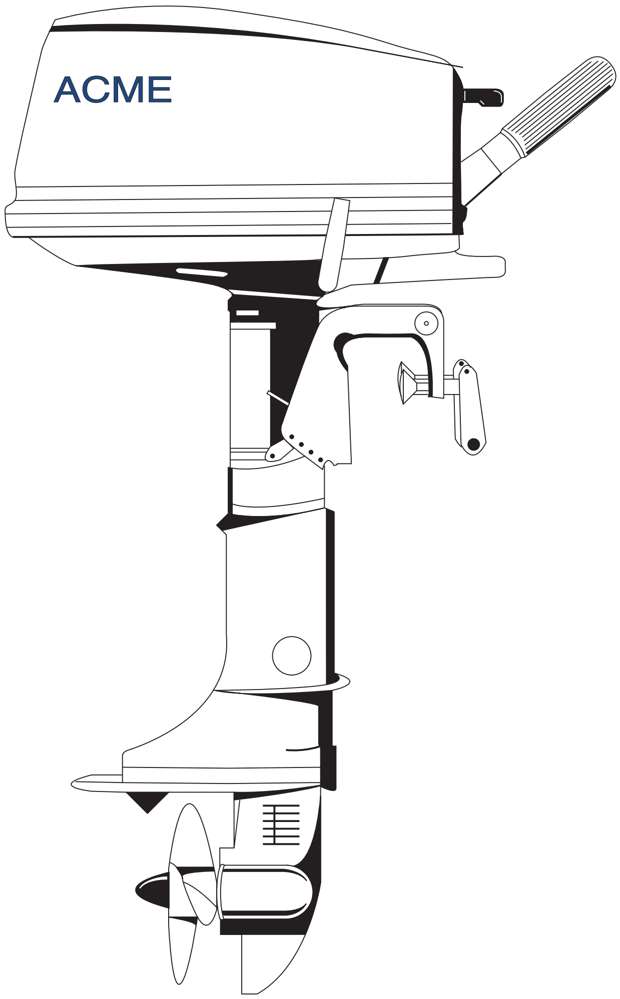


Figure 34.1 Outboard motor
Wet Paper

3. Look at Figure 34.2

   a. What size is the motor?

   b. How is it mounted on the boat?

   c. What approximate size is the boat?

   d. Describe what has to be done to the motor before the towing vehicle departs.

   e. Does this motor have oil injection? Can you tell? If not, what would you need to see in another photo?

   f. Motors bigger than this require *trim and tilt* mechanisms. What does the term trim and tilt refer to?

   g. Where are the controls for trim and tilt and how are they operated?

   h. Motors bigger than this require mechanisms other than a pull start. Describe one such mechanism, where it would be located and how it works.

   i. Where are the bungs located in this photograph?

   j. Are the rollers aluminium or rubber?

   k. Describe one disadvantage of rubber rollers on a trailer that carries an aluminium boat.

   l. Towing lights are required before the trailer can be driven away. Are these in place yet? If not, why were they taken off?

   m. Where is the radio located?

   n. Where is the depth sounder located?

   o. The boat is a centre console. What does this mean?

Wet Paper

Figure 34.2 Motor, boat, trailer and towing vehicle. Equipment supplied courtesy David Claridge and Wide Bay Regional Education Office

Exercise 35
Tools and their use

Questions

1. Obtain a small tool kit like the one shown in Figure 35.1.
2. Examine each of the components so that you can recognise them at a later date.
3. Now complete a table like the one below.

Materials and equipment (per group)

Equipment required

- small tool kit
- spark plug
- spare pull cord
- small vice mounted (optional)
- water repellent fluid

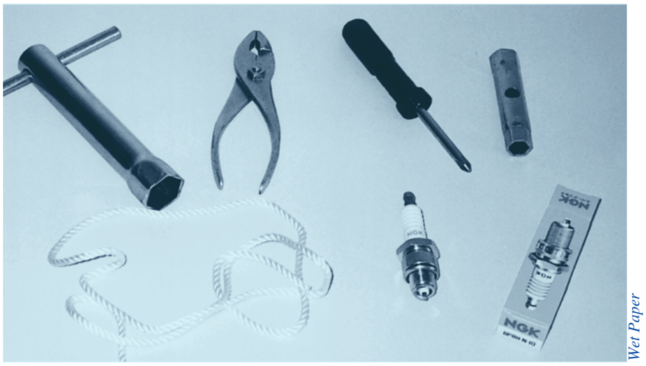


Figure 35.1 Small tool kit commonly supplied with outboard motors (Equipment supplied courtesy Mariner Outboards).

Part of kit	Use
Screw driver	
Spark plug socket set	
Spare pull cord	
Pliers	
Spark plug	
Small socket	
Bench vice	
Wire brush	
Water repellent fluid	
Feeler gauges	

Exercise 36 Starting the motor

Method

1. Clamp the motor to a stand and place a bucket of water under it. A stand is shown in Figure 36.1

   Make sure the water is deep enough to be drawn into the cooling system and make sure if you can't lift the motor, you get someone to help. You can use a brick or timber to raise the bucket off the ground.

2. The fuel with the petrol and oil is connected to the motor by a fuel line.

   You must pump that fuel to the engine before you attempt starting. Some fuel tanks have a vent cap which also needs to be open.

3. If the motor is cold, and there is no petrol in the motor, the choke needs to be opened to give the motor the best chance of starting.
4. The spark plug needs to be clean and the pull cord in good order.
5. The motor is started by spinning it.

   A pull cord is used to spin the motor and a spark from the spark plug ignites the fuel and the motor then starts.

6. Once the motor is running, the motor needs to be put into gear to spin the propeller in a direction which either moves the boat forward or backward.

Materials and equipment (per group)

Equipment required

- outboard motor
- fuel tank
- bucket of water
- sturdy stand to clamp motor on to

Safety

1. Make sure all connections are secure and that the stand you are working on will not fall over.
2. Make sure you look over your shoulder before you pull start so you don't belt someone in the jaw.
3. Run the motor in a bucket of water and make sure the tell tail is visible.
4. Make sure you do not exceed your strength in lifting motors. If you are unsure, ask someone to help you.
5. Don't put the motor in gear in the bucket.
6. Don't exceed the revs while in neutral.

The best place to learn all these things is on land.

The manual of the motor you are using will show you how to connect the fuel line. A sample of what to look for is given in the next exercise. The description below* is for a small outboard engine.

For a larger engine, consult the manufacturer's handbook because many larger engines use a key, are controlled by a battery, a trim and tilt mechanism, and require specific sequencing for starting.

* Developed by Failes (1985) for teaching secondary school students.

Ashore (cold)

1. Recheck that the motor is mounted correctly and is sitting in a bucket of water so that the cooling system will suck the water in through the vents and out through the tell tail. Alternatively attach a set of commercially available outboard motor flushing ear muffs to the tap and run water continually through the motor.
2. Connect the fuel line (check for sand or gunk on the end) and make sure the screw on the cap is loose so the tank can breathe (see Figures 36.2 and 36.3).
3. Pump the bulb until reasonably firm.
4. Check the control arm connections and linkages to see if they are operating correctly.

5. Is the gear lever in neutral?
6. Is the choke on?
7. Is the throttle on 'start'?
8. Gently pull the starter cord until it catches.
9. Look behind you (so no-one gets belted in the mouth when you pull cord!).
10. Pull the starter cord hard three times or until the motor starts. If it does not start after three pulls, turn the choke off.
11. As soon as the motor 'kicks', turn off choke and drop the revs.
12. Check to see if water is coming out from the tell tail (shows water pump is operating).
13. Never change gears when the motor is in the bucket or over-rev the engine when the motor is in neutral.
14. Attach the 'kill switch' to yourself (if required).

Ashore (hot)*

Use the following suggestions when the motor is hot.

1. Gear lever should be in neutral.
2. Throttle should be on start.
3. Same as steps 9, 10 and 11 above.

* Note: When motor is hot, do not use choke.

Figure 36.2 Pumping the bulb

Figure 36.1 Boating starting stand (Acknowledgements to Peter Travis and built by John Wiley)

Figure 36.3 Connect the fuel lines and make sure they are secure.

QUESTIONS

Use your textbook index to find *outboard fuel* and turn to the page which first describes it.
Now complete the following vocabulary exercise.

Outboard fuel

The outboard motor is _________ usually by ____________ fuel supplied from a fuel tank. Two stroke fuel is a mixture of petrol and oil usually in the ratio of 1 L of oil for every 50 L of petrol. The fuel tank has a storage area, a gauze filter, and is attached to the motor by a ________________ .

When the fuel tank is transported, the cap is closed to prevent leakage. However pressure will build up and should be released before connecting the fuel hose.

.___________ is pumped through the line by the _______________ located at the end of the hose near the tank. The flow of fuel mix is controlled by a stainless steel ball at the end of the hose. Before connecting the hose to the motor make sure there is no dirt or sand around the ___________________ .

Mixing outboard fuel

Outboard fuel for smaller outboards is a mixture of ______________ in most cases. In larger modern outboards, oil is injected into the engine.

Safety

Make sure there are no ___________ around when you mix fuel and definitely no smoking in or around fuel tanks. One spark can turn fuel tanks into exploding grenades sending shrapnel and burning fuel all over your body.

Ignition

The purpose of the ________________ is to ignite the petrol and air mixture in the _____________ chamber at the exact moment that will provide the greatest power from the combustion. An ___________ is used to ignite the mixture which occurs at the base of the ________________.

The **spark plug** consists of a body supporting two electrodes between which a spark occurs. The inside ________________ is insulated by a porcelain insulator.

When an electric current passes down the centre of the electrode, it leaps across the gap to the second electrode thus igniting the mixture or charge of petrol and air.

Ventilation systems

A cup of fuel in an open boat will ________________ and burn to make an intense fire. However the same cupful in an enclosed space is covered by a vapour and if ignited will _____.___________ violently. For this reason, boats with enclosed motors must have ventilation systems which allow these gases and vapours to escape.

. ___________ can be passive in which a forward facing cowl catches wind and takes it down into the bilge by a flexible pipe. A similar duct extracts the ________________ air. In an active system, a motor drives a fan which expels the air from the bilge.

Exercise 37 Reading the manual

Questions

Locate the manual that came with your motor and answer the following questions.

1. For what model of motor is this manual?
2. What are the headings listed in the table of contents?
3. What type of fuel is used for this motor and how is it mixed?
4. What is the specification of the motor you are using at school in terms of the following?
   - Bore
   - Stroke
   - Spark plug model
   - Spark plug gap
   - Fuel tank capacity
   - Operating RPM range
5. What is the break-in procedure for the motor?
6. What are the lubrication points and service times for the motor?
7. What routine inspection checks does the manual recommend?
8. What instructions does the manual give about mounting the motor on the transom?
9. What daily inspections does the manual recommend?
10. Does the manual tell you what to do if the motor is submerged? If so, what is the recommended procedure?

Materials and equipment (per group)

Equipment required

- copy of motor manual

Figure 37.1 Courtesy Mariner Outboards

Mixing fuels

1. An outboard requires a 50:1 fuel mix. What does this mean?
2. An outboard tank has a capacity of 5 L and requires a 50:1 mix. Outline how you would go about preparing the fuel for the boat's engine.
3. Outline the ratio of mixes for a 25:1 fuel mix for the following tank sizes:

   a. 12 L

   b. 4 L

   c. 18 L

   d. 30 L
4. What safety precautions should be taken when mixing boat fuels?

Exercise 38 Diagnosis and repair

Method

Each motor will have a small tool kit.

Take this out and make a list of the parts in the kit. Typically it should have a spark plug socket and wrench, open-ended pliers, screwdriver, spare sheer pin, cotter pin, prop, spark plug and cord.

Form a small discussion group and find out how the plug wrench, screw drivers, and pliers are used.

Now mount the motor on the stand supplied and following the next set of instructions.

1. Remove the cowling, as shown in Figure 38.1, from the power head and locate the spark plug.
2. Remove the spark plug cover and the high tension lead. You may need a pair of pliers
3. Select the spark plug socket from the tool kit.
4. Place the socket over the spark plug and carefully wrench it in an anticlockwise direction as shown in Figure 38.2. The plug should move and then the pressure can be reduced and the plug removed by hand.

   If the plug is hot, be very careful not to burn your fingers
5. Lay the plug down and use Figure 38.3 to identify the following parts:
   - Thread
   - Insulator
   - Earth electrode
   - Shell
   - Terminal
   - Spark plug gap
   - Centre electrode
   - Permanent gasket

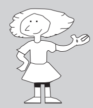
Materials and equipment (per group)

Equipment required

- outboard motor
- tool kit supplied with motor
- feeler gauge (for spark plug gap)
- copy of *Marine Studies*
- spark plug worksheet

Safety

1. If repairs are done when the motor has been running, the components of the power head will be hot. Either allow the motor to cool down, or use a rag to insulate your hands from the heat e.g. spark plug.
2. Never force a spark plug out by using a hammer on the socket as it could break. It must be forced out by a level action.



If you are exerting force, make sure you have a good grip on your tools so as not to slip and injure your hand.

6. If the spark plug has a gap, use the feeler gauge to measure the spark plug gap and look up the manufacturer's specifications. Adjust the gap accordingly with either a screwdriver or by gently tapping the earth electrode on the desk.
7. Use the wire brush and spark plug cleaning set to remove any gunk from under the earth electrode.
8. Re-check the spark plug gap.
9. Continue cleaning the thread and around the gasket.
10. With an insulated pair of pliers, hold the plug close to part of the metal casing and rotate the powerhead in the direction it would rotate if the pull cord were in operation.
11. Look for a clean, bright spark.
12. Insert the spare split pin from the tool kit into the end of the high tension lead and once again rotate the powerhead while bringing the split pin close to the metal case.
13. If there is a bright spark, it means that there is power coming through the lead. Note that these simple tests are to indicate performance only. There is nothing better that having your motor properly serviced by a qualified mechanic who will set all functions to the manufacturers details.

Questions

In your textbook find the section on cleaning a spark plug in the chapter on outboards. It is not in the index of the first edition, but five pages from the end of the chapter.

1. Identify the words a – i from the text and write down the meaning for each.

   Clean the ______________ between the ______________ and in and around the ______________

   Use a wire brush and when replacing, make the d. __________ firm but not tight.

   Make sure you use the correct tools and don't force the ______________ Remove the ______________ and then with the ______________ carefully remove the spark plug and place it in a vice.

Take a piece of _____________ or wire brush and rub between and around the spark gap. Then take a flattened nail or something similar and remove dirt and carbon from inside the well. Check the ______________ from the manufacturer's specifications and replace.

2. Why is a spare pull cord included in a repair kit and how should it be stored?
3. Why do some spark plugs have no earth electrode?
4. Why don't diesel engines have spark plugs?
5. Why is it not advisable to help remove a spark plug with a hammer?

Figure 38.1 Opening the cowling

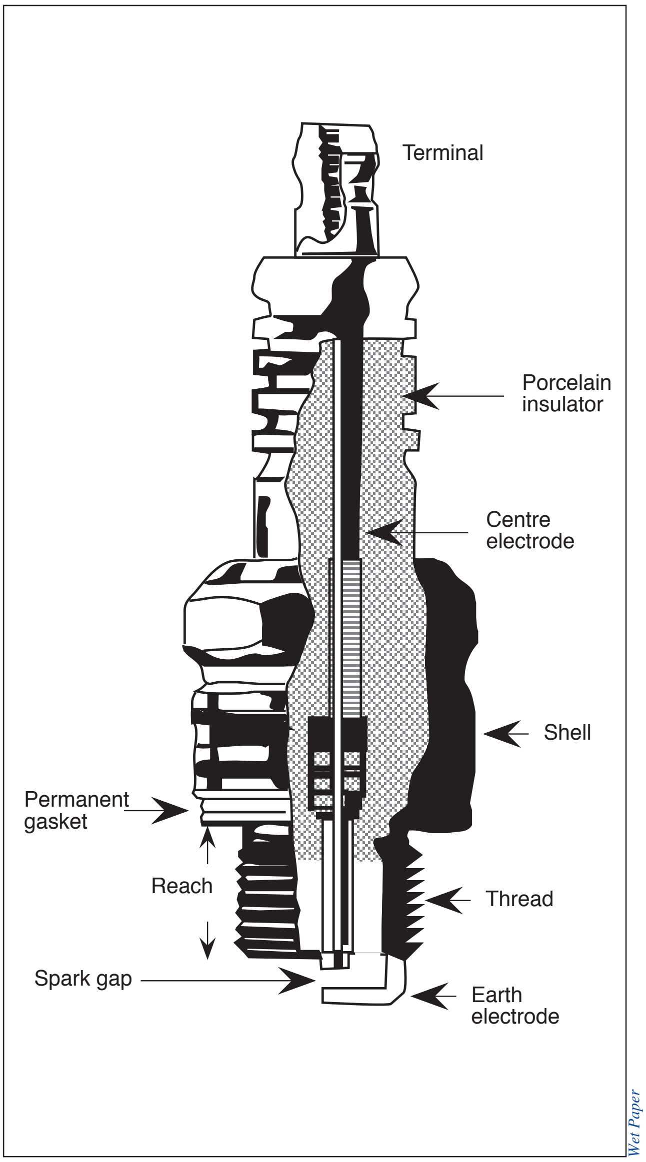


Figure 38.3 Spark plug in cross-section

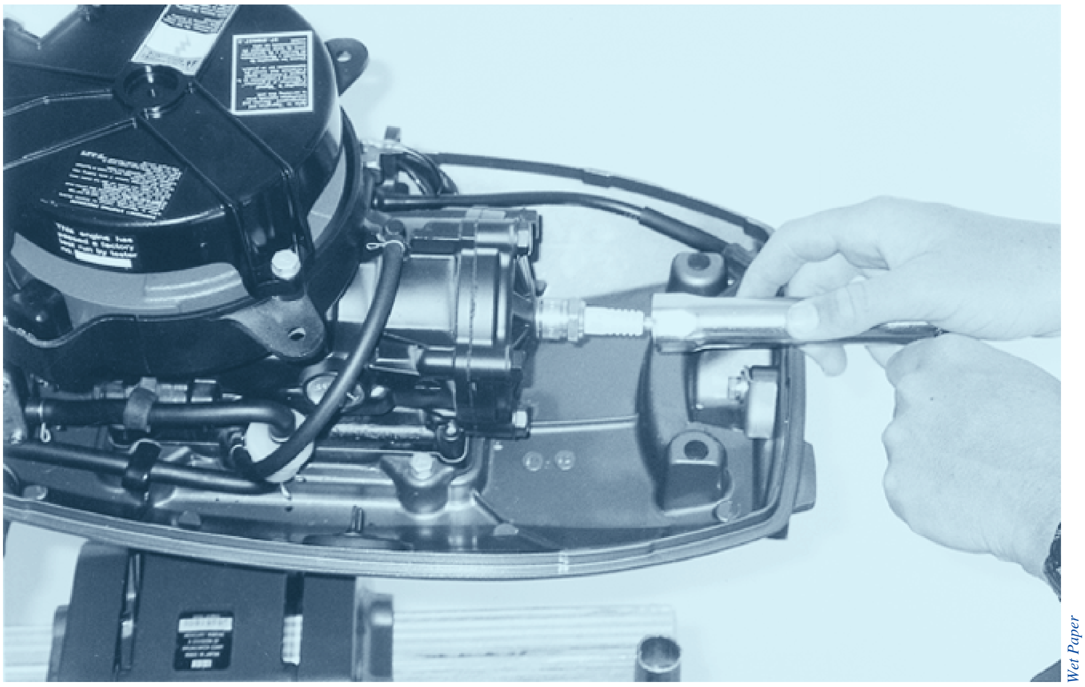


Figure 38.2 Replacing the spark plug

EXERCISE 39
THE COOLING SYSTEM

QUESTIONS

1. In Figure 39.1.a, colour the white part in blue following the arrows
2. Mark on your figure the following parts:
   - Intake point
   - Exhaust point
   - Tell tail
   - Thermostat
   - Water pump assembly
3. Mark in the following in Figure 39.1.b.
   - Impeller
   - Impeller housings
   - Lower gearcase assembly
   - Propeller
4. What does the impeller do?
5. Why have a thermostat?
6. What is the purpose of the tell tail?
7. What is the danger of the piece of plastic that was floating in the water as you were driving, being wrapped around the prop with regards the cooling system?
8. Use your textbook index to find the words *cooling the powerhead*. Complete the following sentences.

   Air cooled ________________ engines are manufactured with metal fins protruding from the outside of the cylinders and cylinder heads to radiate the heat from the engine to the surrounding air.

MATERIALS AND EQUIPMENT (PER GROUP)

Equipment required

- notebook, pencil and rubber
- blue colouring pencil
- copy of *Marine Studies*

Most outboard motors are ___________________ although some manufacturers still market, in the lower horsepower range, air cooled models.

Water cooled. Water cooled systems, though varying with each make of motor, are basically of the design where water enters through an __________________ near the gearcase and is directed to a water pump located in the lower unit.

From the pump, the coolant passes through tubes or channels to the powerhead where operating temperature is thermostatically controlled. Discharge is effected through an exhaust relief and __________________ .

As with all internal combustion engines, ... where regardless of engine speed the flow of liquid is held relatively constant.

Water for cooling the power head is circulated by the ____________ located on top of the ____________ and driven by the ____________ between the engine and the gearcase. A typical pump , consists of a synthetic rubber __________________ which is keyed to the __________________ , and the pump housing which is offset from centre with respect to the driveshaft. __________________ are manufactured from such materials as aluminium alloy, bronze alloy or hard plastic.

Some __________________ have stainless steel liners which the impeller blades revolve against. At slow speeds the impeller blades follow the contour of the housing ... and operates as a positive displacement pump, drawing water in as the area

between the__________________ increases, and being forced out the outlet passage and into the powerhead as the area decreases...

... Limited circulation is often permitted by a

__________________ in the thermostat valve which also allows discharge of air from the cooling system. The

__________________ may recirculate the coolant water in the powerhead until operating temperature is reached, then opened to allow the heated liquid to be exhausted or may bypass the power head with the circulated liquid ...

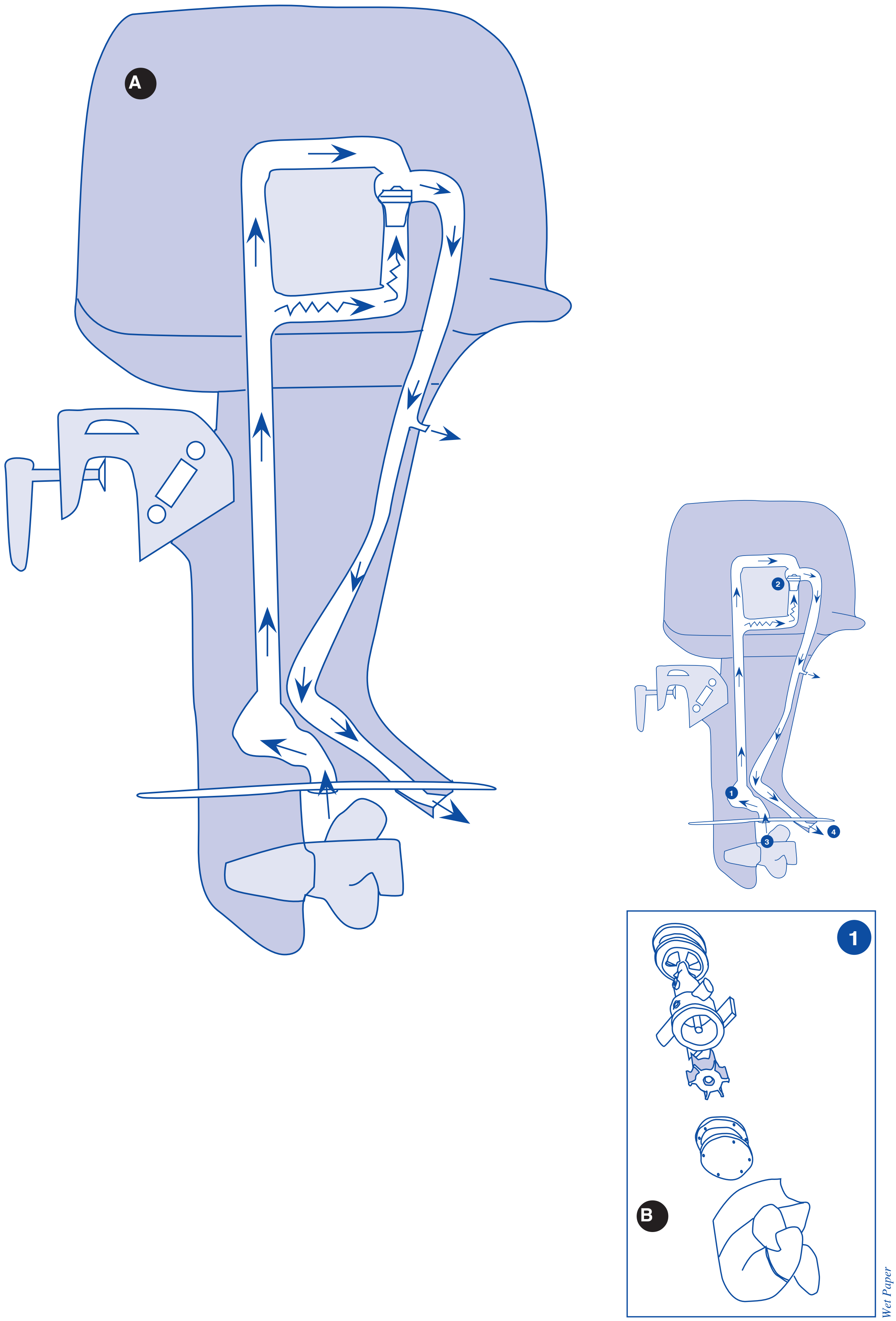


Figure 39.1 Schematic representation of cooling system of outboard motor. Students may make one copy of this page so that they can attach their answers before handing in for marking.

Exercise 40 Lubrication and Maintenance

Method

1. After using an outboard motor, clean down the outside with clean water.
2. Flush the motor till the carburettor is empty of fuel and then clean fuel tank and lines and stow away.

   A simple system for flushing a series of motors is shown in Figure 40.1.
3. Remove the cowling and use the water repellent fluid to spray in and around all electrical parts.
4. Remove any sand or mud which may have worked its way around the rubbers.
5. Replace cowling and use vaseline or grease to lubricate the clamp screws.
6. Check under the throttle grip to see if lubrication is necessary and around swivel brackets and shift handle.
7. Remove prop to see if any fishing line has tangled around the propeller shaft and grease if necessary.

Questions

1. What is the difference between water resistant fluid and grease?

Wet Paper

Figure 40.1 Using a stand to flush and start a motor.

2. Use the textbook index to find the heading *Servicing the motor*.

   Use the illustrations on that page to complete the worksheet in Figure 40.2 in which you are to list the service requirements for the points.
3. In your textbook, find the section on *submerged motor*. What are the four steps to be followed as indicated in that section?
4. Write a paragraph about how a motor should be stored after use.
5. Give two safety hints you should note when carrying an outboard motor.

Materials and equipment (per group)

Equipment required

- grease or vaseline
- water repellent fluid
- worksheet on lubrication
- copy of *Marine Studies*
- old rags

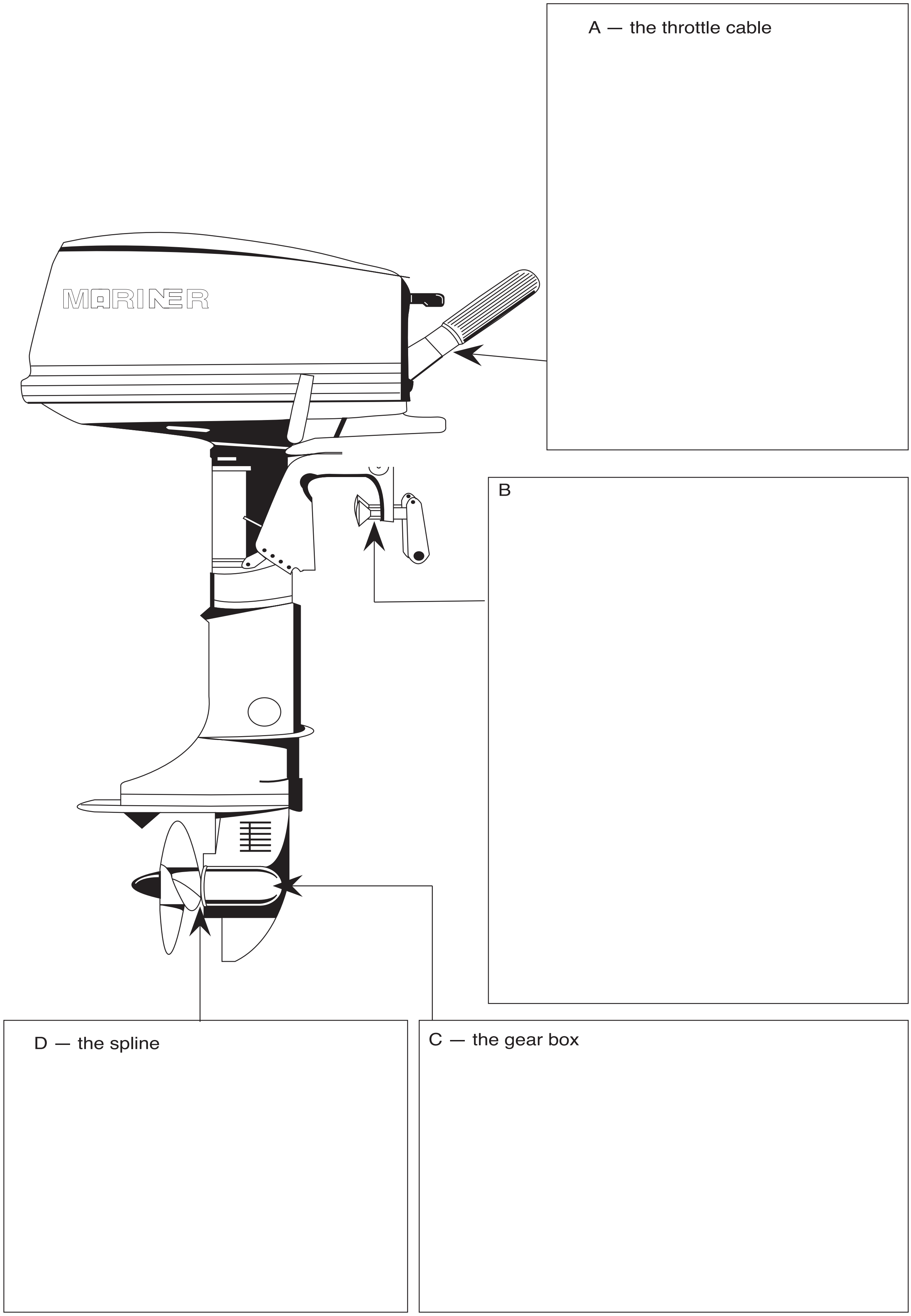


Figure 40.2 Worksheet — lubrication details. Students may make one copy of this page so that they can attach their answers before handing in for marking.

Exercise 41
Fuel systems

Research assignment

You will need to go to a fuel station and interview one of the mechanics.

a. Look up the address of your local fuel station. Record the type of station, address and telephone number.

   Ring up the fuel station, find out the manager's name and record it.

b. Now ring the fuel station and ask to speak to the manager. If the manager is not able to come to the phone, find out a suitable time and ring back.

   When you are able to speak to the manager, explain who you are and the purpose of this call which is to ask for help with your assignment, either in person or over the phone.

In completing this research assignment, make sure you address the following questions:

1. What types of fuel can you buy at the fuel station and what is the pump price per litre?
2. What is the difference between unleaded and leaded fuel and why is Australia moving to unleaded fuel?
3. What does diesel fuel contain and are spark plugs needed in a diesel engine?
4. What type of fuel is used for outboard engines?
5. What type of oil is added and how is it sold?
6. List some of the ways boat-users buy their fuel e.g. premixed, mix it themselves, have boats with oil injectors, etc.
7. For people who mix their outboard fuels, what is the most common ratio of petrol/oil used?
8. Do four-stroke engines require oil to be mixed?
9. Is oil ever mixed with a diesel fuel? Give reasons.
10. What types of fire extinguishers are used at the service station?
11. For a motor whose operations manual specifies a petrol:oil mix of 50:1, how much oil is required to be added to the following sized petrol tanks?
    a. 50 L
    b. 25 L
    c. 10 L
    d. 5 L
12. What is the basic principal of mixing oil and petrol in an oil-injected two-stroke engine?
13. Sometimes small fuel tanks are fitted with hoses. Why is it unwise to allow the hose to roll around in the dirt in the back of the ute, truck or car?
14. Where possible, fuel tanks are filled away from the boat. Why is this?
15. Why is smoking prohibited while filling fuel tanks?
16. What types of fire extinguishers are used for petrol fires?

Materials and equipment (per group)

Equipment required

- copy of local phone book
- money for phone call
- copy of *Marine Studies*

Exercise 42
Power units

There is a large variety of power units that propel boats.

Poster presentation

1. Use your textbook to find the chapter on *outboard motors*.
2. Make up a poster of Figure 42,2 and use reference magazines to find out which boats would have inboard, outboard or a combination as their power unit.
3. Make a presentation in class of your findings.

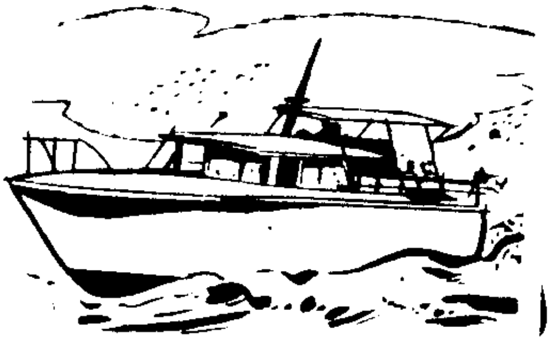


Figure 42.1 What type of power unit could this boat have?

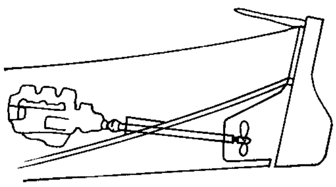
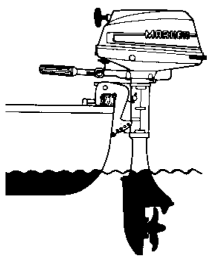
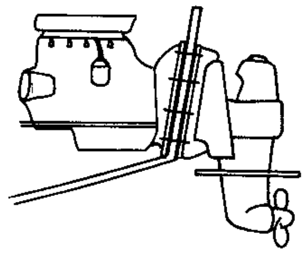
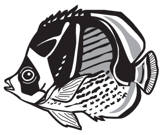
Inboard		Outboard		Inboard outboard	
					
Advantages	Disadvantages	Advantages	Disadvantages	Advantages	Disadvantages
Where controls are located					
How controls change direction					

Figure 42.2 Students may make one copy of this page so that they can make up their poster.

EXERCISE 43
REVISION TEST

Time 30 minutes

35 Marks



Knowledge and understanding

1. Which of the following is **not** an advantage of having an inboard engine?
   a. The inboard engine can be worked on while at sea.
   b. Many of the parts of an inboard engine are inexpensive.
   c. The inboard motor is quiet and difficult to steal.
   d. Inboard motors automatically tilt if they hit an underwater obstruction.
2. The pitch of the propeller is:
   a. the theoretical distance the vessel would advance with one turn of the propeller.
   b. the theoretical angle at which the propeller is placed to give maximum thrust.
   c. the frequency of the sound produced by the propeller in air.
   d. the size of the propeller compared to the angle of the shaft.
3. The small pump driven by the gear box which draws water in through the intake vents is called the:
   a. impeller.
   b. cowling pump.
   c. cooling water intake.
   d. cotter pump.
4. If you are required to add outboard oil to fuel for your motor at a ratio of 40:1, what volume of oil will you need to add to 20 L of fuel ?
   a. 50 mL
   b. 500 mL
   c. 1 L
   d. 2 L
5. Which of the following is **not** a type of cooling system?
   a. Air cooled
   b. Constant circulation system
   c. Pressure temperature system
   d. Sheffield system
6. Air-cooled engines are:
   a. manufactured with metal fins protruding from outside the cylinders.
   b. mostly of less than 20 hp.
   c. manufactured with an intake point near the gearcase.
   d. thermostatically controlled.
7. The water pump is:
   a. located on top of the gearcase and driven by the driveshaft.
   b. located between propeller and impeller.
   c. powered by the movement of water over the water inlet.
   d. a negative displacement pump.
8. When using a pressure temperature system:
   a. a pressure value is used in a negative ratio with the water pump.
   b. as engine speed increases, water pump pressure opens a relief valve passing water to the thermostat.
   c. circulation of water is controlled by a balanced action between the pressure control valve, water pump and the thermostat.
   d. heated water closes the water pump uptake.
9. Label the diagram in Figure 43.2 with these component parts:
   - Water outlet
   - Fuel line conector
   - Lower unit
   - Clamp handles
   - Water intake
   - Starter handle
   - Cowl clamp lever
   - Steering handle
   - Shift lever
   - Propeller
   - Steering adjustment wing nut
   - Anti-cavitation plate
   - Tilt pin
   - Clamp brackets
   - Top cowl

10. Name and state the function of parts 1 – 4 in Figure 43.1 below.

(4 marks)

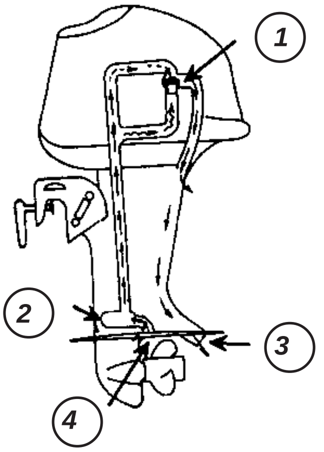


Figure 43.1 Figure for question 10

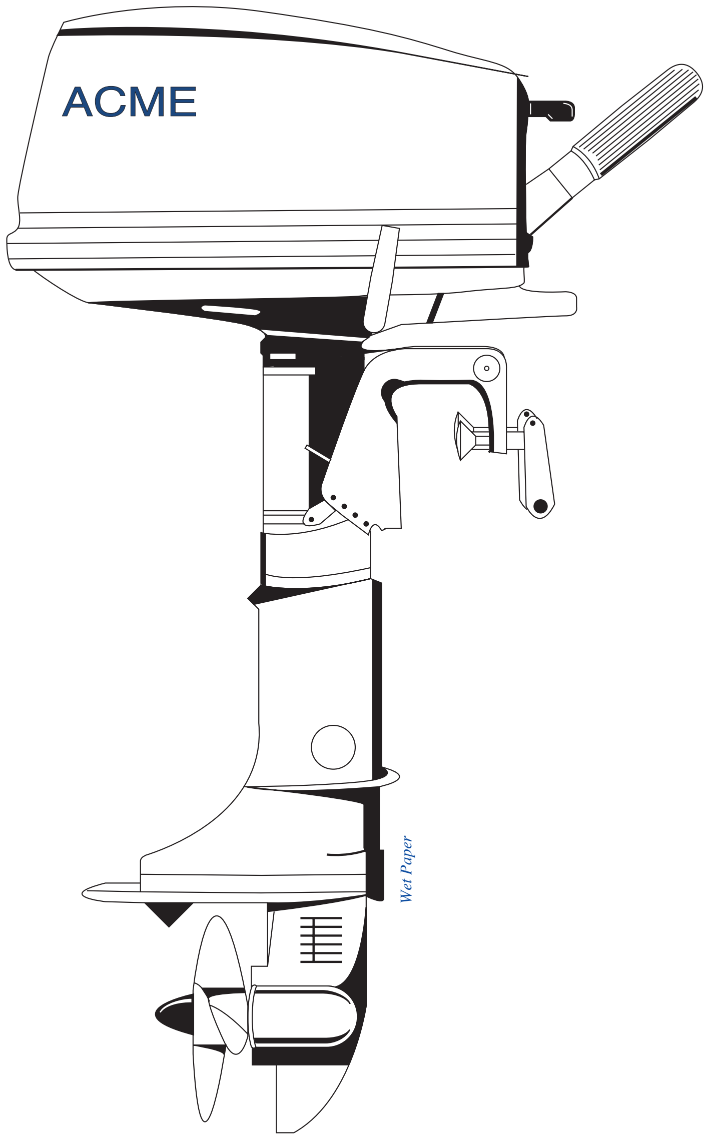


Figure 43.2 Figure for question 9

Information processing and reasoning

1. Use the trouble chart below to:

   a. List 10 reasons why a motor might not start.

   b. The motor speed is slower than normal, the motor does not idle properly and runs irregularly or misses. List three probable causes.

   c. If the propeller is of wrong pitch or diameter, suggest some possible problem which may develop.

(10 marks)

2. On an outboard motor, the propeller shaft gear has 12 teeth and the drive shaft gear has 16 teeth. Calculate the gearbox ratio.

   If the propeller has a pitch of 15 cm, how far will the motor move through the water for one turn of the motor? Allow for 10 per cent slippage.

   If the propeller has 250 revolutions per minute, what will be its speed ?

(5 marks)

Trouble Chart

A. Does not start
B. Runs irregularly or misses
C. Starts momentarily and cuts out
D. Does not idle properly
E. Motor speed faster than normal
F. Motor speed slower than Normal
G. Does not develop normal boat speed
H. Motor overheats

A	B	C	D	E	F	G	H	POSSIBLE CAUSE
•		•						Fuel tank empty or vent screw closed
•			•					Motor is cold
•		•						Fuel line is not connected
•	•	•	•		•	•	•	Fuel line pinched or kinked
•	•	•	•		•	•	•	Fuel filter(s) in need of cleaning
•	•	•	•		•	•	•	Air leak in fuel system
•		•	•					Low speed mixture screws mal-adjusted
			•		•	•	•	Wrong oil in fuel mixture
	•		•		•	•	•	Wrong gasoline in fuel mixture
			•		•	•	•	Not enough oil in fuel mixture
	•		•		•	•	•	Too much oil in fuel mixture
•								Motor flooded
•	•		•		•	•	•	Spark plugs fouled or defective
	•		•		•	•	•	Wrong type spark plugs
•								No spark
•	•	•	•		•	•	•	Weak spark or intermittent spark
					•	•	•	Water pump failure
					•	•	•	Cooling system clogged
				•		•		Propellor damaged
				•	•	•		Tilt angle adjusted
				•	•	•		Boat improperly loaded
					•	•		Transom too low
				•		•		Transom too high
	•				•	•	•	Excessive spark advance
					•	•		Insufficient spark advance
				•	•	•		Propellor of wrong pitch or diameter

Answers
part A
1. d 4. b 7. a
2. a 5. d 8. c
3. a 6. a

Section 3
Small craft handling

Exercise 44
What to wear

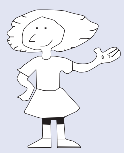
Questions

Read the safety hints to the right, study the photographs on pages 75 – 77 and then answer the following questions.

1. What advantages are there in wearing your PFD all the time in a small boat?
2. Why is it important to pay particular attention to protecting ears, nose and lips?
3. Why wear a long-sleeved shirt?
4. Why does it get colder on a boat than on land?
5. What is the name of the sun protection in Figure 44.1? What special features does it have compared to a hat you would go bush walking in?

Safety

1. Wear a hat that does not blow off in strong winds. Ideally the hat should cover your neck and ears.
2. Wear sunscreen that will stay on for the length of time you go boating. Take special notice of lips and nose as these are nasty places to have cancer cut out when you get older.
3. Wear a long-sleeved, warm shirt. It can get cold on the water.
4. Wear your PFD if at all practical. Close fitting PFDs such as the one shown in Figure 44.2, are ideal for inshore waters.
5. Wear other clothing to suit climate and sea conditions. What you wear in Tasmania, will be different from Cairns. Remember that a beach landing will often require you to get out of a boat into water. Shorts are often a better alternative to jeans in situations such as this.



Wet Paper

Figure 44.1 What to wear in a small boat

Wet Paper

Figure 44.2 Shorts can be better than jeans.

6. You are going to sea on a ship like the one shown in Figure 44.3 which sails from Fremantle in Western Australia to Cairns in Queensland. List the clothes you would take, giving reasons for your choice.
7. You are going sailing in a small sailing dinghy like a Corsair for an afternoon. List the clothes you should pack.
8. Your friend has invited you out on a 10 m yacht for afternoon tea. The boat is moored in the marina. What type of shoes should you wear? Give reasons for your answer.
9. Your friends and you are going camping for a weekend. You plan to do some fishing and snorkelling . You are going in a 3 m tinny. What clothes should you take and how should they be packed?
10. Describe briefly what you should wear for the first day of work experience in each of the following situations. Give reasons for your answer.
    a. Fish shop filleting room
    b. Prawn trawler
    c. Deck hand on a cruise ship
    d. Crew on a tender boat
    e. Life guard with a rubber ducky
    f. Assistant sail instructor
    g. Engine room mechanic
11. What is the main difference in clothing worn in Figures 44.4 and 44.5?

    Give reasons for each of these differences.
12. Comment on some differences between clothing worn on a sailing boat and power boat.

Figure 44.3 Large ship on ocean voyage

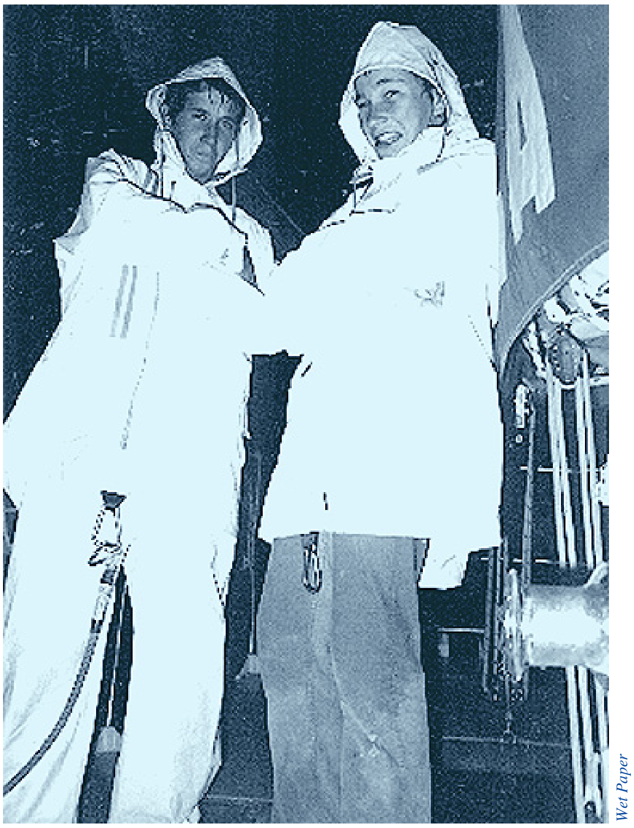


Figure 44.4 Wet weather gear for sailing

Figure 44.5 Offshore vessel for day trip to an island

Exercise 45 Working Together

It is important to know the capabilities of a group so that it can function as a cohesive unit.

This exercise considers an activity of unloading a boat trailer.

Group discussion

1. Form a small group of 3-4 to discuss the following task.
2. Your group has been presented with a situation as shown in the photographs on the next page. The class is a mixture of male and female, with differing levels of capability, confidence, physical strength and height etc.

   You have been asked to untie the boats as shown in Figure 45.1, with the view to unloading the trailer as shown in Figure 45.2.
3. Make up a list of the characteristics of a good working group. In your answer address the following issues:
   a. the different rates of learning of different people
   b. strength
   c. height
   d. weight
   e. maturity
   f. any physical disability e.g. hearing, colour blindness, epilepsy, etc.
   g. leadership
4. a. List the steps your group would take and who would be involved in your group in unloading the trailer.
   b. List the hazards in the activity and make a list of potential injuries that could be sustained.
   c. List the benefits of this activity. Why not have the teacher aide unload the boats for the class?
5. Use the Blu-Tack to secure your butchers paper on the wall and wait for the other groups to finish.

Class discussion

1. Each group discusses their sheet and a class consensus is reached about how the ideal group would work together.
2. The school shown in the photo appoints safety officers for each day the class goes boating.

   Consider appointing safety officers for each of the following situations:
   a. unloading the trailer
   b. while on the water in each boat
   c. loading the trailer
   d. cleaning up and flushing motors

   Discuss the roles and responsibilities involved in the position.

Materials and equipment (per group)

Equipment required

- Butchers paper
- Marking pen
- Blu-Tack or similar to fasten sheets around the room

Safety

Your teacher has to assess the risk of each activity you are about to undertake and so he or she needs to:

a. determine each class member's capabilities in terms of physical attributes, maturity and motor and cognitive development

b. examine the severity or consequence of an injury that could be sustained in unloading a boat trailer

c. evaluate the educational outcomes of the activity and identify the hazards and inherent dangers of engaging in that activity

Wet Paper

Figure 45.1 Untying the boats

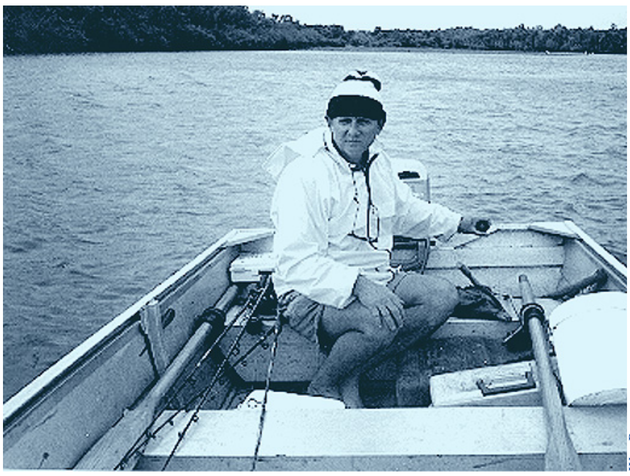
Wet Paper

Figure 45.2 Unloading the trailer (Acknowledgements to Geoff Jensen, Innisfail State High School)

Exercise 46 Getting into and out of a small boat

Questions

1. Look at situations as shown in Figure 46.2 and 46.3. Give one example of how each of the following could be a hazard e.g. water — the person entering the boat slipped, fell over into the water and drowned.
   a. water
   b. moving engine parts
   c. dangerous marine creatures
   d. extremes of temperature
   e. solar radiation
   f. heavy equipment
   g. other vessels
3. Look at Figure 46.1. Two people wish to board the dinghy. Make a list of things to do to comfortably seat the crew.



Wet Paper

Figure 46.1 Photograph for question 3. Photograph courtesy Innsifail State High School.

Safety

1. Make sure you and your crew are balanced.
2. Often the shore is littered with broken glass, sharp rocks and debris. Be extremely careful or, better still, wear protective footwear appropriate to the situation.
3. Keep your feet or shoes clean as mud or wet seats make for slippery conditions under which to work.
4. Take a firm grip of the gunwales.
5. Check the deck in the boat as it often has gear in it which may make it difficult to get a good foothold.
6. If the boat is loaded as shown in figure 46.1, it may be a good idea to rearrange items in the boat before trying to board.
7. If a aluminium dinghy has been sitting out in the sun for some time, the seats will be hot and care should be taken before sitting down.

3. Use your textbook index to find the words *conditions of loading*. Now turn to the page which discusses it in your textbook and answer the following questions.

Conditions of loading

A boat will only ____________________ as well as it is ____________________

A small ____________________ or speedboat will not get on the ____________________ if all the weight is at the ____________________ . The ____________________ should position the ____________________ to get maximum performance from the boat and motor.

Boarding and disembarking

Always face the ____________________ when you get into this type of boat and step into the ____________________ so that the centre of ____________________ is as ____________________ as possible.

Take hold of the ____________________ to steady yourself. If you move from side to side, the centre of gravity changes and the boat will move accordingly.

If you have a ____________________ , any ____________________ movement will move the boat also, so the ____________________ of a boat should be distributed ____________________ .

Wet Paper

Figure 46.2 Disembarking from a small dinghy

Wet Paper

Figure 46.3 Boarding a small dinghy

Exercise 47 Safety

EQUIPMENT

Questions

Use your textbook to answer the following questions.

1. When you launch the boat, why should you check for leaks and the condition of the hull?
2. Why are oars taken aboard a boat before setting out?
3. Why is there a rope (called a painter) at the front of every boat?
4. Why are buckets part of safety equipment and why is a rope (called a lanyard) tied to each bucket?
5. Why does everyone wear a PFD?
6. Why does the boat have a limit to the number of occupants it can carry?
6. Why is an anchor, chain and anchor line part of a boats safety equipment?
7. Look at Figure 47.1 and list of each piece of safety equipment in the photograph.

Research assignment

You may like to view the first segment of the *Safe Boating* video from Exercise 71 page 130 before starting this assignment..

1. Make a copy of Figure 47.1.

   Use a pair of scissors to cut the individual safety items a – e below.

   Now paste them in your notebook giving them their correct label.

   a. Fire extinguisher
   b. EPIRB
   c. Flare
   d. PFD
   e. Weather alert fax
   f. VHF radio
   g. Compass

2. For each piece of equipment you should discuss:
   a. What it is and if there are any different brands.
   b. Their approximate cost
   c. Where they can be purchased.
   d. How long they last or if they have expiry dates
   e. If they are compulsory according to your State law.

3 Complete a safety equipment list for each of the following vessels based on the information supplied in Figure 21, in the Safety Chapter of your textbook:

- A 3 m tinny (open boat) powered by a 9 hp outboard motor that is going to open water.
- An 8 m yacht sailing in smooth waters
- 4.89 m boat going to open waters

Wet Paper

Figure 47.1 Students may make one copy of this page so that they can cut out the individual parts of safety equipment to illustrate their answers.

Exercise 48
Rowing a boat

Method

1. Read the text and study the illustrations 1 – 4, in Figure 48.1.
2. Now board your dinghy, fix the oars as shown in Figure 48.1, face the stern of the boat and practice rowing.
3. Practice turning the boat by pushing one oar forward and dragging the other back.

   Here are some hints to make for a successful experience.

   - Don't try to row too fast.
   - Pull on the oars with equal strength. Keep your arms straight until the oar passes you as shown in Figure 48.1.3 and 48.1.4.
   - Don't dip the oars in too deep, they just have to dip under the water so the blades are covered.
   - Line up a point that you are rowing from and keep it in line in order to row straight.
   - If the boat has an observer, seat this person in front of you so they can see where you are going.
   - If the boat is fitted with a motor, make sure it is in the up position.
   - Remember, the more you row, the better you will become.

Questions

1. What is the advantage of having someone with you when you row?
2. Which direction should you face when rowing?
3. As you approach shore, what should you do?
4. What are the dangers of trying to row too hard?

Materials and equipment (per group)

Equipment required

- A copy of *Marine Studies*
- small aluminium dinghy in a sheltered waterway
- oars and safety gear
- rescue boat with motor

Safety

1. Make sure you and the crew are balanced.
2. Take notice of wind and current to predict where you will end up and how difficult it will be to row.
3. If your oar breaks loose in a hard stroke you may be thrown off balance. This can result in you falling backwards and injuring your head. To avoid this, make gentle strokes at first so that you can get a rhythm.
4. Warn crew not to get up until boat stops and to wear shoes or check out the beach for broken glass or sharp rocks when disembarking.

5. Use the textbook index to find the page which discusses *rowing* and write down the missing words in the text.

Turning

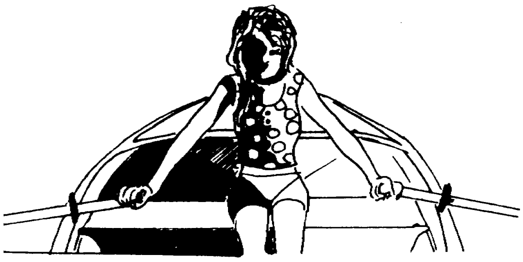
The oars also control the direction in which the boat travels. If you want to go to ____________ , then pull on the oar that is in your left hand, while moving the oar in your right hand in the opposite direction.

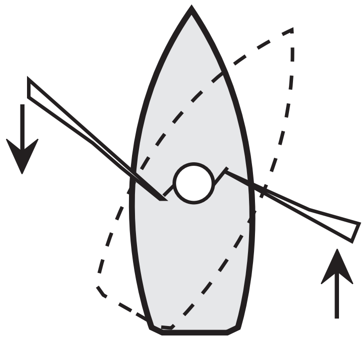
Line up a point on the ____________ and row away from it.

Returning to shore – rowing

Select your ____________ and row towards it. Look around to check condition of beach and warn crew not to get up until the boat has stopped. As the ____________ touches bottom, raise the oars and ____________ inside the deck area. Ask crew to ____________ warning them of sharp objects in the water, ____________ and the rocking of the boat, which may be caused by waves or wash from passing craft. Pull the dinghy well up the beach.

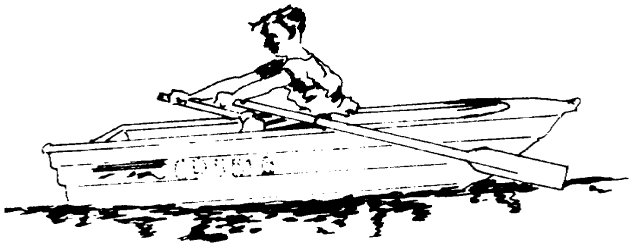
1. When rowing, sit comfortably in the middle of the boat and face the stern.



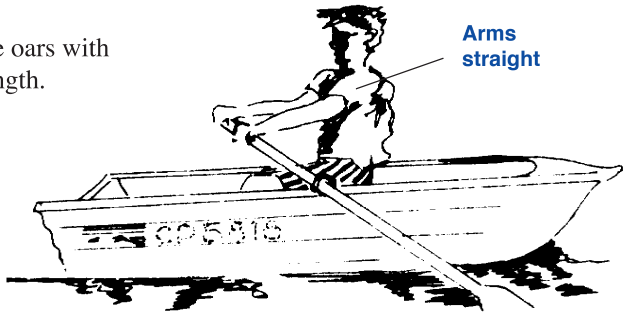


2. You don't have to dip the oars in too deep, they just have to dip under the water so the blades are covered.

5. Turning — the boat can be turned by pushing one oar forward and dragging the other back.



3. Pull on the oars with equal strength.



4. Pull back until the oar blade just passes you and then manoeuvre the blade out of the water so as to repeat the cycle.

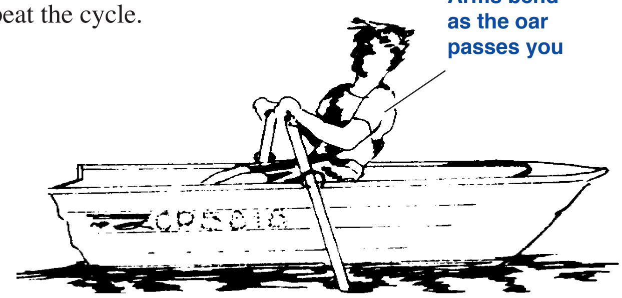


Figure 48.1 Rowing techniques

Exercise 49
Safety instructions

Your teacher is responsible for ensuring that safety requirements are established before classroom exercises can commence.

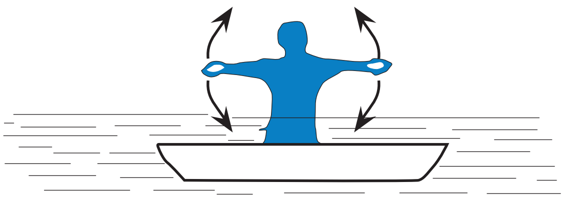
Explicit instructions will be given to you about the area you are allowed to go and any dangers that could occur on the day.

This activity will allow you to discuss these instructions with your teacher and ask any questions to avoid confusion on the day.

Class discussion

Your teacher should go through each of the following points. Make sure you listen carefully and if you have any questions, don't hesitate to ask.

1. A set of simple signals is to be established and practiced to allow communication between boat and shore. Find out what these are. Common signals are one whistle — stop and listen, two whistles — come to the whistle blower. Signals for assistance could be moving arms from side to side as shown:



2. Discuss and watch a demonstration on the use of flares, V-sheets and other distress signalling equipment to make sure you know how to use them.
3. Discuss what to do if someone falls overboard in the first lesson and what is to happen as a result.
4. Discuss procedures for avoiding collisions on the first lesson.
5. Discuss the hazards in the safety instruction box in Figure 49.2.

   Notes:

   a. If you cannot rectify a problem, you should call or signal for assistance immediately.

   b. You should wear suitable clothing to protect yourself from heat and cold.

   c. Your teacher will give you a boat safety checklist for the area you are boating in. In the interests of safety, you must carry this out, take all the safety equipment required and wear PFDs if so instructed.

   d. Don't exceed the maximum number of people who should be in the boat.

   e. Don't start a motor or run a motor when someone is in the water nearby.

   f. Your teacher will continually assess the weather and, if a change is on the way, may have to ask you to pack up and go home early.

   g. Each day you go out, you will receive instructions on tides, water depths, currents, wind, rain or other weather situations which may cause a problem on the day.

Questions

1. When all boats are in the water, practice the raft up drill as shown in Figure 49.1 and discuss the following questions.

   a. What are the signals for rafting up, return to shore, I am in trouble and need assistance?

   b. What happens if someone falls overboard?

   Discuss also any problems groups are having with equipment, the effects of currents, tides, weather, wind or rain.

   Practice moving people from one boat to another and boat stability.

2. When you get home that night, make a list of when each of the following safety checks should be done.

   a. The bung is in place.

   b. Everyone is securely positioned.

   c. Check the ramp for broken glass.

   d. The safety gear is in.

   e. The boat has a rope tied to the bow.

   f. The floor of the boat is not leaking.

   g. The boats are securely tied to the trailer.

   h. The radio works.

   i. The motor is in good working order.

   j. The tool kit is complete.

   k. There is a spare spark plug.

   l. All of your crew can swim.

   m. The right safety equipment is in.

3. Make a list of additional local hazards that could be encountered in your local area that could affect boating in your local area e.g. strong currents in the middle of the tide, blue-green algal blooms, etc.

Figure 49.1 'Rafting up' is an important first time exercise and serves many purposes (photo Geoff Jensen)

SAFETY INSTRUCTIONS*

The following suggestions are taken from the *Draft Safety Marine Studies Modules*, from the Queensland Education Department.

1. Some of the hazards that may be encountered in boating activities include:
   a. water
   b. moving engine parts
   c. dangerous marine creatures
   d. extremes of temperature
   e. solar radiation
   f. heavy equipment
   g. other vessels
2. As part of the process of self-regulation, all persons engaged in boating activities, will need to participate in identifying and managing the additional hazards not mentioned above.
3. Hazardous situations include:
   a. starting a motor while someone is in the water near the propeller
   b. operating in choppy or rough conditions
   c. incendiary devices (flares) being used
   d. uncontrolled rapid unwinding of a winch handle
   e. handling and mixing fuels
   f. loading a vessel beyond its accepted passenger or weight limit
   g. person overboard

Notes

1. These safety instructions are for waters that are either a bay, estuary, canal, lake or dam and are within 1 nautical mile of land.
2. Acknowledgement is made to the Queensland Education Department for supplying the above information.

Figure 49.2 *Safety instructions adapted from draft Education Department policy document

Exercise 50
Going out

Skills*

You have had all the talks and rules about safety, but now you are about to take your boat out. Use the following as a checklist to help you take your first steps in using an outboard motor and boat together.

1. Lower the motor and check that it is properly mounted with the safety chain on (check your textbook if your don't know how).
2. Start the motor as described in Section 2 of this book. Check to see if water is coming out of the tell tail and that the motor idles.
3. When the motor is warmed up, ask your crew to board.
4. Check the depth of water under the propeller to make sure you are not about to dig a new channel out from the shore.
5. For slow water skills it may be more comfortable to sit astride the seat.
6. Look all around and ask your lookout to give the all clear.
7. Engage brain.
8. Slowly reverse out so that water does not splash in over the transom.
9. Pull the gear into neutral.
10. Check to see if the safety boat has been launched with the teacher or person in charge aboard.
11. Now slowly engage forward gear and look around to get the all clear before reversing out.

* Skills discussed are applicable to the types of craft in Figures 50.1 and 50.2

Questions

Study Figure 50.1 opposite and answer the questions.

1. What are four safety checks to be done before anyone gets in the boat?
2. List four basic safety checks of equipment that he should have done.
3. What should have been checked after everyone is in the boat, but before the motor is started?
4. The motor starts and the person holding the boat steady is about to push you off. Suggest a correct and safe procedure.
5. What has not yet been placed in the boat?

Safety before anyone gets in the boat

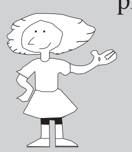
1. Can you swim? What precautions should be taken if your crew cannot swim?
2. Can you row?
3. Can you tie a knot that won't slip if you have to be towed?
4. Do you know the signal for *help, come and rescue me*?

Safety before starting motor

1. Is the bung in?
2. Are the oars and rowlocks secured?
3. Are buckets, anchor, chain, rope and signalling equipment in?
4. Are PFDs on?
5. Is sun cream applied and are hats on (if applicable)?
6. Is the motor mounted correctly?
7. Is the motor's safety chain on?

Safety after your motor is going

1. Make sure you are in the boat when you start the motor.
2. Make sure you have an experienced driver with you to hold the boat steady at the shore while you start the motor.
3. Stow your gear including your crew. Have crew properly accommodated for maximum stability.



Now study Figure 50.2.

6. Which direction will the stern swing with the tiller in this position?
7. Is the observer looking in the right direction? Give reasons for your answer.
8. The student engages forward but the boat goes nowhere. What could be the problem?
9. What is the name of the rope tied to the bow? Why is it important?

Wet Paper

Figure 50.1 Launching and lowering motor

Wet Paper

Figure 50.2 Reversing the boat

Exercise 51 Underway

Skills

For a stern drive boat (i.e. with the motor on the transom)

1. Sit in a comfortable position with one hand firmly on the throttle and another on the gunwale.
2. Think to yourself, if I turn the throttle one way, then it will accelerate. Now if I turn the throttle the other way, it will decelerate.

   Do this a few times to convince your brain that you are doing the right thing.

   Practice increasing and decreasing revs so that you get the feel of the motor.

   Practice steering to port and to starboard so that you get the feel of the motor acting as a rudder, applying the principles as discussed in the section on close-quarters boat handling of your textbook.
3. Apply the boating rules you learnt in Section 1, for example:
   - Which side of the channel to drive the boat.
   - If another boat is approaching you head on, which way to move.
   - The right of way rule and the system of buoyage for the area. Are you entering or leaving port?
4. For the first 15 minutes, just be content with becoming confident.
5. In a boat with a forward drive, study the throttle assembly and the manual and use accordingly. Many small craft have forward drive with a steering wheel to simplify operations. Figure 51.1, a trihull, is extremely stable
6. In forward drive vessels the boat will turn in the direction you turn the wheel.

Safety while underway

1. Don't go too fast.
2. Look around you all the time.
3. Keep to the right of channels and know your local buoyage rules.
4. Get the feel of the throttle.
5. When learning, have a more experienced driver with you.
6. Tell your crew what you are doing or intend doing.
7. If the boat is over 5 hp you must have a licensed driver beside you (this may be different in different States).
8. Never exceed the limit of your confidence.
9. It is best to stay close to shore.
10. Learn to tell the difference between 4 and 6 knots. To do this look at your wake. When the waves just start to break, that's when you are doing 6 knots.

Safety while turning

1. Look over your shoulder to see if you will collide with anyone.
2. Use the chine of your hull to assist the turn. Remember if you are driving a rubber ducky that there will be no assistance from the chine. However if you are driving a deep-V hull or hard chine hull, the boat will turn a lot easier.
3. In forward-drive vessels the boat will turn in the direction you turn the wheel.

   Often a canopy may restrict visibility and it's a good idea to have an observer to help you.

   Make sure you have a good look around before turning or leaving. If any part of the canopy prevents this, tie back parts that impede vision or distract you from driving.

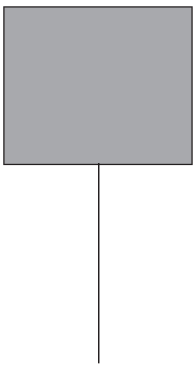
Figure 51.1 A trihull boat with a forward drive

Figure 51.2 A small aluminium dinghy underway

QUESTIONS

Look at Figure 51.2 above.

1. Is the boat on the plane?
2. Is the hull hard or soft chine ?
3. To turn to port, which way should the student push the tiller?
4. If the student increased throttle and leaned forward, which way would the bow go, up or down?
5. The student looks forward and sees a channel approaching with a boat on her starboard bow. What should she do?
6. She is confronted with a marker that looks like this



   a. What does she need to know before making a decision about which side to pass on?

   b. What type of marker is it?

7. Is the student sitting astride the rear seat ? Is this a suitable position for the size of this boat, speed she is travelling and sea conditions?
8. If the motor was changed to a 15 hp, the boat size increased to 3 m and the sea condition unchanged, what alterations do you think the student should make?
9. The motor stops 50 m out from shore, however the student can still see the teacher on the shore. All attempts to start the motor fail. What should she do?
10. Norm gets into the boat. As he is keen as mustard, he jumps into the boat and takes off at a great rate of knots. He rounds the bend out of sight.

    a. List at least five things Norm has forgotten to check.

    b. Are you allowed to drive boats out of sight of your instructor at your school?

    c. What additional precautions need to be taken if you are?

Exercise 52 Coming back to shore

Skills

The beach landing is a skill requiring considerable practice in which you judge your speed so that you can disengage the gears, turn off the engine and lift the motor up just as you glide into the beach.

The only way is to practice and you have to take into account factors such as tide and wind, as well as the type of material that the beach comprises.

Assuming you are now operating the craft by yourself, here are some tips:

1. Sight where you want to make landfall.
2. Always turn your motor off before you pull it from the water.
3. Remember that your boat does not have brakes.
4. Remember that the propeller will hit the bottom if you don't pull the motor up.
5. Come in very slowly. About 10 m from shore, switch off the motor and the boat will tend to move under its own momentum towards land.
6. Now quickly pull the motor up — you will hear a click.
7. When the boat has completely stopped, disembark following the safety suggestions in the box opposite.
8. Avoid windward shores (if at all possible).

Safety as you approach the shore

1. Try not to approach the shore too quickly.
2. Try not to run the boat up onto the beach with the motor still going.
3. Warn others in the boat to stay seated until the boat comes to a complete stop.
4. Never jump out of a boat while it is in motion.
5. Watch out for swimmers and rocks.

Safety after the boat has stopped

6. Ask each person to get out one at a time. Others to remain seated till everyone is out.
7. Warn people to watch for broken glass, sharp rocks and slippery surfaces.
8. Keep an eye out for your following wash or waves which may wash the boat into your disembarking crew.
9. Avoid allowing the boat to slip sideways to the shore as it is dangerous when waves strike the boat from the seaward side and can cause the boat to rock violently.

   Keep the boat at right angles where at all possible. Note that each boat has its own particular features. A rubber ducky, for example, is a very stable boat and can be boarded from almost any side.

Safety in a landing place

1. Select the lee shore to land on if at all possible.

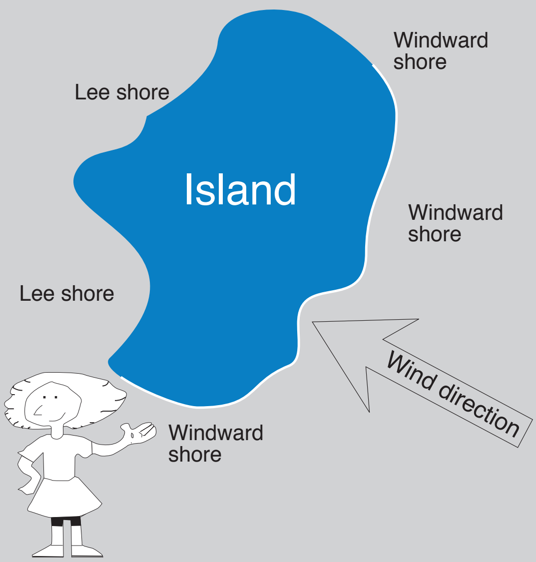


Figure 52.1 Coming back to shore

Questions

Look at Figure 52.1 and the centre boat.

1. Is this a beach or jetty landing?
2. What should the student be about to do?
3. What gear is the motor in?
4. How many knots is the boat travelling?
5. If there were two crew, what should the student be telling them?
6. List three steps she should now perform in order to successfully beach the boat.

Now concentrate on the boat to the left in Figure 52.1

7. List five safety points that should be going through his mind.
8. When should he have the boat in neutral?
9. There is nobody to hold the boat when he has landed it. How should he disembark?
10. Is there any wind or tide in this photograph? How can you tell?

Now concentrate on the boat in the background. A sudden large wind begins to blow off the starboard bow and the driver needs to make a turn and return to shore.

11. How should this person now approach the shore to beach the boat?
12. The wind speed increases to 20 knots. The boats now have to be lifted out and carried back to the campsite. What precautions need to be taken when carrying small aluminium boats in strong winds?
13. The boats are to be stored over night. Rain and strong winds are forecast. What precautions need to be taken for overnight storage of these boats?
14. During the night, trees start to fall, the wind increases to a low howl and you thought that this coming back to shore exercise was a piece of cake. What precautions should you now take to secure the personal safety of your crew?
15. Ask your teacher or friends to relate a personal story of a night of terror at sea. Why do all seafarers respect the sea?

Exercise 53
Mooring at a Jetty

Skills

1. Line up the jetty. Take careful notice of wind and tide and plan to come in against both if possible.

   If unsure of the strength of the tide, come in close and drop speed to gauge their force and then swing back around before you make your final approach.

   If the wind is very strong, it may be an idea to attract someone's attention and ask them to catch a line you can throw them (this depends on the type of boat you have).

2. If conditions are ideal, come in very slowly.
3. Allow the bow to touch the jetty, attach a line to the bow, pull the tiller towards you, put the motor in reverse and walk the stern in.
4. Secure the painter up to whatever is there, cut the motor and ask your crew to disembark one at a time.

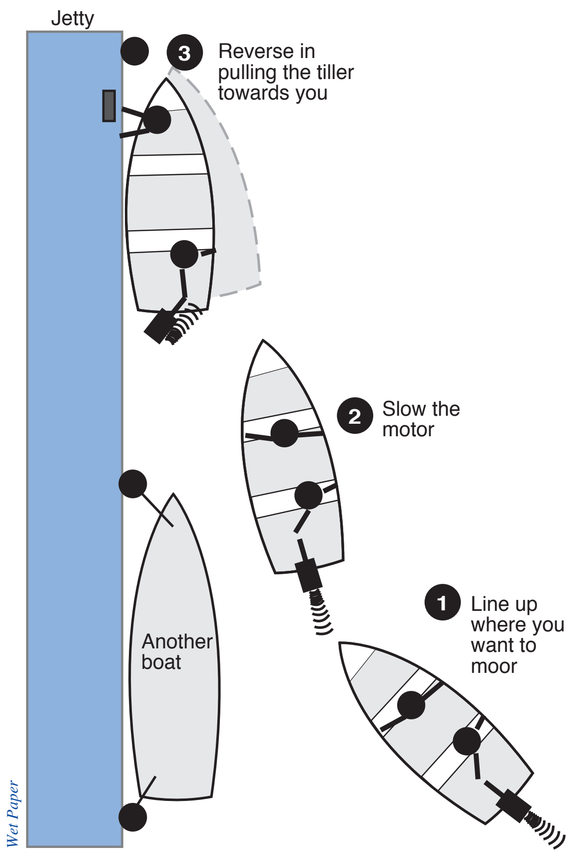


Figure 53.1 Approaching the jetty

Safety at the Jetty

1. Warn crew to keep hands in and remain seated when approaching the jetty.
2. Watch out for waves and wash.

   The role of the skipper should be to warn others of approaching wash and warn crew not to hold onto gunwales on the side of the jetty.

   A helpful hint is to have simple rules, given clearly and loudly e.g. hands in the boat.

Safety while Boarding and Disembarking

1. Load and unload luggage one piece at a time.
2. Don't throw luggage.
3. Lift straight up and pass from person to person to avoid leaning over.
4. Remain in the centre balancing the boat while others get out.

Questions

Look at Figures 53.2 and 53.3 and answer the questions below.

1. Is there any wind or current around the jetty? Give reasons for your answer.
2. What speed is the driver approaching the jetty? Give reasons for your answer.
3. What should the driver in Figure 53.2 be thinking at this point?
4. In Figure 53.3, the boat is just about to touch the jetty. When it does, the motor will be reversed. Which direction should the tiller be pushed — away from or towards the driver's body?
5. If the driver pulled the tiller towards her body, in what direction would the bow move?
6. The examiner wishes to tie the boat up to the railing. What knot should he use?
7. If the driver in Figure 53.2 wanted to moor at the pylon so the examiner could tie up, describe how she should approach this mooring and what type of knot would the examiner use around the pylon?
8. List three safety points to remember while at the jetty.
9. List three safety points to remember while people and gear are boarded and disembarked.

Wet Paper

Figure 53.2 Approaching the jetty A.

Wet Paper

Figure 53.3 Approaching the jetty B.

Exercise 54
Mooring to other places

Skills

Mooring to another boat

1. Make sure you have fenders ready. If these are not supplied, use towels or PFDs to prevent damage to your boat (and possibly to you if you upset the skipper of the other boat).
2. Ask the person you intend mooring beside if they agree and tell them how long you intend mooring for.
3. If you are using the other boat to cross to a crowded jetty, make sure your feet are clean (only do this as a last resort).

Mooring to a buoy

This may be necessary if no berth is available or you are on a reef, where the authorities require that no boat be anchored to avoid damage to the reef. In some tests, this is a compulsory element so here are some hints.

1. Approach the buoy in forward gear, moving slowly into the wind or current.
2. When almost a metre from the buoy, engage reverse gear so that you stop the boat.
3. Ask your crew to pick up the buoy, or if you are by yourself, disengage gears and move to the bow and pick up the buoy.

Mooring to a rocky shore or groyne

1. Check out the bottom very carefully to see if it is reef or mud. A coastal quick release or CQR anchor will become difficult to dislodge in a reef situation.
2. If turbid waters prevent you from seeing the bottom, test the depth with an oar. If this is not possible it may be best not to anchor and seek local knowledge.
3. If unsure about whether to stop the motor, pull the motor up and row in.
4. Mooring depends on the condition of the weather as well. Waves and wind might make a mooring unsafe.

Safety

1. When mooring to another boat, remember to use fenders or some means of preventing damage.
2. When approaching a rocky shore in a fibreglass or wooden boat, be careful not to damage the hull.

   It is best to avoid these situations if at all possible.
3. Seek the lee shore if possible. This can be as simple as the other side of the boat or jetty.

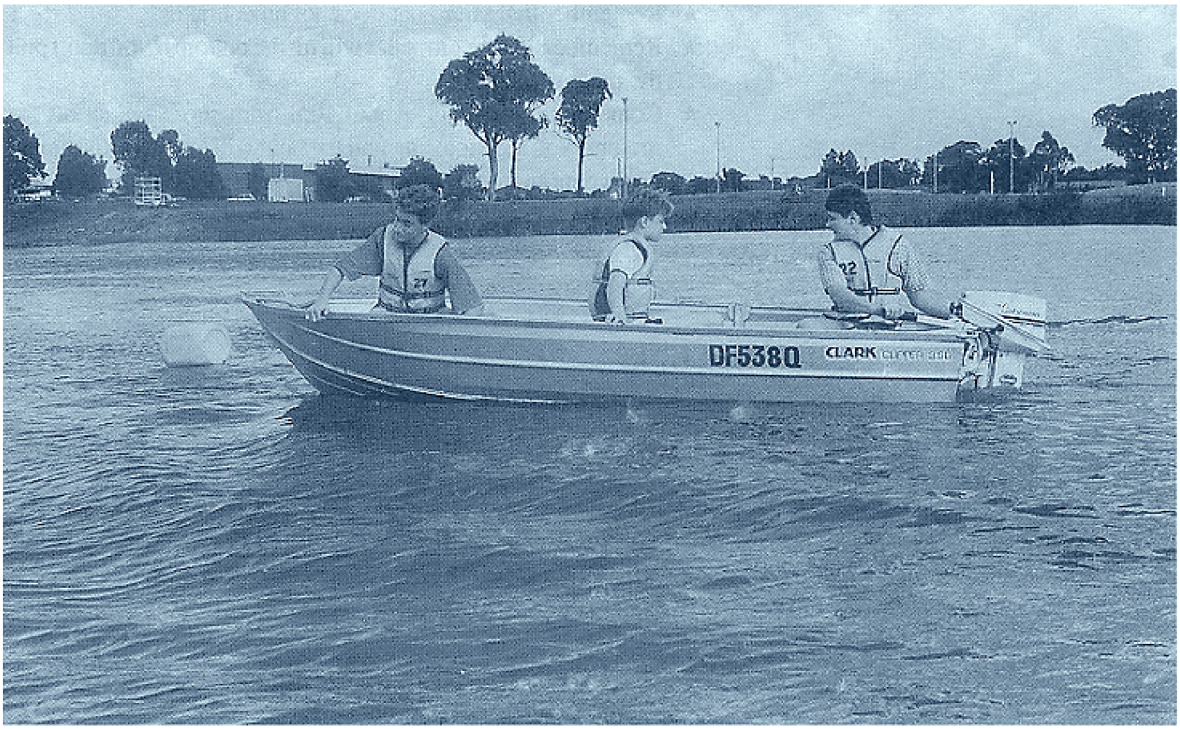
Questions

Study Figure 54.1 and answer these questions.

1. You are coming alongside the school principal's fibreglass yacht in a 3.5 m aluminium runabout and wish to board. How should this situation be best approached?
2. Why are mooring buoys becoming more frequent in marine national parks?
3. Why is it necessary to practice mooring to a buoy?
4. As the boat approaches the buoy, it will go out of sight. How will the driver know when the boat is just touching the buoy?
5. Some examiners will fail you if you touch the buoy. How can you make sure that this does not occur?
6. Are fenders needed when mooring to a buoy?

Study Figure 54.2 and answer these questions

7. What steps has the driver taken to get this far?
8. The driver wishes to pick up a passenger and his snorkelling and fishing gear. What instructions should the driver give on stowage of the gear and boarding the boat?
9. The wind is blowing 25 knots. Is this a windward or lee shore?
10. In this case the water is crystal clear. However, if the water was dark and murky, how should the driver have approached this shore?



Wet Paper

Figure 54.1 Mooring to a buoy

Wet Paper

Figure 54.2 Mooring to a rocky shore or groyne

Exercise 55
Leaving a jetty

Skills

You will have better control of your boat if you are able to face into currents or wind. This description is for ideal conditions with no other boats at the jetty.

1. Check if the channel is clear of vessels.
2. Check wind and tide because you may be able to just drift out.
3. Put motor in reverse and push the tiller away from you.
4. Move out from the jetty, then place the motor in forward gear and proceed up the starboard side of the channel.

Safety

1. Check to see that you will not collide with anyone when you leave the jetty.
2. As you fend off be careful not to injure fingers and hands.
3. Make sure you put the engine in reverse and increase the throttle slowly.

Questions

Study Figure 55.2 and answer these questions.

1. Is the tide high or low? Give a reasons for your answer.
2. The student is being examined on mooring at a jetty and pylon. The boat at the jetty is still tied up.

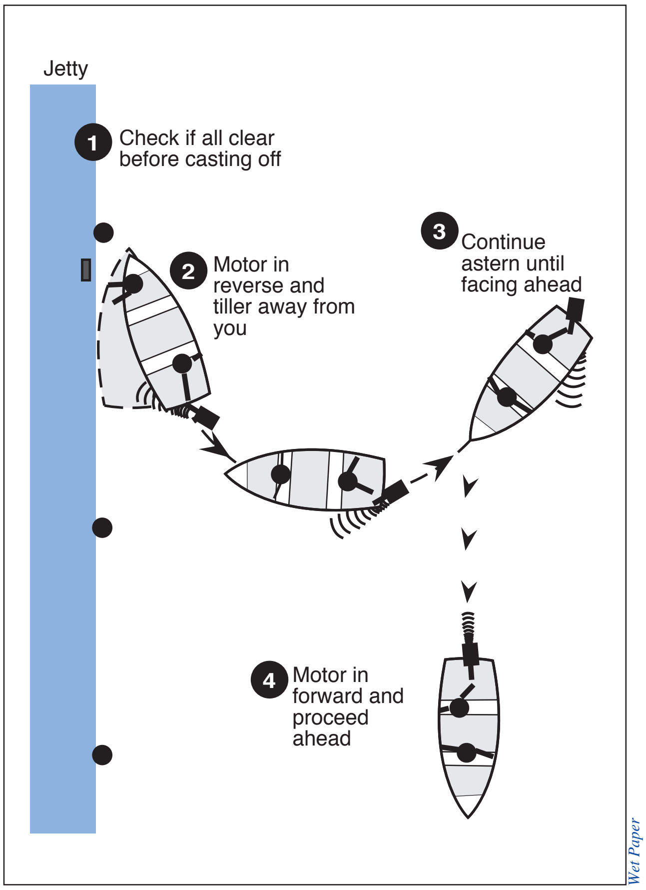


Figure 55.1 Leaving a jetty and turning

There is no wind or current. The examiner is ready to begin the test and has asked the student to depart.

Describe the steps that the student should follow.

3. The student is then asked to moor at the fibreglass runabout beached in the background and told not to run aground. The water depth drops away rapidly from the shore and is 3 m under the runabouts stern.

   Describe how the student should approach and moor beside the runabout

4. During the exam, a larger passenger vessel moors at the jetty. The examiner knows the skipper and wants to be transferred on board. However, the jetty has over 100 tourists embarking so he asks to be transferred directly from the dinghy to the larger vessel. The water round the jetty has become disturbed with the wash of the boats. What method would you recommend for the transfer of the examiner?
5. What other ways should you leave a jetty if other boats are moored behind you?

   Consider what may happen if a boat was moored directly behind you and you reversed out as shown in Figure 55.1.

Study Figure 55.3 and answer these questions.

6. Approximately how fast is the boat travelling?
7. Has the tiller been pulled towards or pushed away from the driver? Give reasons for your answer.
8. The examiner has now seen the skipper and reboarded the dinghy. The student has passed the exam but the examiner wants to be dropped off on the shore. Describe how this is best done, remembering that the water is very deep near the water's edge.

Wet Paper

Figure 55.2 Describe the steps taken next.

Wet Paper

Figure 55.3 What happens in this situation?

Exercise 56 Preventing collisions at close quarters

Questions

Watch the section in the safe boating ASMA video that deals with manoeuvring and answer these questions (see page 130, Exercise 71).

1. How can you use the thrust off an inboard engine craft to your advantage when mooring?
2. What is the advantage of manoeuvring a twin screw vessel?

Look at Figure 56.1 and answer the following questions.

3. Redraw the figure indicating the direction of the prop, stern, bow, port and starboard sides.
4. Is the boat going ahead or astern? Give reasons for your answer.
5. If the boat is going ahead and her bow is turned to port, what will be the direction of the stern?
6. Name one important safety step to do if you are the driver in this situation.
7. Draw an arrow near the propeller to show in which direction water in the close vicinity will move.

Look at Figure 56.2 and answer the following questions.

8. Is the boat going ahead or astern? Give reasons for your answer.
9. If the boat is going astern and her bow is turned to starboard, in what direction will the stern move?
10. Name one important safety step to do if you are the driver in this situation.
11. Draw an arrow near the propeller to show in which direction water in the close vicinity will move.

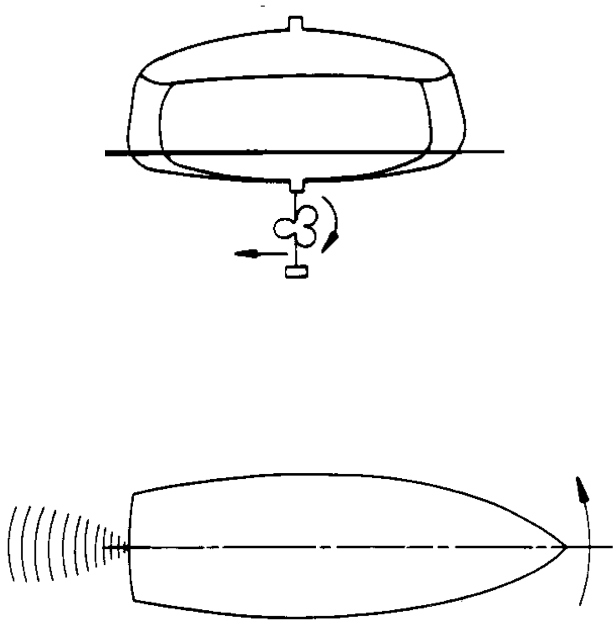


Figure 56.1 After AMSA Brochures, Commonwealth of Australia (reproduced with permission).

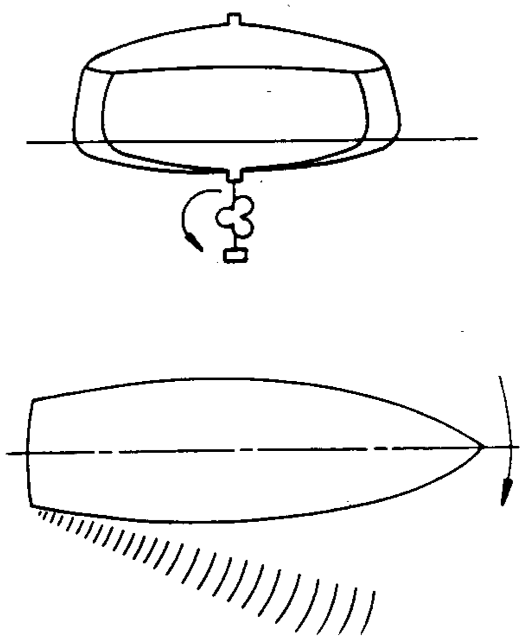


Figure 56.2 Adapted from AMSA brochures, Commonwealth of Australia (reproduced with permission).

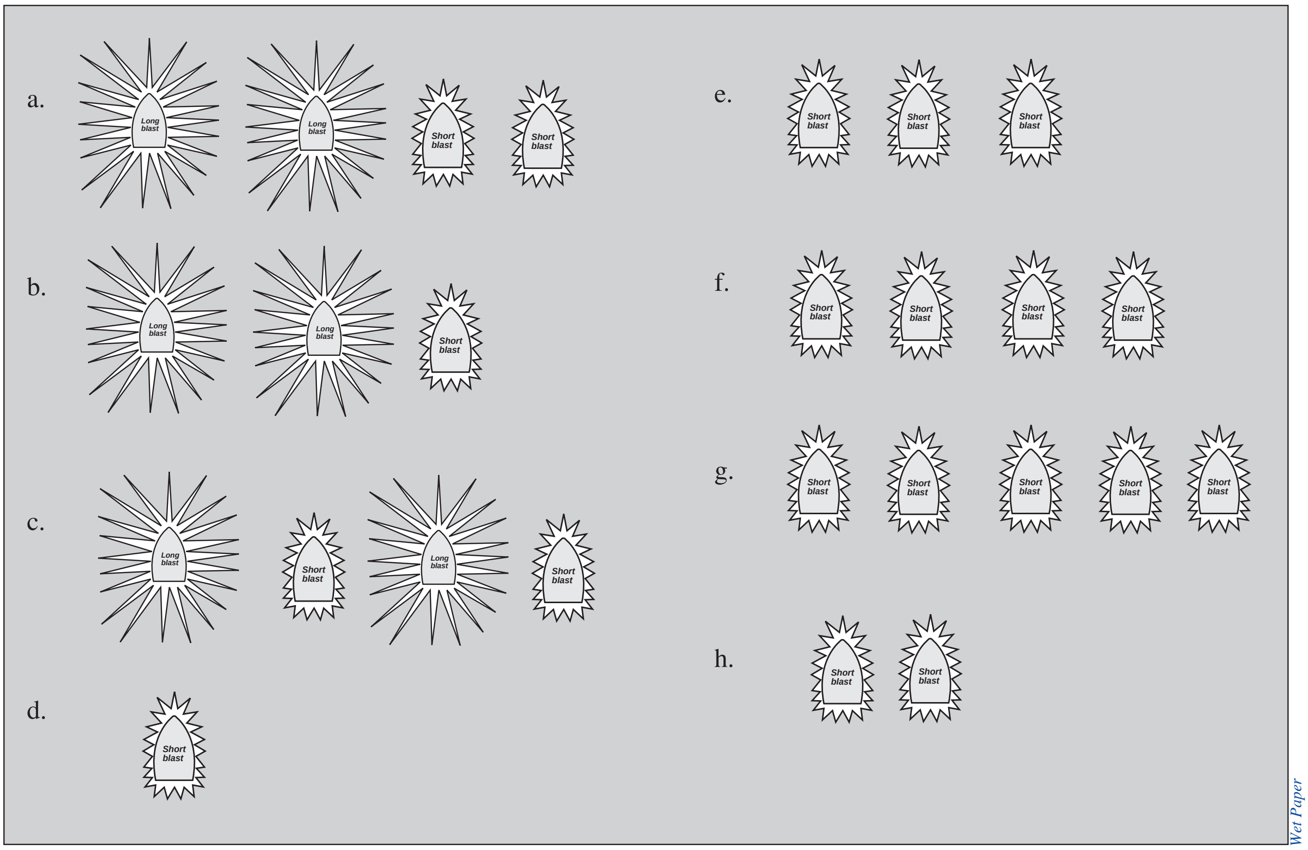


Figure 56.3 Sound signals

Use your textbook index to find the words *manoeuvring and warning signs (Rule 34).* Now turn to the page which discusses it in your textbook and answer the following questions.

12. What do the following signals a – h mean in Figure 56.3 mean if you are travelling in a narrow channel?

13. You hear five short blasts of the whistle. What does this mean?

14. Compete the following sentences.

    If lights are used for the signals for question 1's signals then the interval between flashes shall be about ____________ second.

    The duration of each ___________ shall be about one second and the interval between successive signals shall not be less than ____________ seconds and the light must be an ______________ light of minimum visibility 5 Nm.

15. What do each of the following sound signals mean?

16. Complete the following sentences.

    In ______________ whether by day or by night a ____________ vessel shall sound at intervals of not more than 2 minutes, one _______________ blast.

    If the vessel that is under way stops or can make no progress through the water, it shall sound at intervals of not more than 2 minutes ______________ of about 2 seconds between them.

Materials and Equipment (per group)

Equipment required

- AMSA Video on *Safe Boating*

  Available from:

  AMSA Sales and Marketing, PO Box 1108 Belconnen ACT 2616

Exercise 57
Planing your boat

A boat is on the plane when just enough throttle is applied to level off the boat under normal conditions. The bigger the waves, the harder it is to plane the boat.

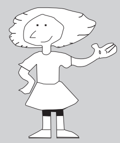
Skills

Once you are confident with your slow water skills you are ready to plane the boat.

1. Accelerate the boat so that the bow rises and then falls as you gather speed, thus trimming the boat on an even keel.
2. Some suggestions to make your boat plane properly:
   - If you are in a small boat you may have to lean forward to get the boat to plane.
   - You don't have to go flat out to plane a boat. All you have to do is accelerate enough to get the bow of the boat to rise and then fall onto its keel.
   - Always have a firm grip of the gunwale and throttle.
   - Use your brain to control your hand movements and think about what you are doing.
   - Be prepared to adjust your speed to sea conditions.
   - If you see a wave coming, slow down and ease the boat through the wash as described in Exercise 58.
   - Make sure everyone and everything are secure before you start planing. Distribute the load evenly.
   - Cut back on the throttle as the boat planes to economise on fuel.
   - Make sure your motor is trimmed correctly as shown in Figure 57.1. An incorrectly trimmed motor can cause your boat to porpoise, i.e. nose dive and then rise up. This can be dangerous.

Safety

1. Always warn the crew about what you are doing.
2. Always keep a good look out for objects ahead of you or other boats or different wave types.
3. Always look over your shoulder to check if it is safe to turn.
4. You don't have to have the throttle on full to plane the boat so cut back to a speed you feel comfortable with.
5. Listen to your own brain, not others, especially if they want your boat to go faster. Some young drivers seem to know two speeds only: flat out and stop — there is a speed in between!



Questions

Study Figure 57.2 and answer the following questions.

1. How do you know when your boat is on the plane?
2. List five safety points to keep in mind when planing a boat.
3. The driver in Figure 57.1 sees a large vessel approaching. Moving to the right of the channel he notices a very large wake. What should he do?

Look at Figure 57.3 and answer the following questions.

4. You have a 3 m boat with one other person on board.
   a. What size waves will prevent you from planing your boat?
   b. At what sized seas would you make for the nearest lee shore?
5. You are the skipper of a 4.3 m runaboat and have three people on board.
   a. Describe how you would drive the boat in a 1.25 m sea.
   b. Up to what size waves could you comfortably plane the boat in?

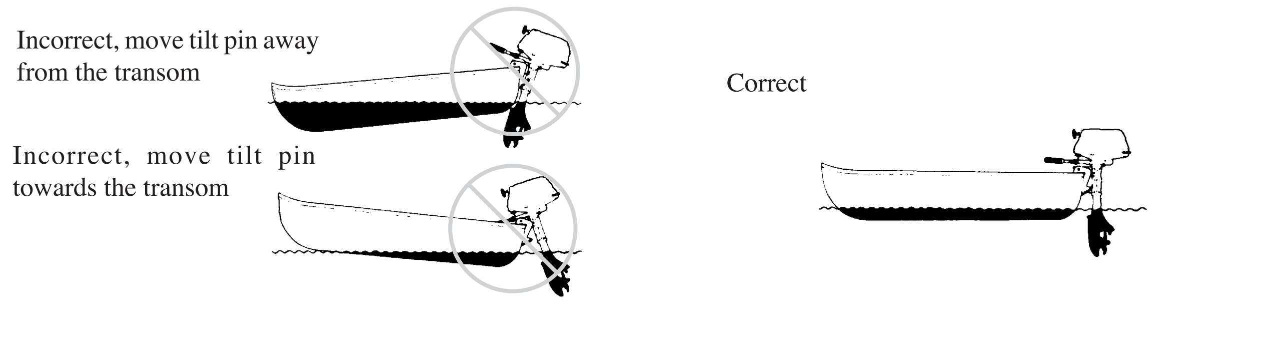
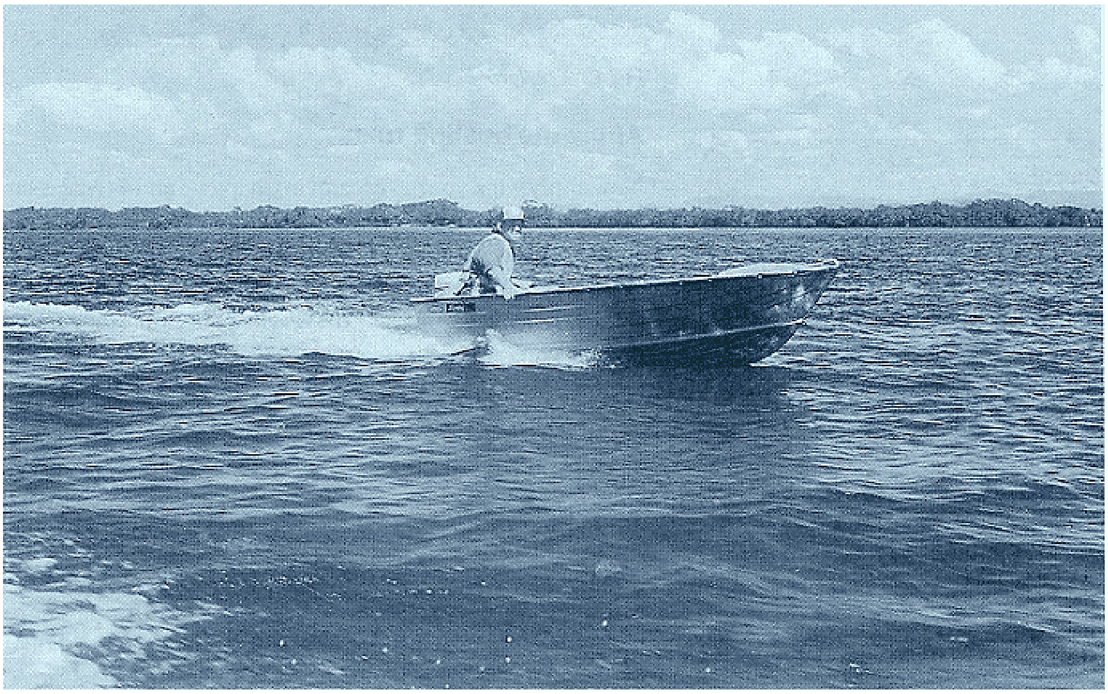


Figure 57.1 Trim and tilt mechanisms affect the way a boat planes (Illustrations courtesy Mariner Outboards).



Wet Paper

Figure 57.2 Planing your boat

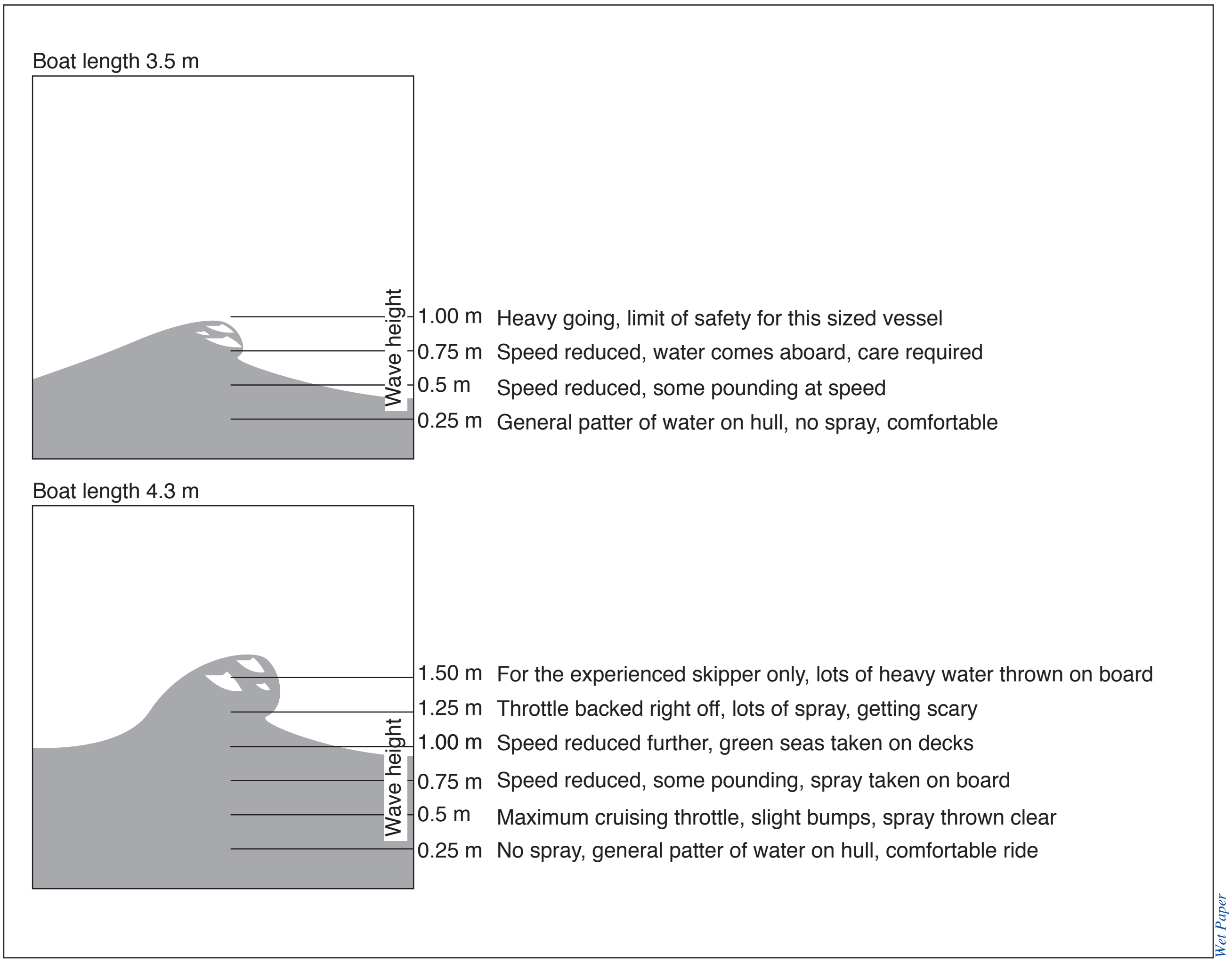


Figure 57.3 Boat size and wave height

Exercise 58 Crossing a wash and figure of eight

Skills

Crossing a wash of another boat

There is an art to this. A small wash will be easily crossed straight ahead but hang on and keep an eye on your passengers. Crossing a larger wash demands some skill.

1. Slow down to a speed from which you can safely accelerate and decelerate.
2. Approach the wash at an angle so that the hull of the boat just rocks through it. For a bigger wash, accelerate and decelerate so that you go up and over the waves in the wash.

Turning

1. Practice making a U- or S- turn while on the plane. Make sure you warn crew of your intentions, look over your shoulder to see if it is safe to turn, and keep a careful eye out for obstructions.
2. Here are some suggestions to help you in the manoeuvre:
   - Decelerate and accelerate in the turn to keep the boat on the plane.
   - Decelerate and or accelerate in the turn so the chine of the boat does not slip out.

     This is termed *fishtailing*.
   - Don't slow down too much or the boat will come off the plane.

Safety when crossing a wash

1. Don't try to jump the wash, rather allow the boat to move up and over it.
2. Slow down to raise the bow as you enter the wash and then accelerate up and into the wash.

Safety in the figure of eight

1. Look over your shoulder to see if you will collide with anyone.
2. Warn the crew of what you are about to do.
3. Warn the crew to hang on tight.
4. Check for waves and submerged objects in the turning path.

Figure of eight

This manoeuvre is performed on the plane. Make sure you have plenty of space, that there are no other boats in the vicinity and that you have good control of the throttle. Make sure crew knows what you are doing.

1. Look all around to see you have space to safely make the manoeuvre safely and make a wide arc U-turn.
2. Keep the boat on the plane in a wide arc and on an even keel.
3. Cross your wash and hang on tightly.
4. Keep the boat on the plane.
5. Look over your shoulder again and make another U-turn.

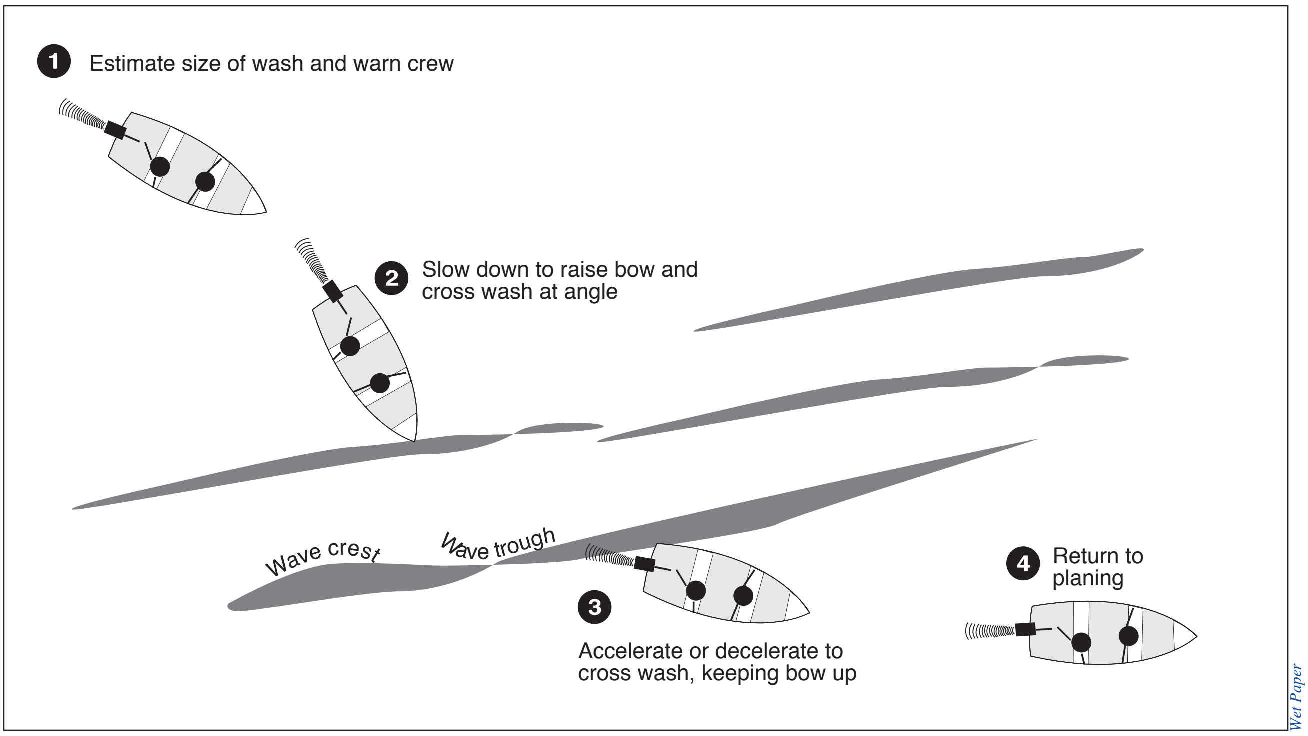


Figure 58.1 Crossing the wash

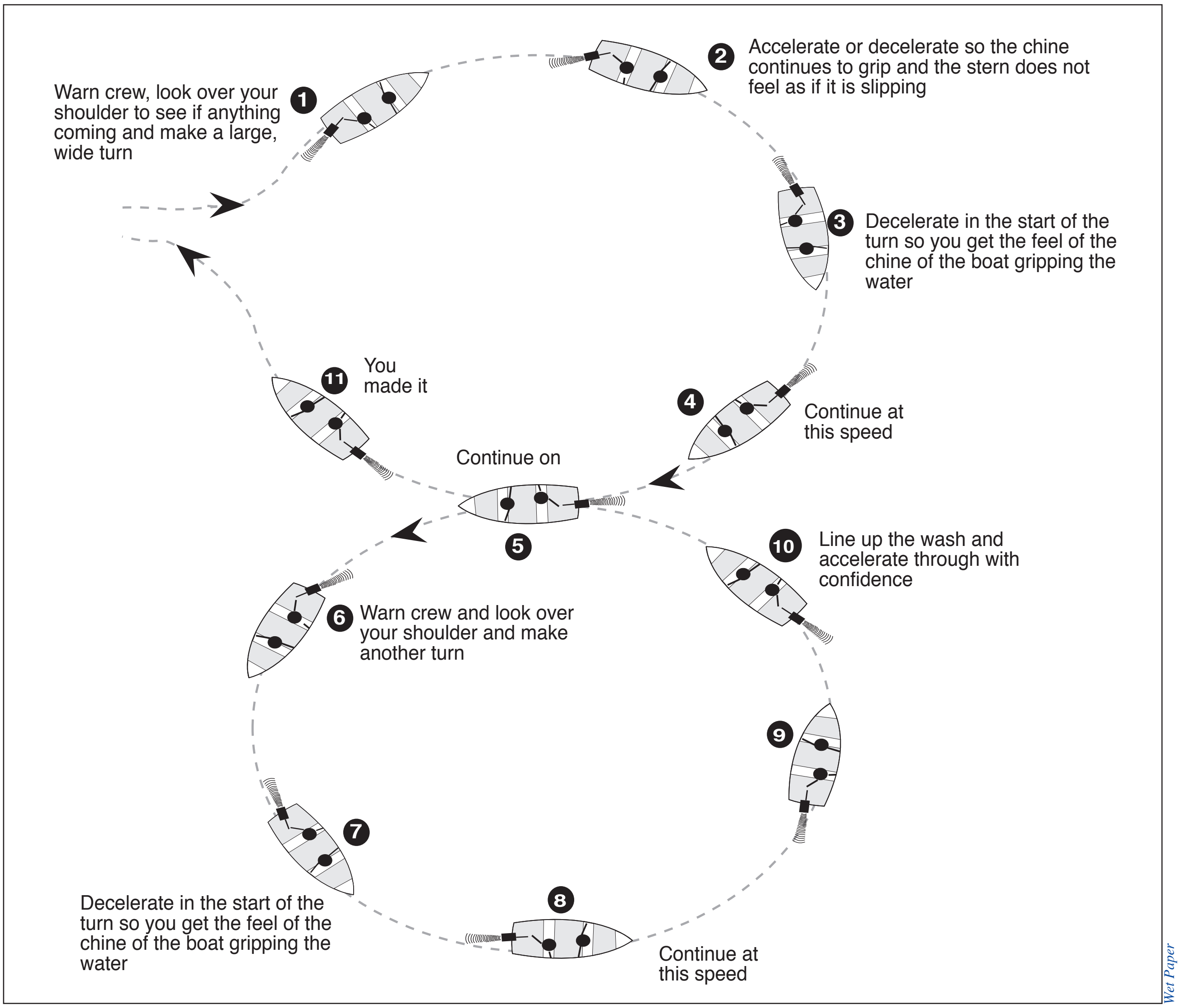


Figure 58.2 Figure of eight

Exercise 59 Recovery of object from water

Skills

It is common for objects like caps, PFDs or containers to be blown or dropped overboard. This exercise lets you practice the recovery of these small items.

1. Swing the boat in the preferred direction making a circle. The circle allows you to keep the object inside your search circle
2. Turn the boat around as quickly as you can with safety and head back towards the object in the water.
3. When near the object, bring the boat up into the wind or current whichever has the most effect on your boat.

   Take care not to get into a position where the boat will be blown onto the object causing the propeller to hit it.
4. Drive the boat close to the object but not so close as to strike it.
5. Stop the engines if there is a possibility of the propeller injuring the object.

   Use some common sense in rough conditions, where you may place yourself in danger if you cannot restart the motor. In this case, do not stop the engines but place the motor in neutral.
6. If the boat is a small dinghy, retrieve the object over the stern, so as to avoid capsizing the boat.

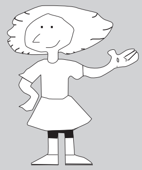
   Care should be taken not to cut the object on the propeller.

Questions

1. Look at Figures 59.2, 59.3 and 59.4 on the next page and write a sequence of steps that the students have used to recover the life jacket that has blown overboard.
2. Why are engines stopped in the sequence?
3. In some cases the engines are not stopped. Describe one such situation.

Safety

1. Light objects can be recovered over the stern, but a heavy person brought into a boat will need counterbalancing in the bow.
2. Stop all engines when you are near anyone in the water.
3. Take care not to cut the PFD on the propeller.



4. Look at Figure 59.1.

   a. A strong rip current is flowing in the opposite direction to the wind. The wind is 10 knots. Redraw the illustration to show which way you should approach the object in the water.

   b. There is no current and the wind is 5 – 10 knots. Would you approach the object in a different way and if so how?

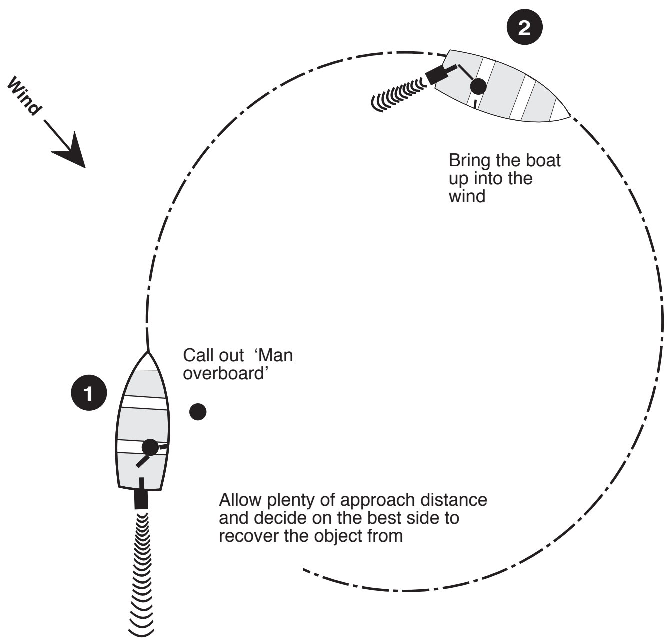
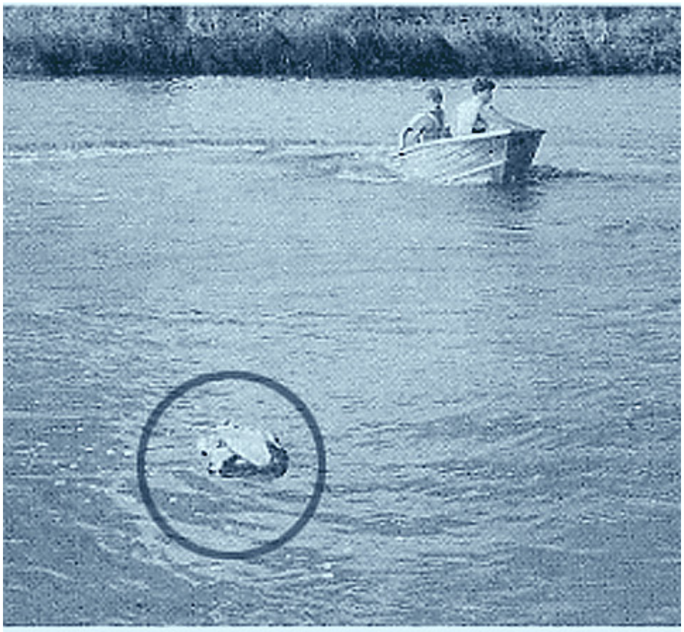
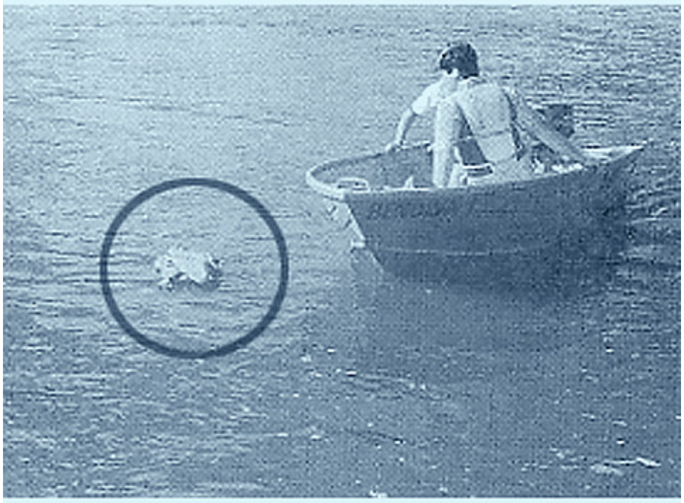


Figure 59.1 Rescue pattern
Wet Paper



Wet Paper

Figure 59.2 Turning the boat around



Wet Paper

Figure 59.3 Approaching the PFD

Wet Paper

Figure 59.4 Recovery over the stern

Exercise 60
Person overboard drill

The assistance of the Australian Maritime College in providing the opportunity for taking these photographs is greatly appreciated. For course information and details about Mariners Courses you can write to:

Academic Registrar
Australian Maritime College
PO Box 986
Launceston TAS 7250
Telephone: 003 26 0711
Fax: 003 26 6493

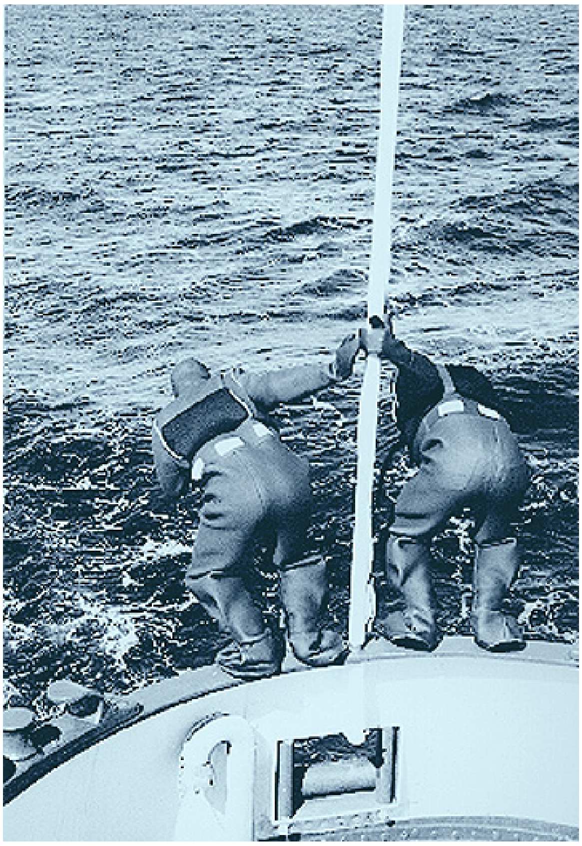


Figure 60.1 Two students from the Australian Maritime College jumping into the Southern Ocean off Tasmania as part of lifeboat training.

Skills

The following is adapted from the draft Education Department Safety Policy Document.

1. The drill when a person falls overboard will vary depending on:
   a. the vessel type and size
   b. weather conditions
   c. crew left on the boat
2. At all times the safety of the vessel and crew on board must be kept in mind. There is no point in putting others in danger.
3. The basic requirements when a person falls overboard could include:
   a. watching the person in the water (any information that may make it easier to return to the location should be noted).
   b. changing course to be able to return to the person in the water in a safe manner.
   c. manoeuvring the vessel to effect the recovery in the most efficient way possible. In Figure 60.4, the students steamed straight up to the two people in the water, kept the motor running but in neutral and hauled them in over the side. The skipper of the vessel deemed that this was the most appropriate decision at the time having taken into consideration the sea conditions.
   d. being aware of the dangers to the person in the water from the vessel e.g. hull and propeller.

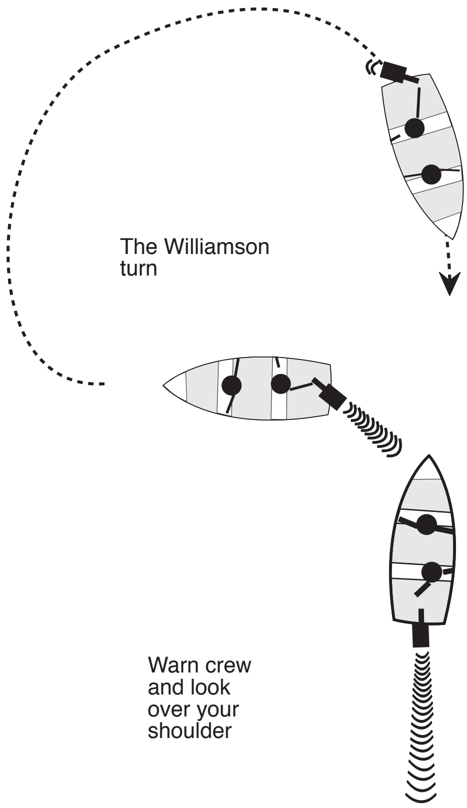


Figure 60.2 The Williamson turn which gets you back to where you started
Wet Paper

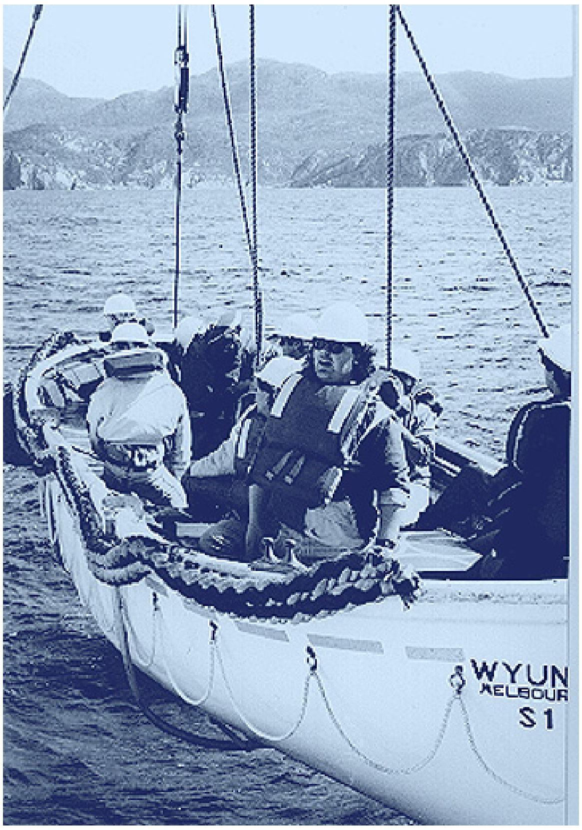


Figure 60.3 Students from the Australian Maritime College launching a lifeboat

Figure 60.4 Students performing a rescue

Exercise 61 Anchoring

Based on an original activity by Peter Hamlyn, Mackay North State High School.

Experiment

1. Design a series of experiments to test the effectiveness of an anchor with different scope ratios as shown by Figure 61.5.
2. Fashion out an anchor from tinplate and test the force required to drag the anchor at different scope rations.
3. Graph the scope versus the force from information collected in a data table (see Figure 61.5).
4. Draw two conclusions from your experiment and write a paragraph on each.
5. Suggest a number of designs for different situations.

Skills

Use local knowledge and advice to select a danforth or rock pick anchor.

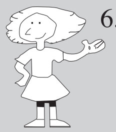
1. Motor up to the place you have been told to anchor.
2. Make sure your anchor rope is tied to the boat with a bowline.
3. Estimate the depth of the water by lowering the anchor to the bottom.
4. Now run out five times that length and wait till the anchor holds as shown in Figure 61.3
5. Take a sighting on a known object and observe if that object moves to check if the anchor has held. If the anchor fails to hold, try again.
6. Once the anchor holds, switch off the motor.
7. Restart the motor and ask your crew to pull in the anchor rope as you slowly move forward. The anchor will break free and pull up till the fluke is at the surface.
8. Wash any sand or mud off, pull it on board and stow it.

Questions

1. Redraw the diagram of the anchor, chain, shackles and rope in Figure 61.4
   a. Use your textbook to identify the parts labelled A – H.
   b. What type of knot or splice would you make at 1?
   c. What is the name of the part of the rope at 2 and what type of knot would you make here?

Safety

1. Make sure you don't get your limbs tangled in the rope or chain when anchoring.
2. Keep hands clear of ropes under strain.
3. Allow chains to run through blocks and not over the gunwales.
4. When 'weighing anchor' allow the boat to do the work of dislodging the anchor.
5. Keep anchors well stowed.
6. Allow at least five times the depth of anchor rope.



2. List three safety hints when anchoring, giving reasons for each.
3. Why is scope an important consideration when anchoring?
4. What type of connection is shown by Figure 61.1 and where is it used?
5. Look at the Figure 61.2
   a. What is the name of the anchor shown?
   b. Where is it used?
   c. What would be connected to point A and why?
   d. If the prongs at B became bent, what is the best method of repair?

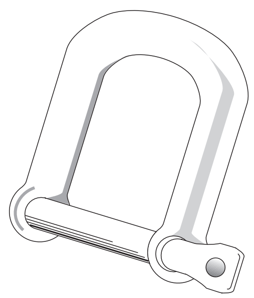


Figure 61.1 Diagram for question 4
Wet Paper

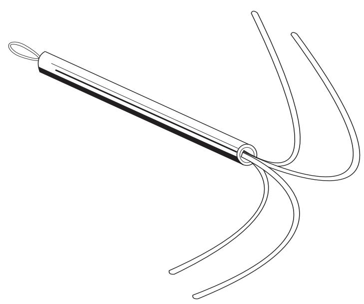


Figure 61.2 Diagram for question 5
Wet Paper

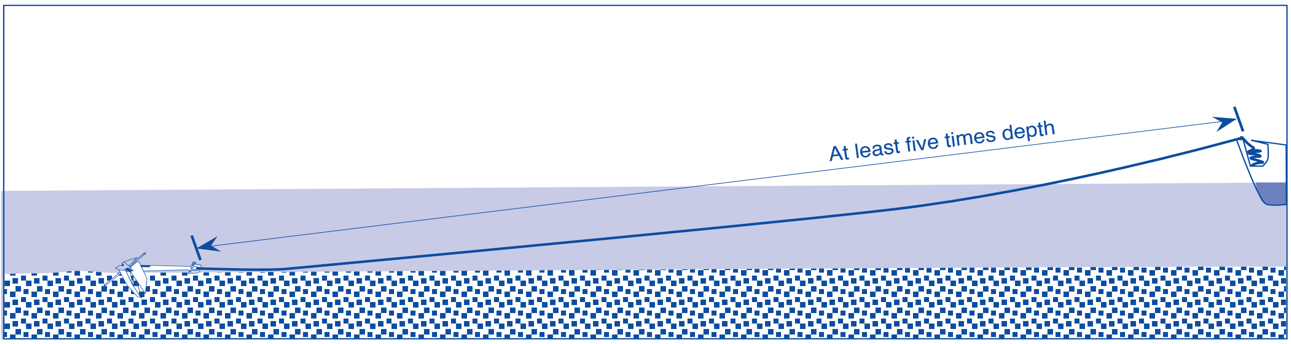


Figure 61.3 The scope of an anchor
Wet Paper

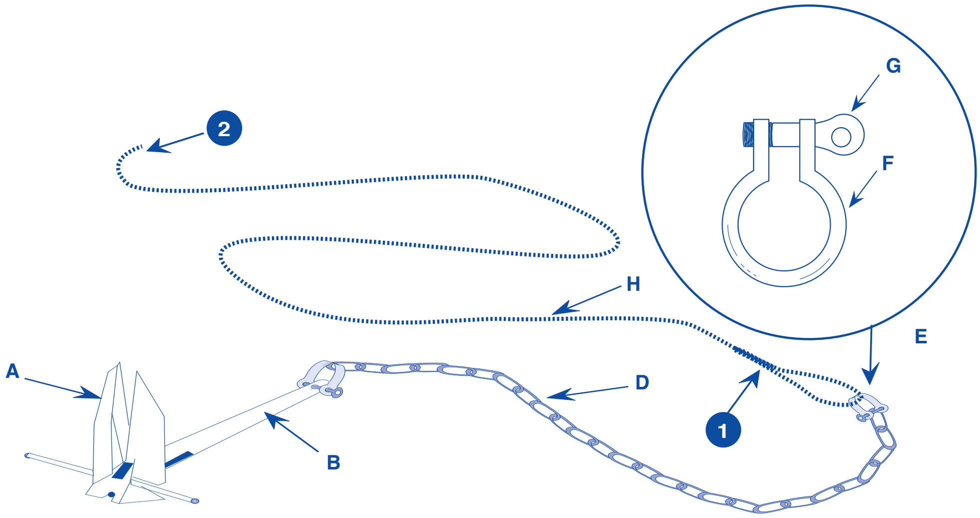
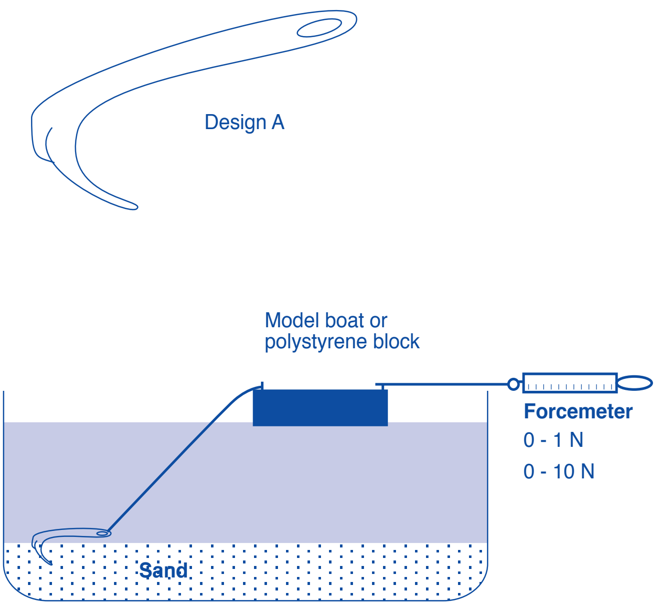


Figure 61.4 Coastal quick release anchor, chain, shackles and rope
Wet Paper



Rode (mm)	Depth (mm)	Scope (mm)	Force (N)

Figure 61.5 Ideas for anchor research project
Wet Paper

Exercise 62
The sailboard

The following extract is reprinted courtesy of the publishers of *Californian Boating the Right Way*.

The sailboard is a hybrid watercraft that combines the features of a surfboard and a sail boat. The craft has a centre board but no rudder and steering is accomplished by changing the position of the mast and sail. A swivelling universal joint at the base of the mast permits the operator to turn the mast or lay it over in any direction by manipulating the wishbone boom.

Because of their light weight, generous sail area and low water resistance, sailboards are nimble performers in even a moderate wind. They are also relatively inexpensive, easy to store and transport, and simple to rig. For these reasons sailboarding is becoming very popular worldwide.

Skills

1. If you are trying to sailboard for the first time, choose a place to practice that is near shore and protected from strong winds.

   A light onshore wind is better for learning and allows you to practice sailing across the wind without fear of being blown far offshore.
2. Always check the board and sail rig before sailing. Most modern sailboards are equipped with a mast leash that keeps the board and the rig from drifting apart if they become separated in a knockdown.

   If your craft does not have one, attach a retention line to the board and the mast or carry a light towline.
3. Wear appropriate clothing when sailboarding. Appropriate clothing includes deck shoes with nonslip soles for traction and protection, a wetsuit for warmth and a PFD for buoyancy.
4. Avoid overexposure to the sun and apply a good quality zinc cream and or sunscreen
5. Find out about local regulations and conditions before venturing out. Sail with a group and talk to the locals.
6. Sailboarding and surfboard riding don't mix. Surfing is a very fast sport, and waves and other surfers are unpredictable.
7. Never sail alone or in heavy weather.
8. Guard against falls in shallow water and if a fall is unavoidable, try not to fall headfirst.
9. Remember a sailboard in many Australian States is classed as a sailing boat so sailing rules will apply.
10. If you are in trouble, try to stay calm, stay with the board and use the signal to attract attention as shown in Figure 62.1.
11. Should the sail rig and the board become separated, swim for the board, get on and paddle to the rig.
12. If launching through the surf make sure you have experience in reading the surf as well as experience in sailboarding.

Questions

1. Where should you learn to sailboard?
2. What would be appropriate clothing to wear in your local area if you were to take up sailboarding?
3. What local regulations apply to sailboarding?
4. Is a sailboard classed as a sailing boat in your State?
5. Two sailboarders are approaching head on. What should they do?
6. A power-driven vessel approaches a sailboard from the port bow. What should the sailboarder do?
7. Should you sailboard among surfboard riders in 2 m surf? Give reasons for your answer.
8. Complete the following sentences from the information supplied in the introductory paragraphs of this exercise..

   The sailboard is a hybrid watercraft that combines the features of a surfboard and a sail boat. The craft has a ________________ but no ________________ and steering is accomplished by changing the position of the ________________ and ______________ . A swivelling ______________ at the base of the mast permits the operator to turn the mast or lay it over in any direction by manipulating the ________________
9. In your notebook, redraw the illustration of the sailboard in Figure 62.2.

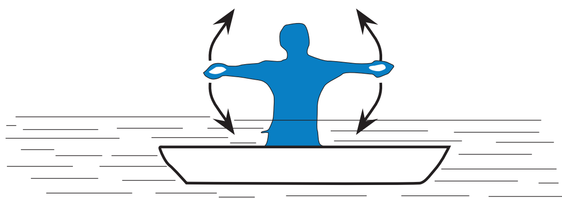


Figure 62.1 Signal to attract attention

Wet Paper

Safety hints

1. If you are trying to sailboard for the first time, choose a place to practice that is near shore.
2. Always check the board and sail rig before sailing.

3. Wear appropriate clothing.
4. Never sail alone or in heavy weather.
5. If you are in trouble, try to stay calm.
6. Avoid overexposure to the sun and apply a good quality zinc cream and or lotion.

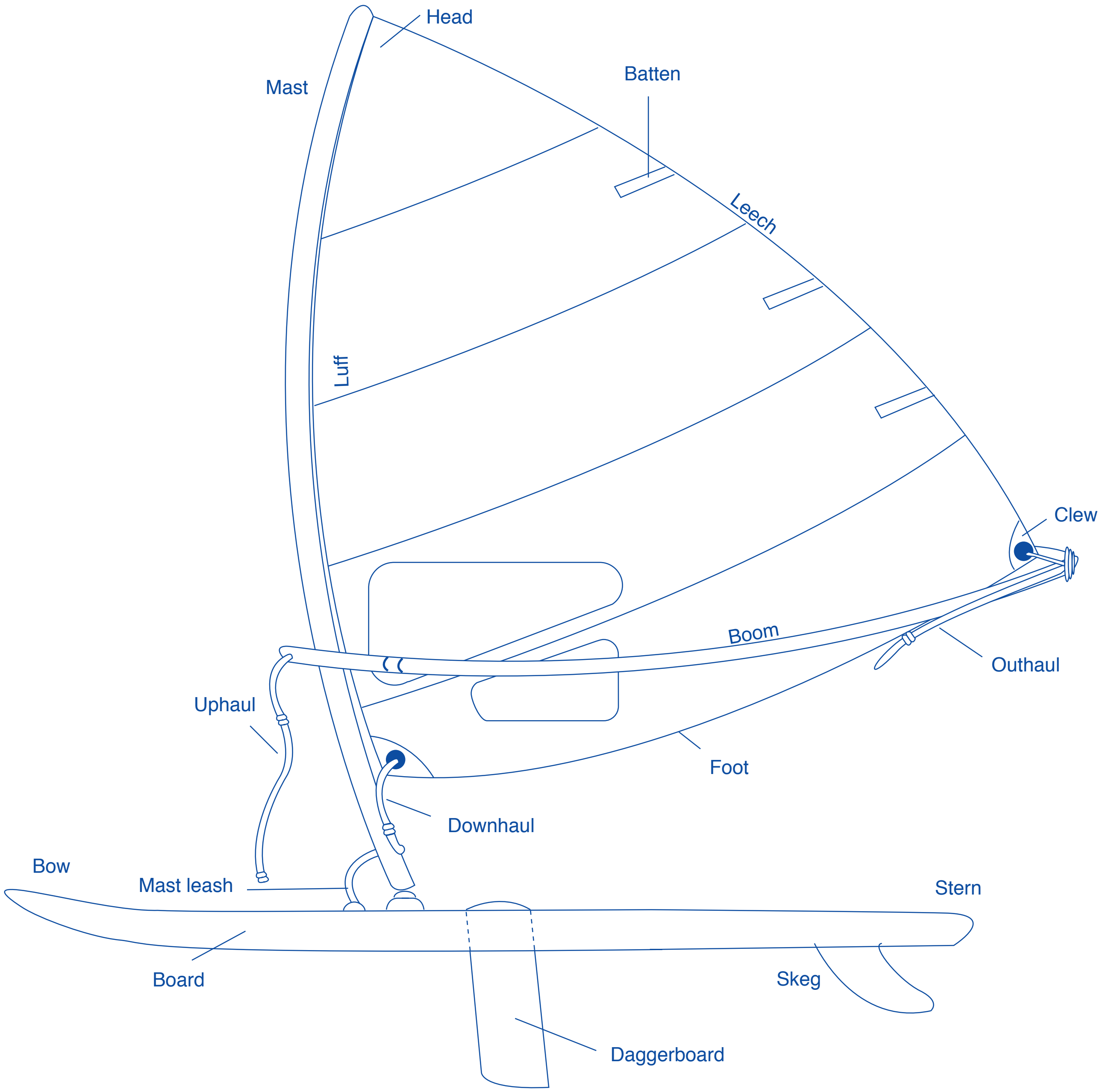


Figure 62.2 Parts of a sailboard.
Wet Paper

EXERCISE 63
THE CORSAIR

Based on original work by Graham Rogers, Clontarf Beach State High School, Queensland. Reproduced with permission.

The diagram in Figure 63.1 is of a Corsair which is the type of sailing craft you are going to do most of your training in. The boat is an Australian design, by Alan Payne. It is basically a family-orientated racing/cruising dayboat that is sloop rigged with spinnaker. The hull is made of fibreglass and it tends to be a stable, forgiving type of boat.

QUESTIONS

1. Redraw Figure 63.1 in your notebook.
2. Fill in the missing words in the following passage.

   The hull of the Corsair is made of ________________ because it is a durable material that is easily shaped. The hull is designed to ________________ on water and move through it easily. The mast is held in position by ________________ and ________________ . The purpose of the mast is to support the sails. The mast is made of ________________ . The Corsair has two sails which are ________________ and ________________ . The mast and boom are connected by the ________________ . The position of the boom is controlled by the ________________ .

You have been shown the procedure for the rigging a Corsair and the procedure to pack up the vessel ready for trailing.

3. Fill in the gaps in the description of the steps during rigging.

   a. Unpack the trailer by untying the ________________ and removing the equipment in the ________________ .

   b. Untie ________________

   c. Stand ________________

   d. Attach ________________ to the ________________

   e. Check that the ________________ is in the hull and the ________________ are closed.

   f. Fit the rudder system ensuring the ________________ is through the pintle.

   g. Attach ________________ to the ________________ and raise in the top of the mast. Lock off the halyard.

   h. Take the ________________ off the trailer.

4. A ________________ is used to hold the wire to the sails and ________________ .

   Draw one in your notebook and name the parts of a shackle.

5. Draw a rudder system. Indicate the following parts:
   - Rudder blade
   - Rudder head
   - Tiller
   - Tiller extension
   - Gudgeon
   - Pintle
6. What are the three wires that hold the mast up called?
7. What are the front and back of the boat called?
8. Describe where you would use the following terms and what each of them means.
   - Bolt rope
   - Header
   - Stay
   - Stern

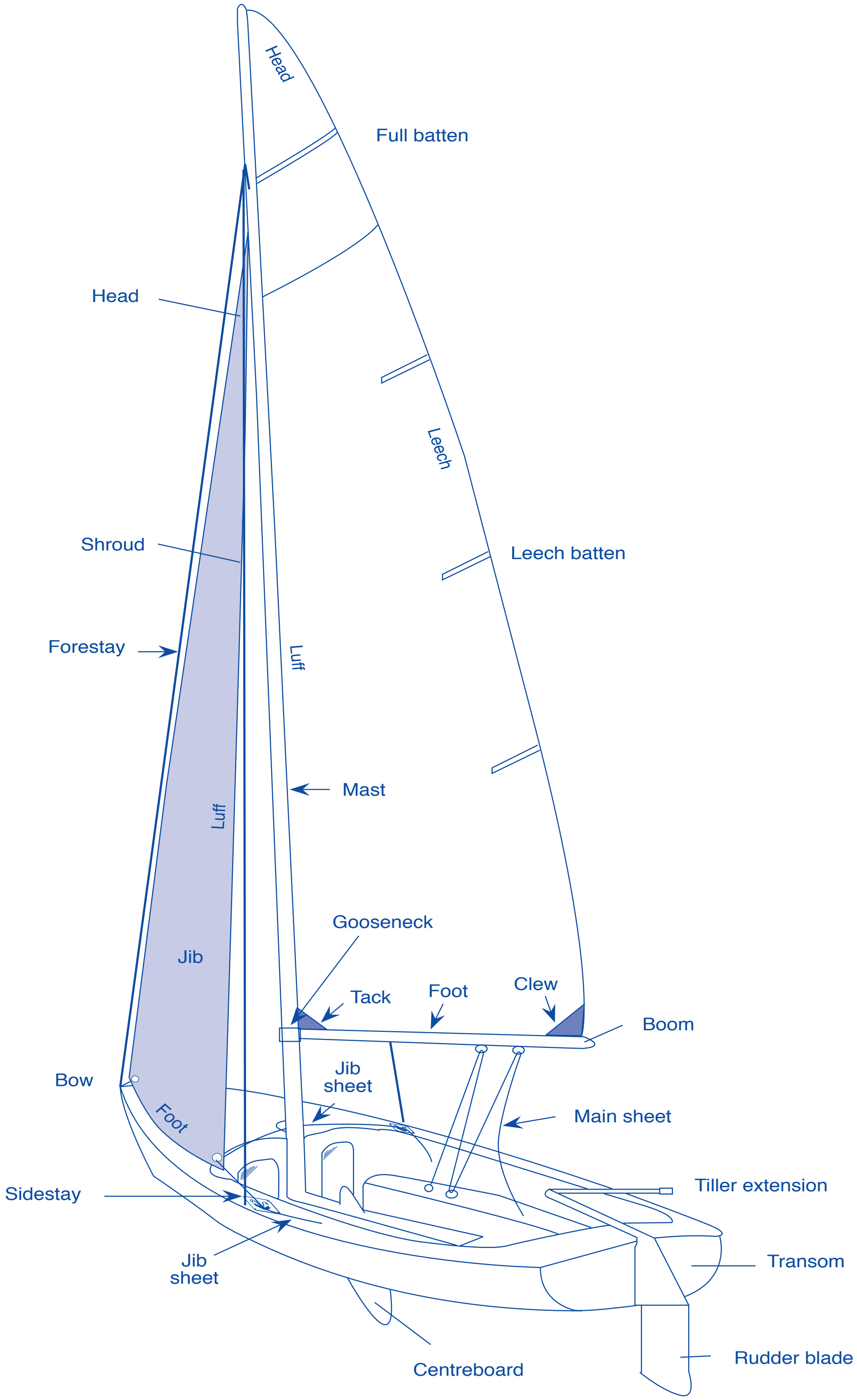


Figure 63.1 The Corsair
Wet Paper

Exercise 64
Tacking and Gybing

Based on original work by Graham Rogers, Clontarf Beach State High School, Queensland. Reproduced with permission.

Tacking

Tacking is the turning of a sailing boat so that the bow (front) of the boat passes through the wind. At some stage of the turn therefore the bow is pointing directly into the wind. If the turn is stopped at this point then the vessel is said to be caught in irons. In this situation it is impossible for the vessel to sail in a normal manner.

Study Figure 64.2 which shows a sailing boat going through a tack.

The tack shown is called a roll tack. It is the ideal tack as the vessel does not lose any speed during the tack.

Gybing

Gybing is when you turn the boat so that the wind blows over the stern. It is a turn that can be very dangerous because at some time the boom must travel from being right out one side of the boat to right out on the other side.

This allows it to travel at high speed and with a lot of force through an area in which the crew must avoid injury.

The secret to a good gybe is control. Gybing skills should be learnt in calm conditions so that few problems will occur in strong winds.

Questions

1. What does a helmsperson say to the crew before tacking?
2. Which sail is released first and why?
3. What must the crew avoid while changing tacks?
4. Which sheet does a crew need to use during a tack?
5. Which way must the helmsperson face during the tack?
6. Do a series of drawings looking down on the top of the boat in each of the positions through the tack. Show the position of the crew, sails and tiller in each drawing.
7. When does the helmsperson change hands on the tiller when gybing?
8. Do you let the mainsail cross by itself or do you control it during gybing? Give reasons for your answer.
9. How should the centre board be trimmed?

Safety

1. Call to others in the boat that you are about to tack or gybe.
2. Keep a good look out during the manoeuvre.
3. The crew should assist and control the passage of the mainsail.

10. Do a series of drawings to show the position of the crew, and sails during a gybe. Indicate the wind direction.
11. What do you look for in the jib when preparing for a gybe?
12. When is the best time to gybe?
13. Redraw the illustrations in Figure 64.1 to indicate who has the right of way in the following situations?

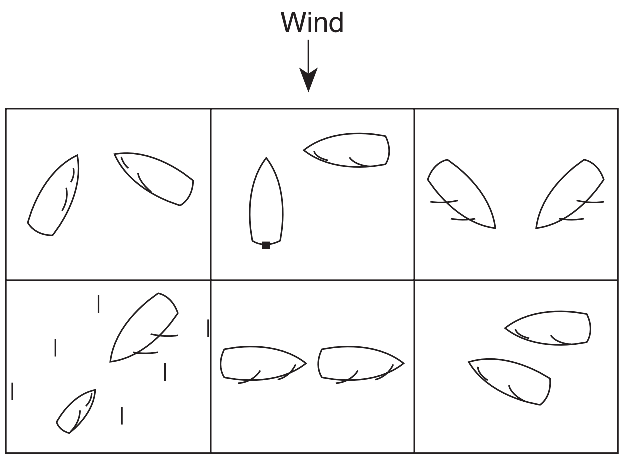


Figure 64.1 Diagram for question 12
Wet Paper

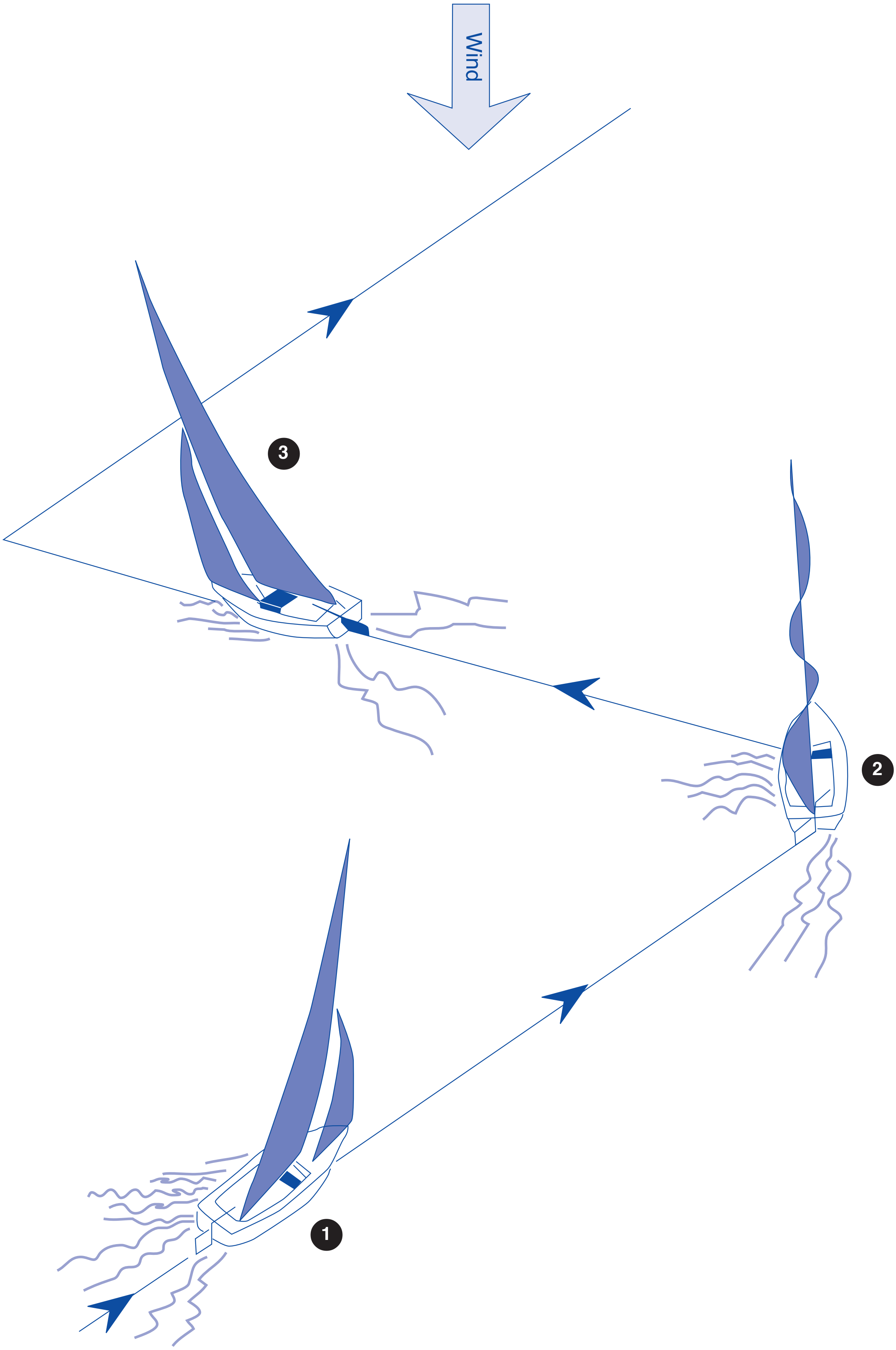


Figure 64.2 A sailing boat going through a tack
Wet Paper

Exercise 65 The points of sail

Based on original work by Graham Rogers, Clontarf Beach State High School, Queensland. Reproduced with permission.

Questions

1. You are on the beach and about to go for a sail. The wind is blowing onshore and you wish to set the sails for a course. Study Figure 65.1 and answer these questions.
   a. Select a boat of your choice and write a paragraph explaining how you would sail a basic triangle and what sails you would use.
   b. If the wind is coming over your left shoulder and you are sitting on the starboard side facing towards the bow, what type of tack are you on?

2. When discussing sailing it is important to know how sails are set and how the boat is using the wind. Study Figure 65.2 and make up a table like the one shown at the bottom of the next page. Match the number of each drawing to its appropriate point of sail (listed below), sketch it, and give a brief description of the situation.

   Points of sail are given below.

   - Close-hauled starboard tack
   - Running port tack
   - Head to wind
   - Beam reach
   - Close reach
   - Beam reach
   - Close-hauled tack
   - Broad reach
   - Running starboard tack

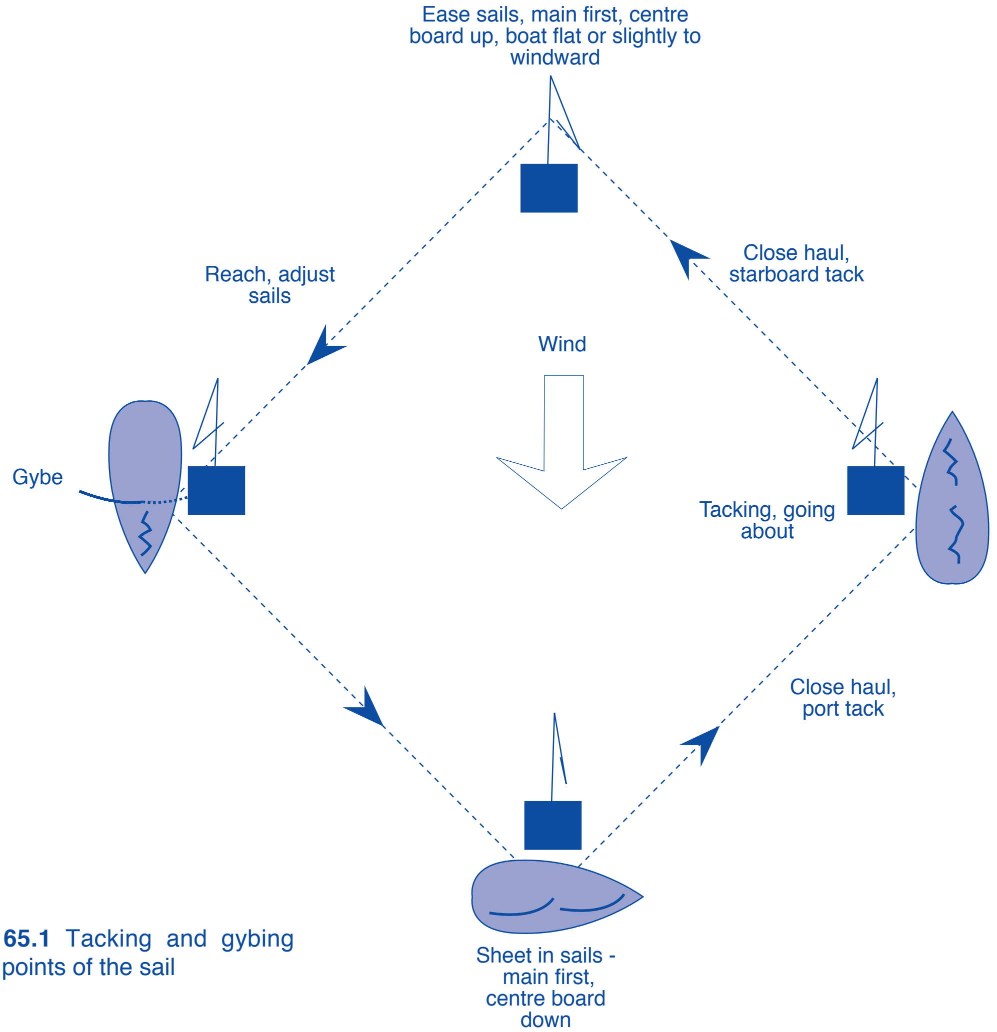
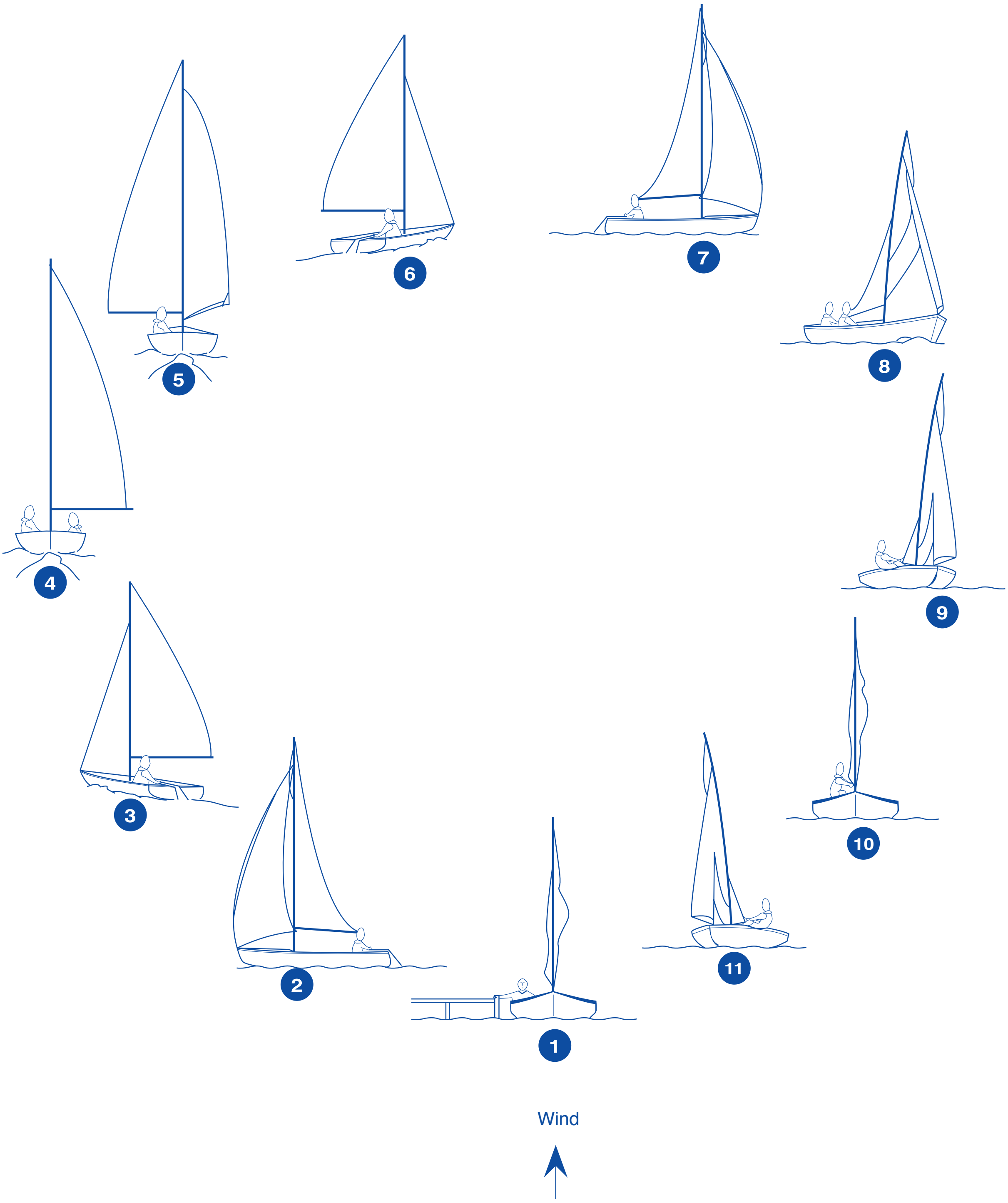


Figure 65.1 Tacking and gybing through points of the sail
Wet Paper



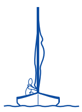
Number	Point of sail	Illustration	Your explanation
10	Head to wind		When you are in your boat and you are facing directly into the wind and the sails are flapping

Figure 65.2 Points of sail
Wet Paper

Exercise 66
Capsize drill

Based on original work by Graham Rogers, Clontarf Beach State High School, Queensland. Reproduced with permission.

Skills

1. Don't panic. Call to each other. When everyone is accounted for then carefully go through the procedure to right the boat. Make sure you are in contact with the boat at all times.
2. Crew checks the centreboard is down and sheets are free. Helmsperson swims around back of the boat and checks the rudder.
3. Crew stays in cockpit holding toe straps and floating. Helmsperson holding the main sheet, swims to the centreboard.
4. Helmsperson shuts the bailers and climbs onto the centreboard. The crew throw the jib sheet over to the helmsperson.
5. The helmsperson, once on the centreboard, checks the crew is ready, stands close to the boat and levers back with the jib sheet.
6. When the mast is level with the water, check everything is OK.
7. As the boat rights, it will swing head to wind. Bring it up in a controlled manner. When nearly righted, the crew should be in the boat and the helmsmen slides in over the gunwale.
8. Bail and sail. Be ready to avoid another capsize.

Questions

1. A person falls overboard, what does the helmsperson do?
2. Your sailing boat capsizes. What is the first thing you should do?
3. Use the information in Figure 66.1 to complete five sentences which describe what to do if a sailing boat capsizes.

Safety

1. Never recover a person with his or her back to the boat.
2. Make sure you don't capsize your own boat.
3. Assess carefully the size of the person you have to recover and the size of your own boat then select the most appropriate method.

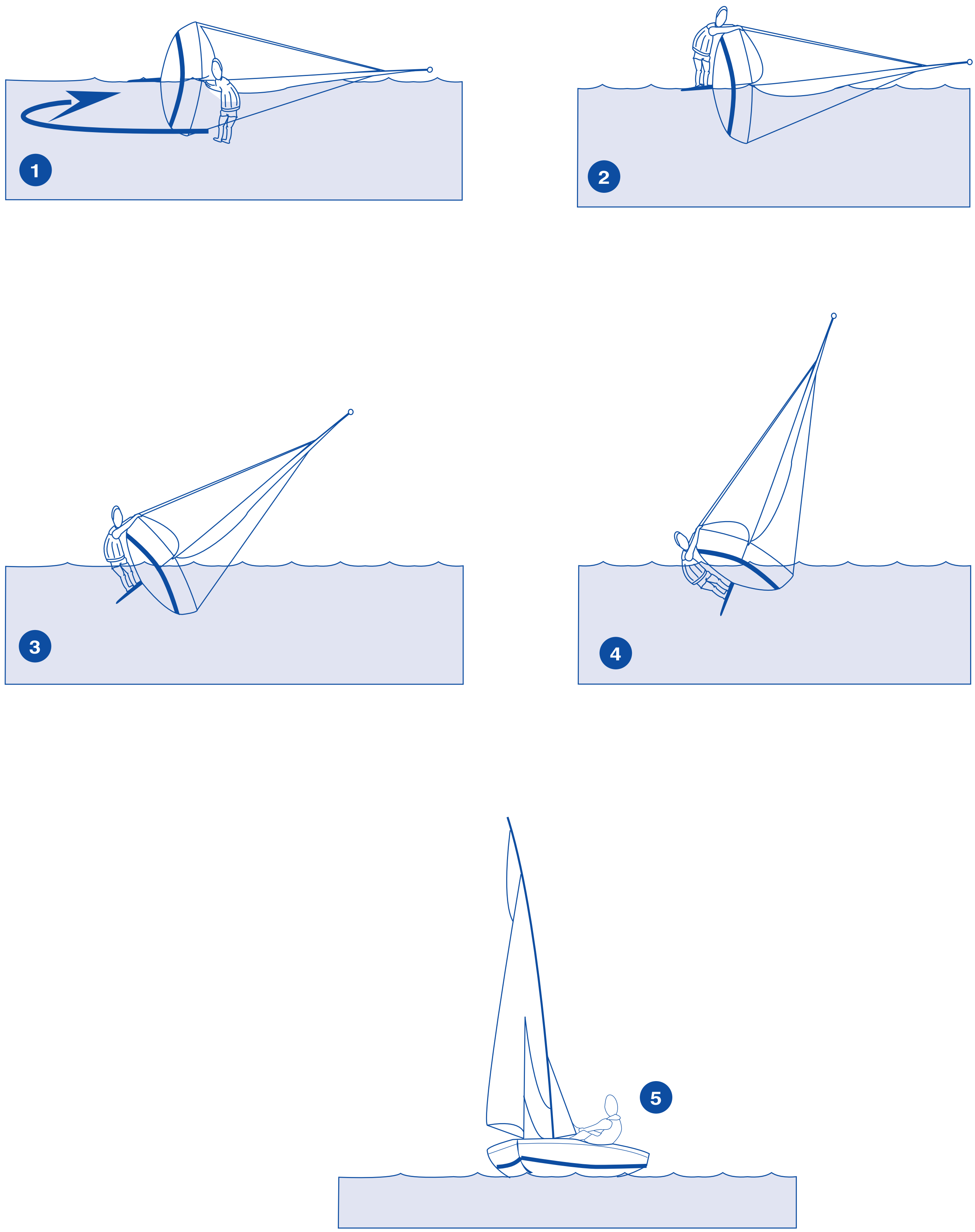


Figure 66.1 Capsize drill
Wet Paper

Exercise 67 Launching a sailing boat

Based on original work by Graham Rogers, Clontarf Beach State High School, Queensland. Reproduced with permission.

The purpose of this exercise is to learn how to launch a sailing boat.

Safety

1. Be careful of broken glass and sharp objects around the shoreline.
2. Make sure the boom is secured or someone is holding it.
3. Face the sails into the wind

Questions

Most of the skills used in launching are also used when retrieving a boat.

1. Study Figure 67.1.
    a. Which way do you face the boat before raising the sails?
    b. What has to be done before the mast is raised?
    c. What is the crew member doing to the rudder and tiller?
    d. How should you leave this shore and which direction should you face the boat?
2. Which jib sheet does the crew use?
3. Can you reverse a sailing boat?
4. Which sail do you use when reversing?
5. Describe the way you would leave shore from in front of your Marine Studies centre in a south-easterly breeze.
6. What is the difference between a fixed keel, a swing keel and a retractable centreboard?

    Redraw the diagrams in Figure 67.2 in your notebook to help explain your answer.
7. Write a one-page essay on your experiences from your first sail.

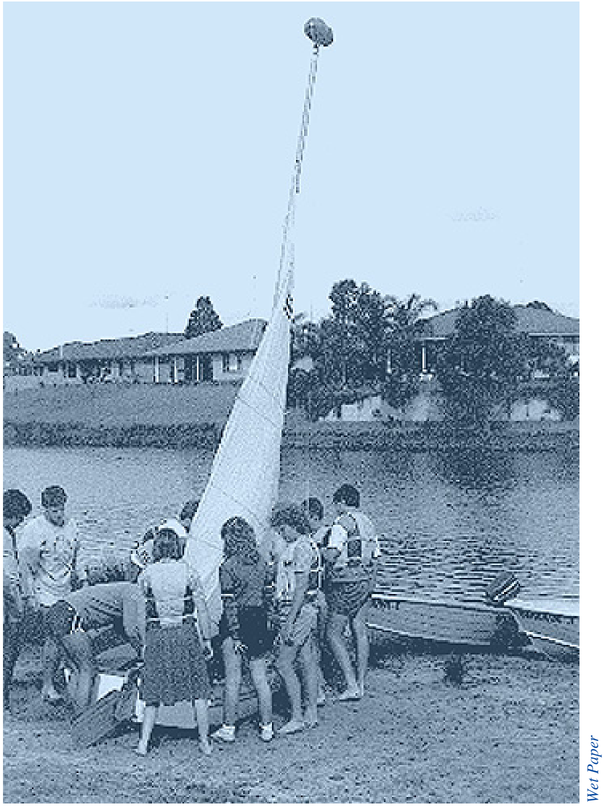


Figure 67.1 Preparing to launch

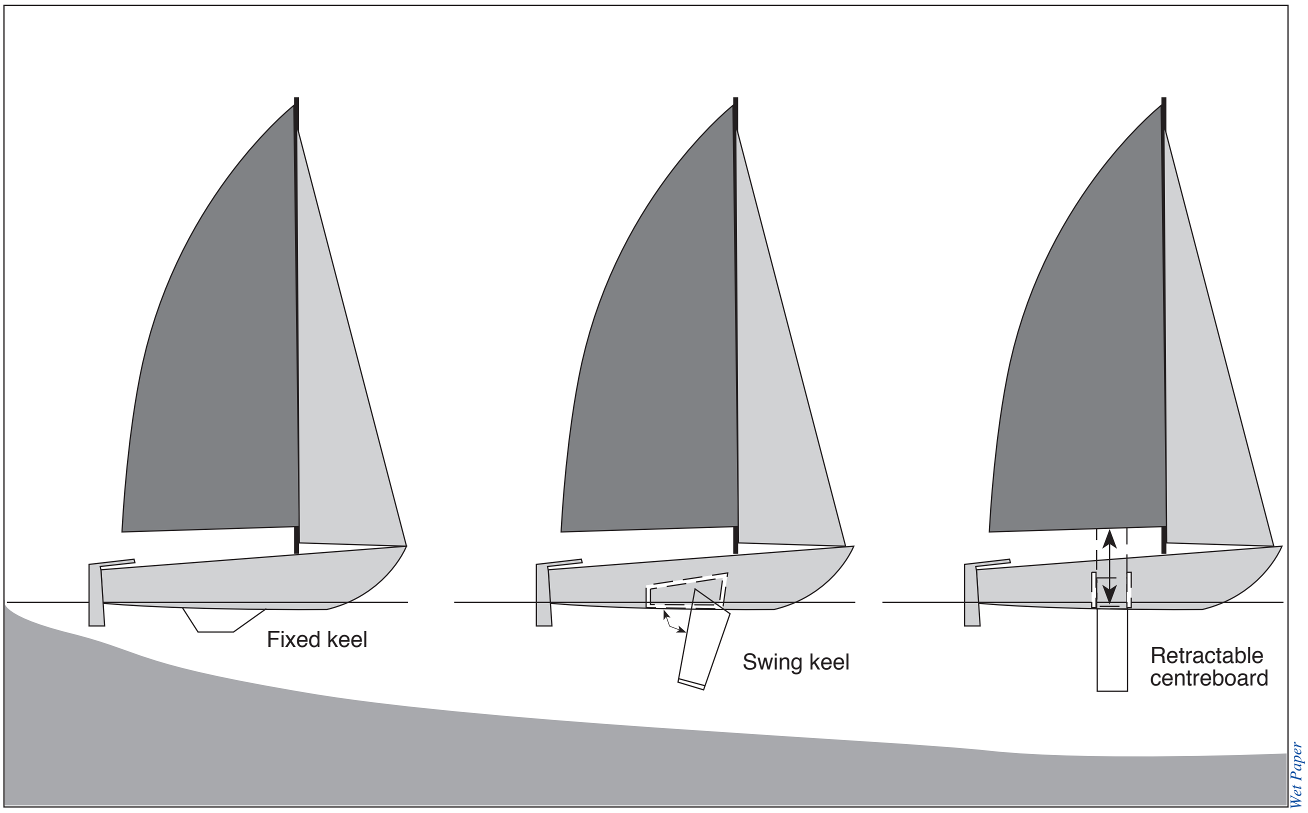


Figure 67.2 Types of keel

EXERCISE 68 REEFING THE SAILS AND MOTORING

Based on original work by Graham Rogers, Clontarf Beach State High School, Queensland and the Expedition Boat Shed in Fremantle, WA. Reproduced with permission.

QUESTIONS

1. What happens when the sails are reefed?
2. Name two methods by which this can be achieved.
3. Under what circumstances would you need to paddle your sailing boat?
4. Why do the sailing boats in Figure 68.2 have motors?
5. Look at the boats in Figure 68.2. This question is only for students in Western Australia.
   a. What type of boats are they and where are they located?
   b. What is a sea trek and where do schools go sea trekking?
   c. What special provisions need to be taken on a sailing boat in a sea trek?
   d. What safety precautions are taken in sea treks?
6. All vessels on the water require a second means of propulsion. On a small sailing boat this is achieved with oars, a motor or paddles.

   Discuss the following points as a group.

   a. What is the best way to get to safety?
   b. How far is it?
   c. What human resources are available and how can they be best used?
   d. What help may be available?
   e. What dangers may arise?

Reefing of sails

This is a method, generally associated with larger sailing vessels, of controlling the power of the sails.

It involves reducing the area of sail on either the main, headsail or both. This can be achieved by taking down one sail and replacing it with a smaller one.

However this is often inconvenient and requires a large number of sails to be carried which is costly bulky.

Methods of reefing are shown below but all tend to distort the shape of the sail.

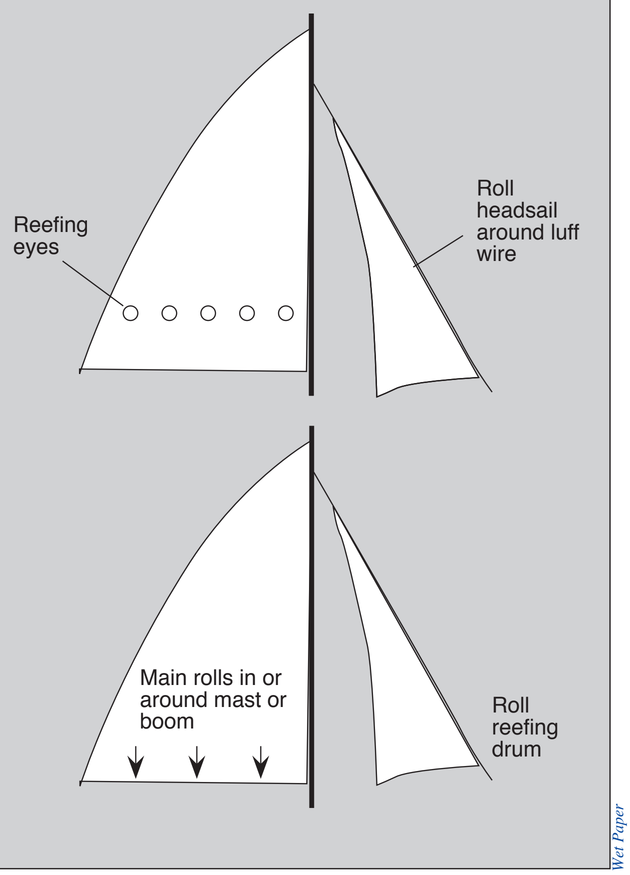


Figure 68.1 Reefing the sails

Figure 68.2 Students practice for a sea trek in the Swan River, Perth, W.A. Photograph courtesy Paul Willison.

Exercise 69
Towing

Skills

1. Make sure your boat is tied securely by a strong point in the bow section using a bowline.
2. Throw your line to the other boat and have them tie another bowline around a strong point in their stern.
3. Assess the sea conditions. Shorten your towing line in rough conditions however be wary that when the tow line is made close to the rudder of the boat being towed, your steering will be impaired.
4. Lighten the load in the boat being towed.
5. If possible raise the motor of the boat being towed and secure it from moving about.

Questions

1. Why are bowlines the preferred towing knots in learning situations?
2. Study Figure 69.1 and write a paragraph about how the student driving the boat successfully hooked up the other boat for a tow.
3. Use your textbook index to find *towing* and then complete the following.

   The best rule of thumb is to throw your _________________ to the other vessel in the hope they will accept it.

   Before doing so, make sure your boat is secured in the centre so it will be towed evenly. Knots used will be under great _________________ , so it's best to tie the rope to the strongest part of the vessel. A small _________________ would be of little use under strain.

   If knots are used, then close the one that will undo easily i.e. a _________________ or slippery hitch. Keep in mind what safety precautions you would need to have if the line were to break and advise the crew accordingly.

   Finally, control your _________________ according to the state of the sea and keep a good eye all the time on the vessel being towed.

   Be prepared to stop at any time.

Safety

1. Keep hands well clear of the towing line.
2. Check the condition of the tow rope before use. Do not use a rope that will break.
3. Use bowlines for all knots unless otherwise directed.
4. Avoid quick acceleration if you are driving the towing boat.
5. Remember that the boat being towed does not have brakes so keep hands and fingers inside the boat and prepare to fend off.

Wet Paper

Figure 69.1 Towing

EXERCISE 70 FACTORS AFFECTING HANDLING

SKILLS

Rough weather

This is shown in Figure 70.1.

If caught in rough weather in a small dinghy head for the nearest lee shore, beach the boat and wait for better weather.

If this is not possible, you will have to handle each wave as if you were crossing a large wake, keeping the bow up at all times.

This is very similar to crossing a wash. A planing boat does not handle well in rough weather and is in danger of swamping so keep careful control of the boat.

Emergency stop

The sudden sighting of a log, or something falling from the boat, may cause you to want to stop suddenly.

The emergency stop is the means by which a boat is stopped in less than its length in an emergency.

How to do an emergency stop is shown is shown in Figure 70.2.

1. Warn the crew to hang on.
2. Drop the throttle to zero while pushing the tiller in the safest direction.
3. The boat will stop broadside with the stern wash passing the transom.
4. Put the motor into neutral.

QUESTIONS

1. Outline the steps to be taken in an emergency stop.
2. You are caught in rough weather and cannot make shore.
   a. The waves are beam on. Describe how you should drive your boat.
   b. You sight the shore but now have the waves stern on. Describe how you should drive your boat.
   c. You get close to shore but now have to turn your boat head on to get onto the lee side. How should you reposition your crew and drive your boat?
3. Use the textbook index to find the page which discusses *factors affecting handling* and complete the following questions.
   a. List four factors that affect the way a boat will perform when it is driven at sea.
   b. V-shaped hulls come in two varieties. What are they are and what contribution do they make to directional stability?
   c. What features of inflatables make them a useful boat?
   d. Name two disadvantages of inflatables.
   e. What are semi-rigged vessels and what advantages do they have?
   f. Draw a diagram of a cathedral hull. What advantage does this shape have over other hulls?
   g. Draw a diagram indicating the correct way to mount your outboard motor so that the boat and motor will perform to the best of their abilities.
   h. How does the number of crew affect the boat handling?
   i. Where should the following gear be stowed so that the boat will perform to its best ability?
      - Fuel tank
      - Oars
      - Water
      - Anchor, rope and chain
      - Signalling gear
      - Fishing rods
      - Handbags
      - Lunch
      - Snorkelling gear
      - Buckets
      - PFDs
      - Radio

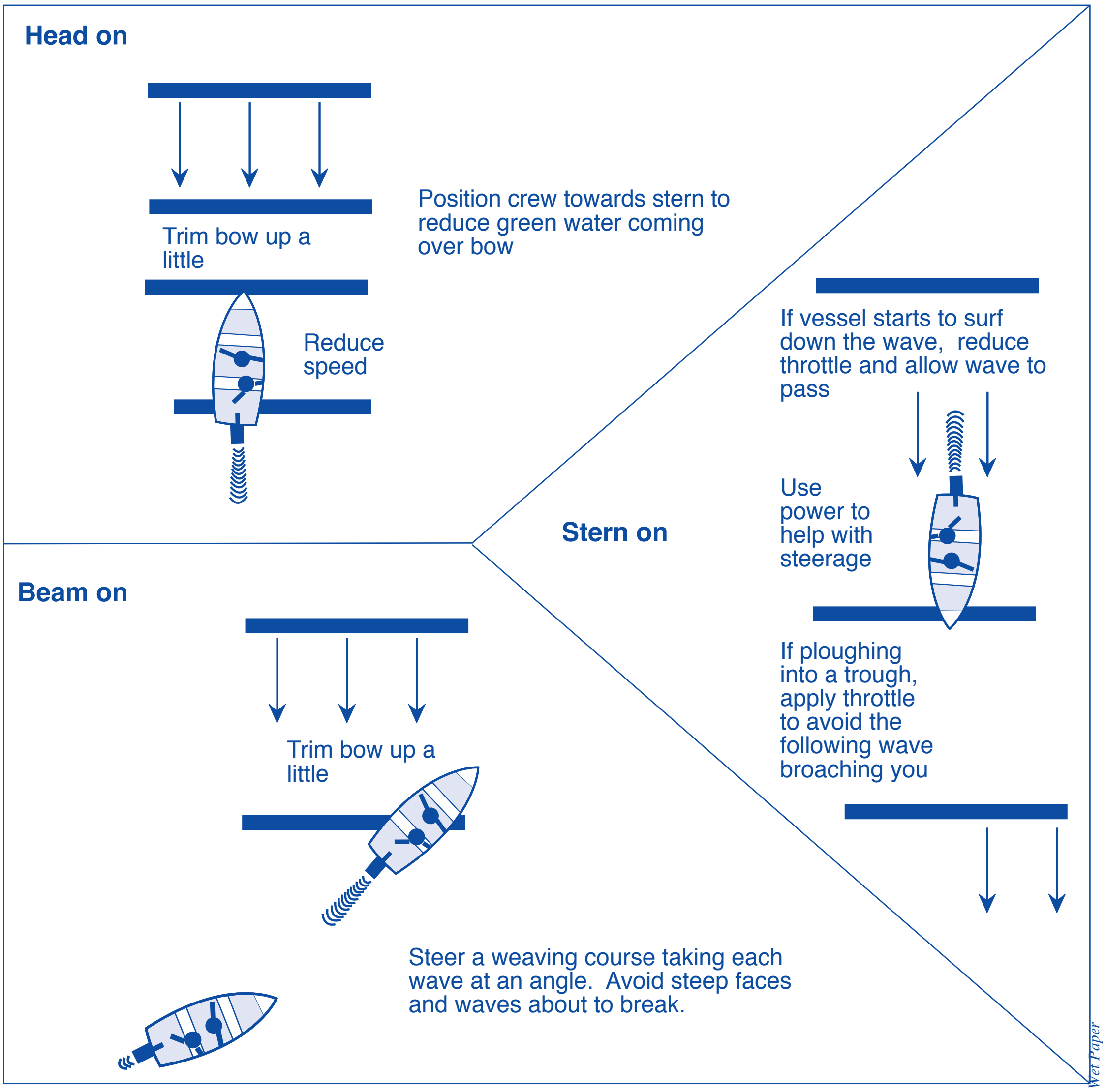


Figure 70.1 Rough weather handling (after Steve Hall, Palm Beach Currumbin State High School)

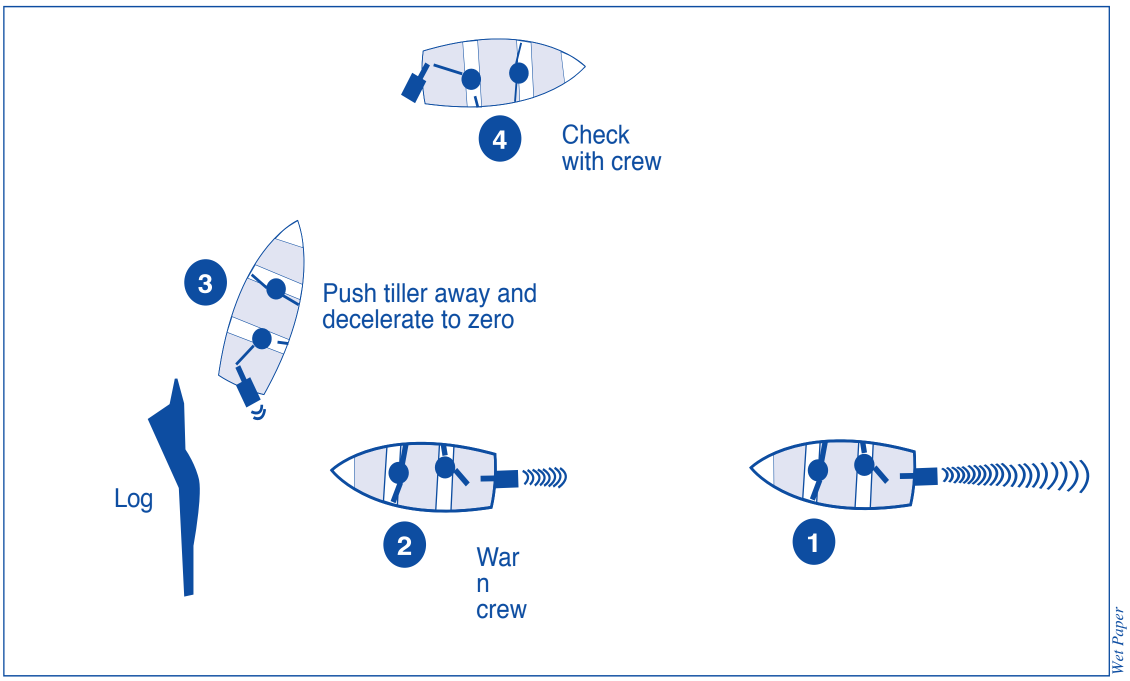


Figure 70.2 Emergency stop

Exercise 71
Safe boating

Acknowledgements to Mark Rickard, Benowa State High School for helping develop this exercise.

Questions

This exercise uses a video produced by The Australian Maritime Safety Authority, which is divided into four sections. View each section separately, stop the video and then answer the questions.

Research assignments are given for additional exercises.

Introduction

1. Which electronic instruments are considered vital safety equipment?
2. Which identification number do Australian Overseas Telecommunications and VHF communication services use as their emergency auto-seaphone channel?
3. List two sources from which to gain up to date weather forecasts.
4. What would be one sign that may indicate to you that the weather is about to change?

Manoeuvring

5. How can you use the thrust off an inboard engined craft to your advantage when mooring?
6. What is the advantage of manoeuvring a twin screw vessel?

Boating regulations

7. What is the name of the set of rules which bind navigators worldwide?
8. Draw diagrams to illustrate the following collision regulations.
   a. Port tack giving way
   b. Windward vessel keeping clear
   c. Actions when unable to determine a situation
   d. Overtaking vessel keeping clear
   e. Approaching a vessel 'head on'
   f. Giving way to a vessel to starboard
9. What is the primary obligation of all skippers?

The Whitsunday area

10. Where are the Whitsunday Islands located?

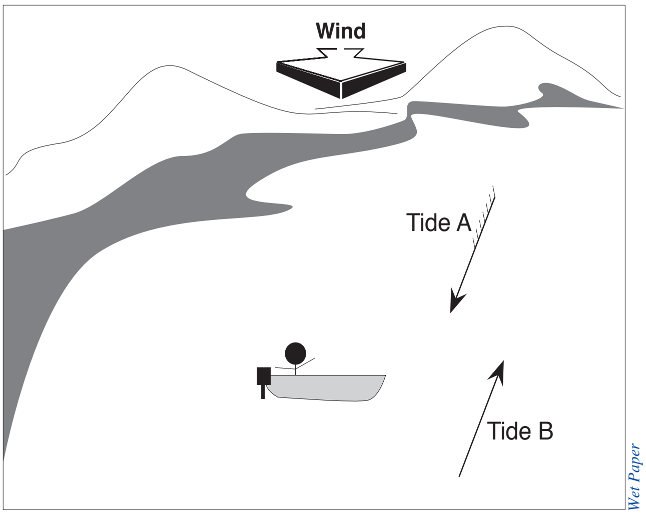


Figure 71.1 Diagram for questions 19 and 20

11. List some of the potential hazards for novice mariners or mariners with no 'reef' experience.
12. Complete this statement: 'In boating, you need to expect the ______________________ '.
13. Why do the tides cause mariners so many problems?
14. Why are many vessels only using chain warps?

Anchoring and mooring

15. What factors make the 'plough' or CQR (coastal quick release) anchor, so popular for anchoring in reef waters?
16. How does chain increase the holding power of an anchor?
17. What is the general ratio of scope for an anchor warp?
18. You anchor in calm conditions. Two hours later the wind starts to blow and the current increases due to the tide. What alterations should be made to the anchor?

Tides

19. What effect does wind and tide opposed create in an area where tidal range occurs as shown in Figure 71.1 and why is this so?
20. As a skipper of a small craft in Figure 71.1, what tidal stage would allow safe passage?

Trouble shooting

21. Match the two sides of the maintenance table in Figure 71.2.

22. Place a number in front of each statement to indicate its priority in dealing with an outboard engine that has been submerged.

- Spray the spark plug holes with water dispersant.
- Turn the engine over to remove water from cylinders.
- Remove engine from water ASAP.
- Start the engine and run for at least 30 minutes.
- Remove spark plugs and fuel filter.

Navigating the reef

23. Why is it important in reef areas to wear polarising sunglasses?

24. Complete the statements / rules to avoid running aground

   a. Plan ______

   b. Wear______

   c. Select______

   d. Anchor______

Tourism and anchor damage

25. Which type of coral shows the greatest signs of damage from anchors?

26. Work as a group to discuss the alternatives to large plough chain anchoring systems? Brainstorm ideas first and then present your suggestions to the class.

27. Work as a group to discuss practices that mariners could adopt to avoid damaging reef while ‘letting go’ anchors?

Research Assignments

1. Volunteer rescue organisations like Air Sea Rescue and Coastguard are frequently called upon to assist people who have ignored the ‘essentials’ list.

   Contact your local volunteer rescue group and survey them as to their most frequent type of ‘call-out’ problem.

2. Prepare a poster suitable for display in your classroom to alert mariners to the problems commonly encountered in your local area.

3. Investigate alternative approaches to anchoring with reef damaging chain.

Component/Observation	Maintenance
1. oil/water on floor or bilge 2. fan belt 3. fuel filter 4. water pump impellor 5. oil dipstick	a. change at 100 hour intervals b. check and top up if necessary c. tighten hose clamps with screwdriver d. check tension and carry spares e. check exhaust and water are being expelled

Figure 71.2 Table for questions 21 and 22

Summary

1. Don’t overestimate your boat or your ability
2. Don’t go offshore unless your boat has been designed for open waters
3. Don’t overload your boat
4. Don’t presume your boat will never breakdown or strike conditions which are too rough for its design
5. Always check the weather forecast and know where you are going by studying a chart that you are going to take with you
6. Check fuel, oil and battery levels
7. Check safety list and that equipment is accessible and crew know how to use it
8. Tell someone where you are going and let them know you’ve returned or reached your destination

Sea Safety Education
Phone (06) 279 5972
Fax (06) 279 5858
PO Box 1108 Belconnen ACT 2616

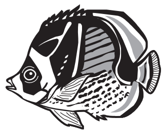
Materials and Equipment (per group)

Equipment required

- AMSA video on *Safe Boating*

Exercise 72
Revision test

Time 60 minutes



35 marks

Knowledge and understanding

1. The handling of a boat depends on many factors. Which of the following is **not** a factor discussed in the text that affects the boat handling?
   a. Power unit, drive, propeller type, and number
   b. Weather, tide, current, waves and swell
   c. The age and experience of the skipper
   d. Conditions of loading
2. Boats that have a deep V-hull:
   a. have greater directional stability.
   b. have greater stability.
   c. are built for high speed work.
   d. are designed for river and creek work.
3. Regardless of whether the boat is powered by an inboard or outboard motor, close-quarters handling and manoeuvring to leave a jetty are the same. Suggest the correct method of leaving the jetty in the conditions shown in Figure 72.1. You may wish to use a diagram to help explain your answer.

   (3 marks)
4. LPG is:
   a. liquified petroleum.
   b. low pressure gas which can be used to fuel a number of appliances such as stoves and refrigerators.
   c. licensed petroleum gas stored in cylinders.
   d. a common fuel for inboard motors.
5. When rowing, the oars control the direction in which the boat travels. If you want to go to port and you are sitting in the correct position in the dingy, would you:
   a. pull on the oar in your right hand while moving the oar in your left hand in the opposite direction
   b. pull on the oar in your left hand while moving the oar in your right hand in the opposite direction.
   c. pull on the oar in your right hand for a number of short sharp strokes.
   d. dip the oar deeper into the water on the starboard side

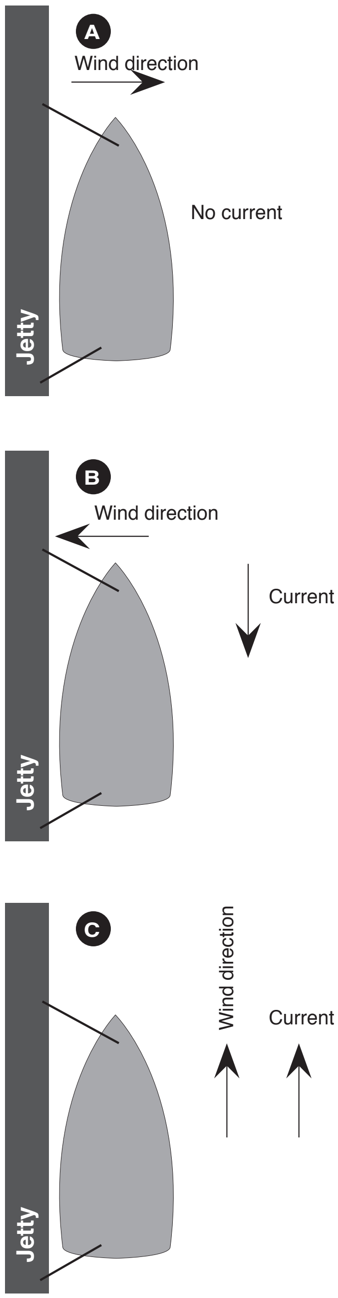


Figure 72.1 Diagram for question 3
Wet Paper

6. Make a list of some sensible suggestions you may give to a person who is having trouble rowing a dinghy.

(1 mark)

7. List two advantages and two disadvantages of inflatable boats.

(2 marks)

8. The propeller shown in Figure 72.2, is turning in a clockwise direction. In which direction will the stern be driven when looking at the vessel from behind? Give reasons for your answer.

(2 marks)

9. Describe how a boat should come along side a pontoon or jetty. You may wish to draw a diagram to help with your explanation.

(1 mark)

10. As skipper of a speedboat you wish to complete a U-turn. What safety precautions would you take and how would you go about completing the turn ?

(1 mark)

11. Match the anchor names listed below with the appropriate pictures in Figure 72.3.

Sea anchor, drogue reef anchor, grapnel bruce, danforth, admiralty pattern, coral or rock.

(3 marks)

12. Select one anchor from the list above and describe its advantages and/or disadvantages.

(1 mark)

13. Discuss the man overboard procedure you have been given by your instructors.

(2 marks)

14. You are about to anchor in 4 m of water in windy conditions. What amount of anchor line and chain would you use ?

(1 mark)

15. Draw a diagram of a sailing boat and indicate where the following would be found: gooseneck, main sheet, centreboard, transom

16. On the same drawing indicate and name the three wires that form the standard rigging.

17. Draw a diagram of a rudder system. Name four parts.

18. Draw a diagram of a mainsail and name all sides and all corners.

19. What is the method of reducing sail span called? When is it used?

20. There are three basic controls on a main sail. They are:

a. uphaul, downhaul, boom vang.

b. outhaul, inhaul, boom vang.

c. cunningham, outhaul, boom vang.

d. boom vang, mast, cunningham.

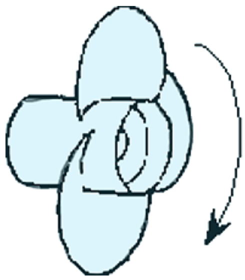


Figure 72.2 Diagram for question 8
Wet Paper

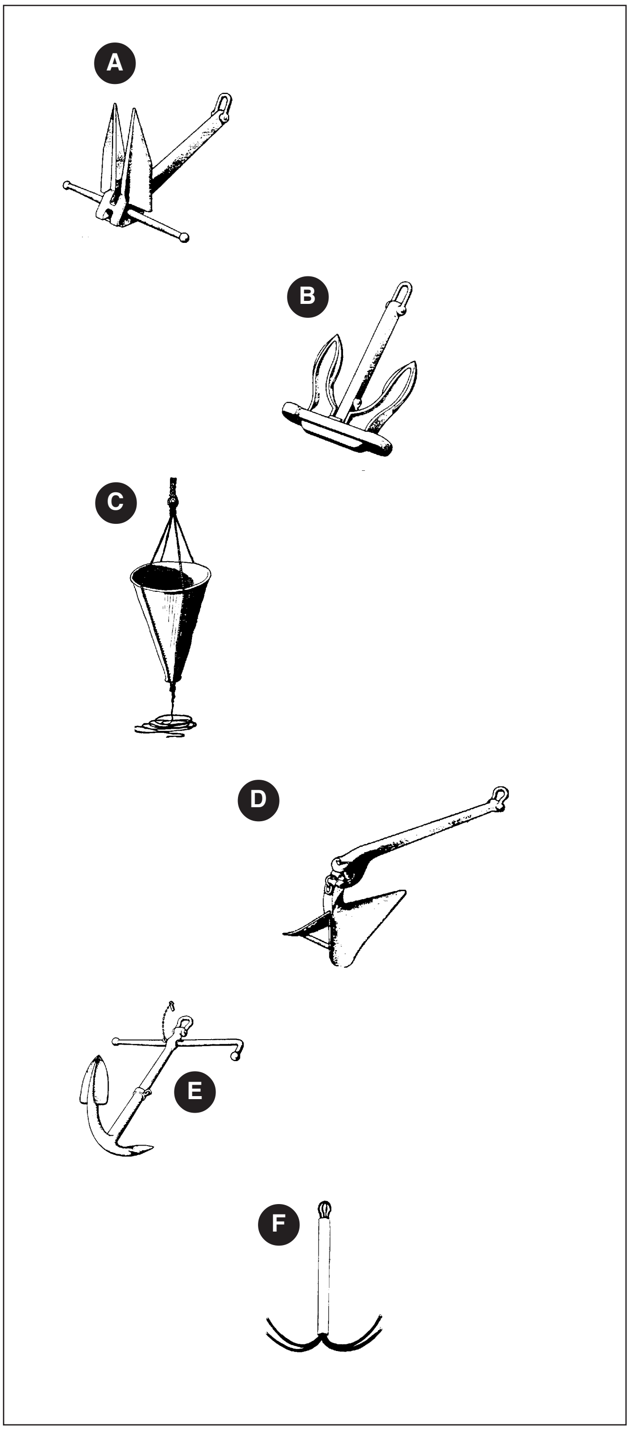


Figure 72.3 Diagram for question 11 (Illustrations courtesy Queensland Transport, Reproduced with permission)
Wet Paper

21. The centreboard is used to:
    a. stop the boat.
    b. minimise leeway and provide some forward drive.
    c. keep the boat upright.
    d. provide a seat for the main sheet hand.
22. The spars on a Corsair consist of:
    a. mainsail and head sail.
    b. centreboard and rudder blade.
    c. the hull.
    d. the mast and boom.
23. The hull of a boat is comprised of many parts. The front end and back end are called:
    a. the stem and stern.
    b. abeam.
    c. pointy end and blunt end.
    d. fore quarter and aft quarter.
24. The boom vang is there to:
    a. hold the mast and boom together.
    b. control the vertical movement of the boom.
    c. injure the foredeck hand.
    d. control the top of the head sail.
25. State the use of the parts of the boats listed below:

    Boom vang, cleat, self bailer, bolt rope, halyard
26. There are three types of PFD. Name the type that you used during the course and state one disadvantage of this type.
27. List four aspects of a sailing dinghy that indicate that it is a seaworthy vessel.
28. List five methods of signalling distress.
29. You plan to go sailing on an overcast day in early August. The wind is from the south-west at 10 – 12 knots. Give a brief list of the clothes you would wear on such a day.
30. State which vessel has right of way in each situation in Figure 72.4. Give reasons for your answer.

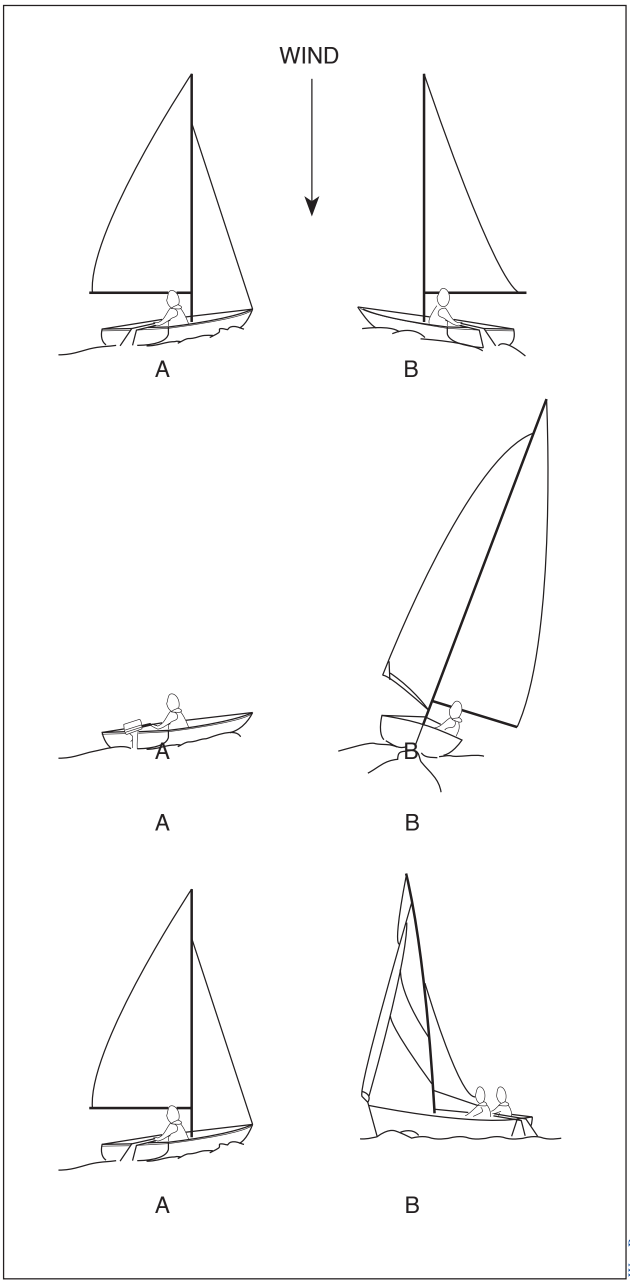


Figure 72.4 Diagram for question 30

Answers
1. c
2. a
3. See text
4. a
5. b
6-30 See text

Section 4

Tides and weather

Exercise 73

Tide types

Based on an original exercise by Tim Ryan, Maryborough State High School.

Questions

Study Figures 73.1 and 73.2 over and answer the questions

1. Predict the tidal range for the following Australian cities and towns.

    a. Perth

    b. Brisbane

    c. Adelaide

    d. Burnie

    e. Mackay

    f. Broome

2. a. State which regions of Australia will have tidal ranges greater than 6 m.

    b. Discuss some problems these tidal ranges may cause for people living in these regions.

3. Define the term *diurnal tides*. Which areas of Australia would experience this type of tide?

4. Predict the type of tides experienced by the following areas.

    a. Spencer Gulf

    b. Shark Bay

    c. Gulf of Carpentaria

    d. Arnhem Land

    e. Great Australian Bight

    f. Port Macquarie

    g. Port Hedland

    h. Magnetic Island

5. How might the shape of the coastline affect the tidal range? What other factors may affect the height and time of a tide in an area?

6. Define the following terms.

    a. Intertidal zone

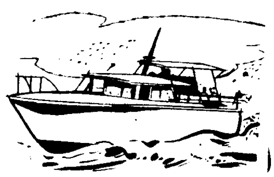
    b. Ebb currents

    c. Tidal range

Research

In Tahiti, the tide times are the same each year.

Suggest if solar or lunar influences will be greater in Tahiti. Explain your answer.



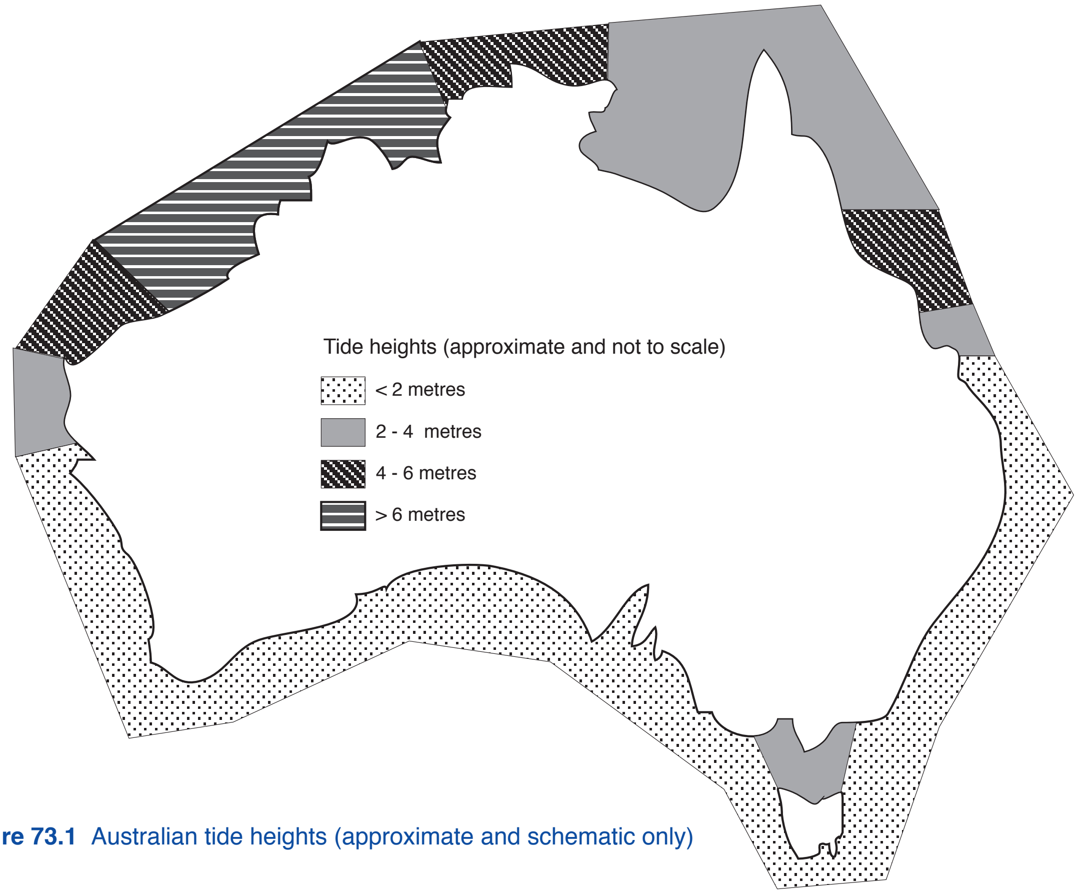


Figure 73.1 Australian tide heights (approximate and schematic only)

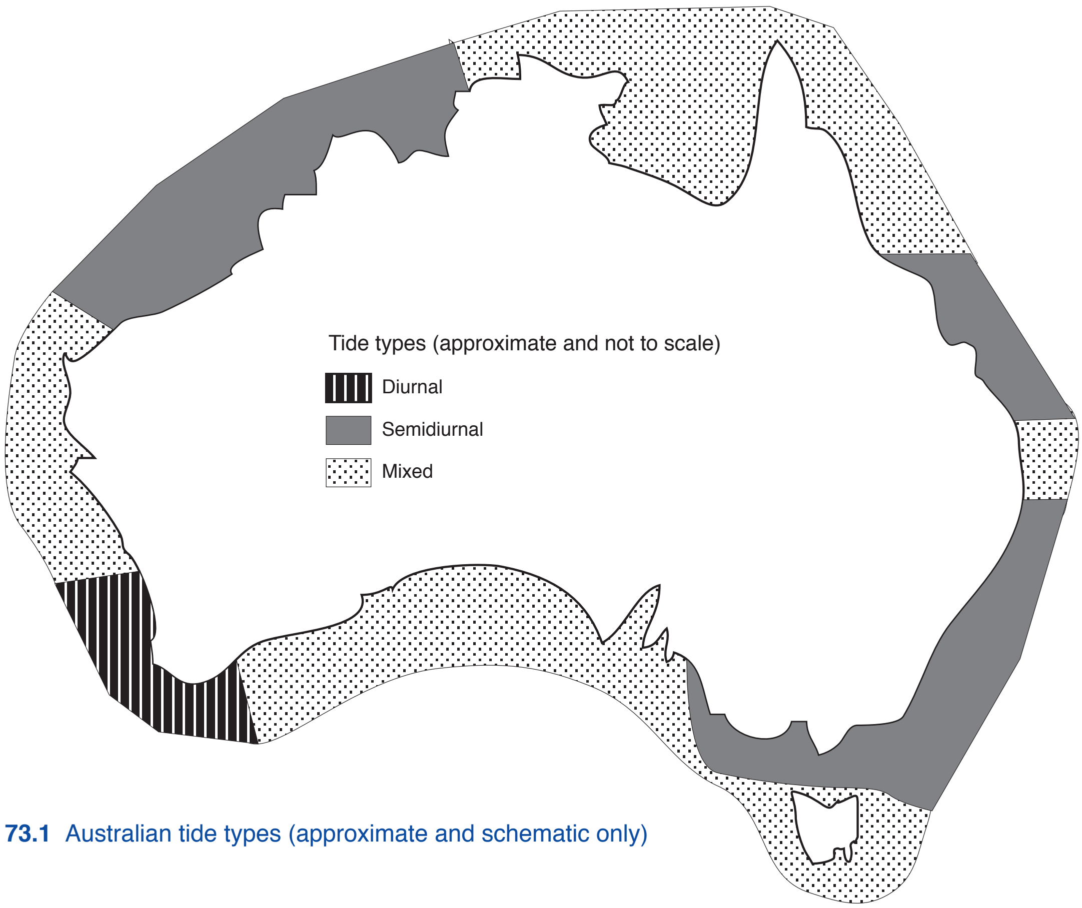


Figure 73.1 Australian tide types (approximate and schematic only)

Wet Paper

Exercise 74
Tides

Based on an original exercise by Tim Ryan, Maryborough State High School and part of an article written by Brian Davis for the Beach Protection Authority.

Method

Read the following article by Brian Davis, and then answer the questions on page 139.

Origin of tides

The two principal tide-generating influences are the gravitational attractions of the moon and the sun. Despite the moon’s smaller mass, its relative closeness leads to a tide-generating force about 2.2 times that of the sun. Figure 74.1 shows the sun-earth-moon system. The moon’s orbit is elliptical and inclined to the plane of the earth’s orbit at 5°09'. The angle between the moon and the equatorial plane (the declination) changes gradually from a maximum to a minimum to a maximum again each orbit, and the positions of the closest and furthest points (perigee and apogee) change over an 18- to 19-year cycle. The moon takes some 28 days to move through its orbit, with the earth rotating once per 24 hours during this cycle, and this produces a complex pattern of lunar attraction during the lunar month.

Earth’s orbit around the sun is also elliptical taking about 365 days and having closest and furthest points known as periphelion and aphelion. The constant inclination of earth’s axis to this plane of orbit adds a further element of complexity to the system.

On earth, the waters of the oceans and seas are relatively mobile under the influence of the gravitational attractions. Lunar attraction, combined with the rotation of the earth and moon about a common centre of mass over their 28-day cycle, leads to the formation of tidal “bulges” on opposite sides of the earth as depicted in Figures 1A and 1B. The daily spin of earth within this watery envelope results in different thicknesses of the bulge (i.e. tide height) passing a given location depending on its latitude and the declination of the moon on that day. Normally there are two high tides per day, but at some locations only one tide per day occurs as the moon nears maximum declination (see Figure 74.1A).

A similar although smaller solar bulge is also present and there are two occasions each month when the bulges are coincident and add together to produce the so called spring tides. This happens at full moon and new moon (e.g. at positions B and B’ shown in Figure 74.1). When a full or new moon occurs as the earth nears periphelion, lunar and large solar bulges line up and abornomally high and low tides (king tides) are experienced.

These bulges are not, however, free to move around the earth following the moon. The distribution of the land masses and the relatively shallow nature of the oceans cause the bulges to be trapped within the oceans and they move much the same way as circular waves which form in a large shallow basin as it is tilted.

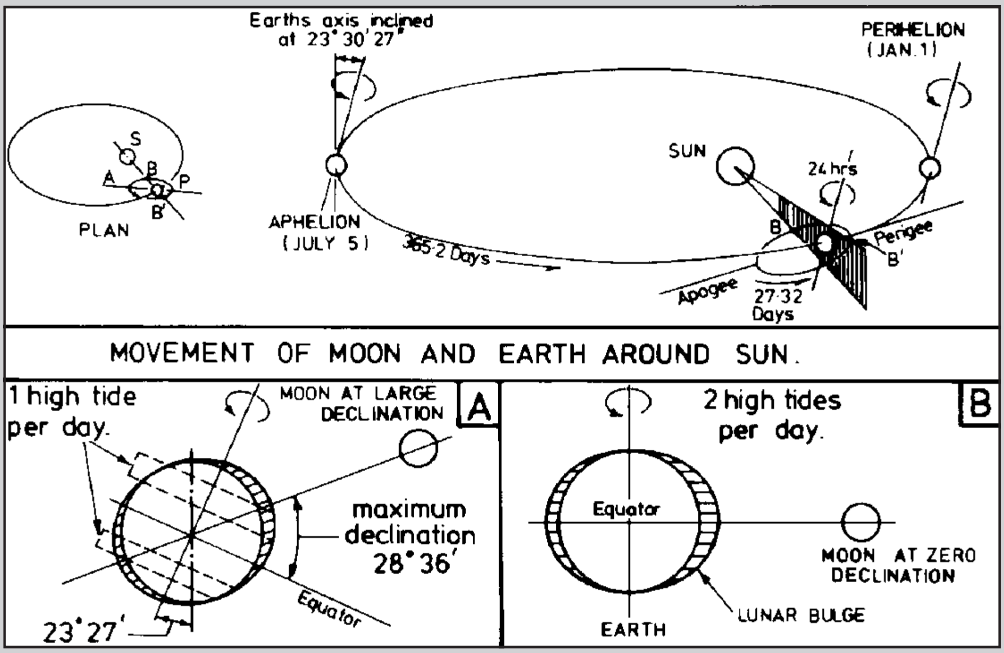


Figure 74.1 Generation of one high tide and two high tides per day

The gravitational attractions of the moon and the sun provide the regular tilts and the whole ocean may sort itself into a number of basins each with a circular tidal wave. As with cyclones, the direction of rotation in this hemisphere tends to be clockwise, but there are some exceptions. Adjacent basins may interact with each other and with the shallow continental shelves to focus the waves at one location producing an unusually large tidal range.

Although complex, the movements of the moon and earth around the sun are precisely predictable and observation of tidal behaviour at a particular site shows regular patterns. Analysis of these patterns allows the separation of the tide into various components each of which is directly linked to a regular solar or lunar pattern and accurate prediction of tidal behaviour over long periods of time can then be made.

Tides in Queensland

Tidal behaviour in Queensland can be illustrated by the distribution of cotidal and corange lines plotted in Figures 74.3 B and C. Cotidal lines join places which experience high tide at the same time. An arbitrary start time is marked on one line and the progress and shape of the crest of the tidal wave can then be followed. Corange lines link up places which have the same maximum tidal range.

Two counter-rotating basins, one centred in the Coral Sea and the other near New Zealand combine to push a tidal crest towards the Australian land mass.

The topography of the ocean floor bends this wave into two lobes which approach the Queensland coast from the south and north-east simultaneously.

The shallowness of the Great Barrier Reef causes an increase in the range height as the Coral Sea crest moves south-west onto the shelf.

At the same time the Tasman arm of the crest has swung westwards, increasing in range, and the two crests converge on the Broad Sound area where a maximum range of greater than 10 m has been recorded.

Meanwhile the northern arms of the Coral Sea crest has moved towards the restricted waters between Cape York and New Guinea, increasing in height as the two coastlines funnel the crest towards Torres Strait. Here a very peculiar effect occurs.

The Arafura Sea, north-west of the Gulf of Carpentaria belongs to an entirely different system of tidal basins centred in the Indian Ocean and tides there are rarely in phase with those of the Pacific. Torres Strait being the shallow connecting channel between the two systems can experience large differences in tide height on the eastern and western sides and strong tidal currents (up to 6 knots) often develop.

Interference of waves from these two out-of-phases systems produces the unusual tidal patterns at Thursday Island and Weipa seen in Figure 74.2A.

The increasing range southwards from Cairns is also apparent in Figure 74.2 and 74.3. It is this tidal exchange of up to 15 per cent of the volume of water within the reef (some 30 000 cubic kilometers overall) which helps promote the growth of the vast reef colonies off the central and northern Queensland coast.

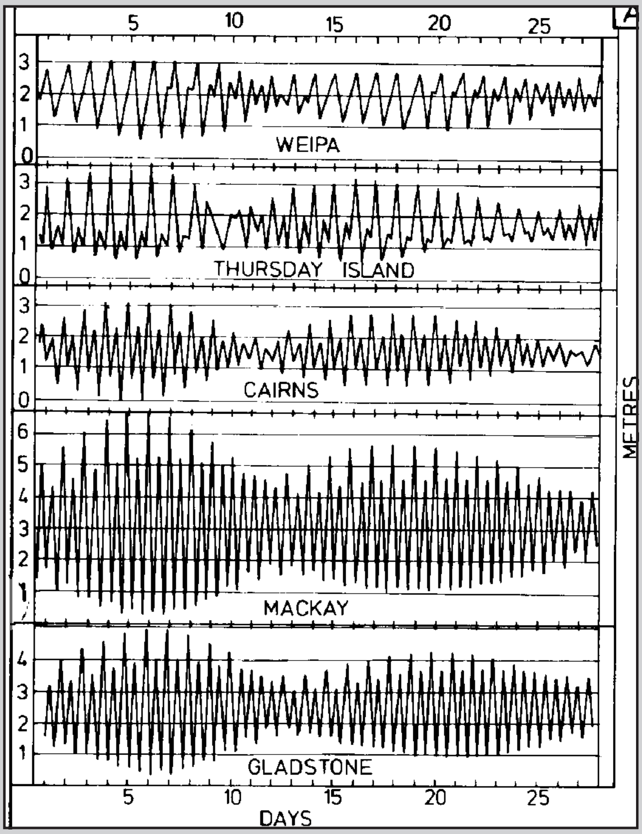


Figure 74.2 Queensland tidal variations

Wet Paper

Questions

Read the article on the origin of tides in the boxed sections and answer the following questions.

1. Define the following terms.
   a. declination
   b. perigee
   c. apogee
   d. perihelion
   e. aphelion
2. Which areas of the coast could expect only one tide per day?
3. Explain why spring tides occur when the moon is at full moon and new moon.
4. Suggest a reason to explain why strong tidal currents (up to 6 knots) can occur in the Torres Strait.
5. Access the information to explain the tidal ranges found in the Broad Sound area.
6. From the information in Figure 74.3.c on corange, predict the tidal range in metres for the following towns:
   a. Bowen
   b. Brisbane
   c. Ballina
   d. Cooktown
   e. Townsville
   f. Port Alma
7. Predict which areas or towns in Figure 74.3.b, would experience high tides at the same times as Rockhampton.
8. Use the information on tidal variations to answer the following questions.
   a. What is the tidal variation at Mackay?
   b. How are the tides in Weipa different from those experienced in Mackay?
   c. Are the two tides experienced each day on Thursday Island of the same height? Calculate the heights.
   d. Generalise about the tidal variation found in Cairns.
9. Explain why predicting tidal height and time is such a complex task.

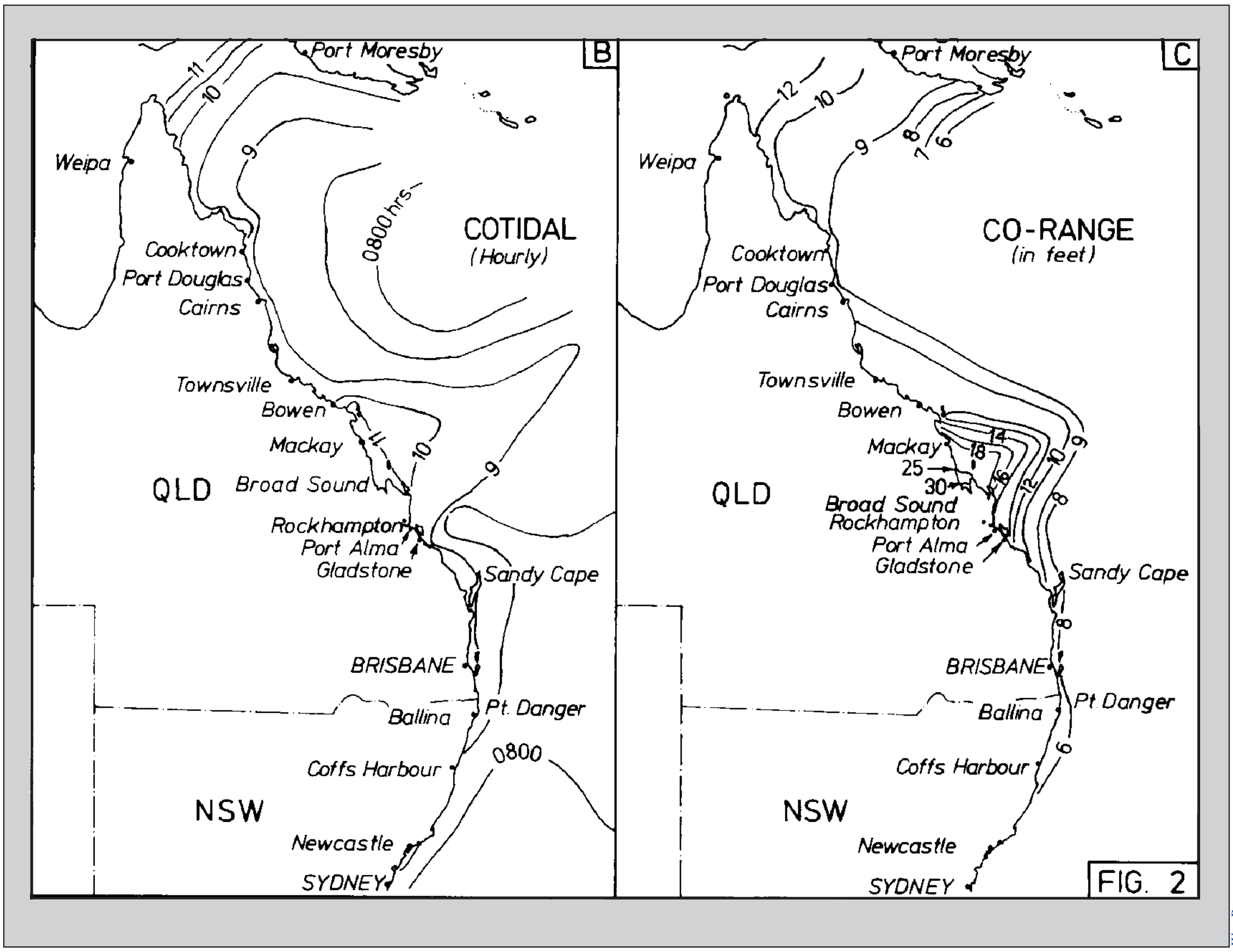


Figure 74.3 Cotidal and corange lines as the tide approaches coastline

Exercise 75
Tide cycles

Questions

Use the tide tables in Figure 75.2.

Daily tides

1. Write down the daily tides and times for 1 May for both Conneltown and Waterhouse landing
2. Draw a graph of tide height versus time of day for the four tides in the day.
3. Are the high tides and low tides different heights?
4. When do these occur?
5. Offer an explanation for the different heights.
6. Is the tidal range different for Conneltown and Waterhouse landing? If so, by how much?
7. Using Figure 75.2, answer these questions
   a. What dates does full moon occur?
   b. When do half, first and last quarters occur?
   c. Are they the same for both places?

Monthly tides

1. Draw a graph of the tides over the month for both Conneltown and Waterhouse landing. Use only the highest high and lowest low for each day.
2. Are there differences in tide heights over the month? Write a paragraph putting into words what your graph shows.
3. On what dates do the spring tides occur and where do the neap tides occur?
4. Draw sun, earth and moon diagrams as shown in Figure 75.1, and explain why spring and neap tides occur.

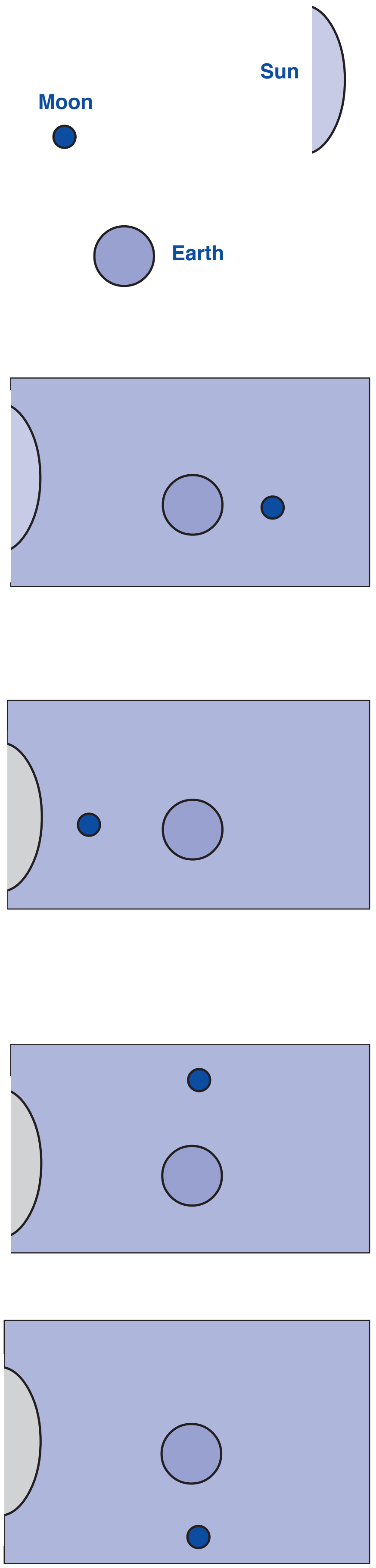


Figure 75.1 Movement of the moon around the earth
Wet Paper

Materials and equipment (per group)

Equipment required

- graph paper
- pencil, ruler and rubber

Conneltown tides

MAY

Day	Time	m	Day	Time	m
1 SU	0221	0.99	16 MO ●	0311	1.02
	0815	2.32		0850	2.12
	1424	0.51		1506	0.36
	2101	2.55		2201	2.75
2 MO ○	0252	1.06	17 TU	0355	1.15
	0836	2.22		0923	1.91
	1452	0.49		1544	0.49
	2133	2.58		2243	2.64
3 TU	0328	1.16	18 WE	0446	1.29
	0900	2.08		1001	1.70
	1523	0.52		1623	0.67
	2208	2.56		2335	2.47
4 WE	0409	1.28	19 TH	0559	1.41
	0930	1.92		0650	1.42
	1559	0.60		0804	1.40
	2252	2.48		1040	1.49
				1704	0.86
5 TH	0502	1.41	20 FR	0044	2.30
	1008	1.73		0945	1.31
	1642	0.72		1145	1.32
	2352	2.37		1752	1.04
6 FR	0637	1.48	21 SA	0224	2.20
	1059	1.54		1126	1.19
	1735	0.87		1602	1.29
				1910	1.18
7 SA	0145	2.30	22 SU	0340	2.17
	0949	1.31		1154	1.10
	1338	1.41		1654	1.41
	1917	0.99		2117	1.22
8 SU	0322	2.40	23 MO	0427	2.17
	1024	1.12		1200	1.04
	1535	1.57		1726	1.55
	2107	0.95		2223	1.20
9 MO ☾	0415	2.52	24 TU ☽	0505	2.18
	1056	0.91		1150	0.96
	1635	1.79		1757	1.70
	2219	0.86		2313	1.17
10 TU	0505	2.62	25 WE	0538	2.18
	1133	0.70		1204	0.86
	1731	2.03		1828	1.86
	2320	0.78		2355	1.16
11 WE	0552	2.68	26 TH	0608	2.17
	1211	0.50		1224	0.76
	1826	2.28		1857	2.02
12 TH	0013	0.73	27 FR	0032	1.15
	0637	2.67		0632	2.16
	1250	0.35		1245	0.66
	1918	2.50		1924	2.18
13 FR	0102	0.74	28 SA	0104	1.14
	0717	2.60		0654	2.14
	1327	0.27		1307	0.55
	2004	2.67		1951	2.36
14 SA	0147	0.80	29 SU	0135	1.12
	0751	2.47		0721	2.12
	1401	0.24		1331	0.45
	2045	2.77		2021	2.52
15 SU	0229	0.90	30 MO	0208	1.09
	0820	2.30		0750	2.09
	1434	0.27		1401	0.36
	2123	2.80		2055	2.64
			31 TU ○	0247	1.09
				0822	2.02
				1435	0.32
				2133	2.70

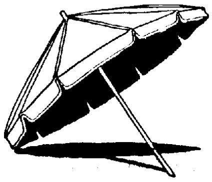
Waterhouse landing tides

MAY

Day	Time	m	Day	Time	m
1 SU	0438	1.15	16 MO ●	0451	0.98
	1025	4.89		1035	4.82
	1641	0.75		1647	0.42
	2253	5.44		2308	5.94
2 MO ○	0515	1.28	17 TU	0536	1.04
	1059	4.62		1121	4.60
	1712	0.91		1726	0.58
	2327	5.39		2353	5.86
3 TU	0554	1.46	18 WE	0623	1.16
	1135	4.30		1209	4.36
	1744	1.13		1808	0.84
4 WE	0002	5.26	19 TH	0040	5.66
	0636	1.69		0712	1.32
	1211	3.97		1302	4.13
	1815	1.40		1851	1.16
5 TH	0038	5.08	20 FR	0129	5.39
	0721	1.91		0807	1.49
	1253	3.67		1358	3.94
	1849	1.66		1942	1.50
6 FR	0122	4.87	21 SA	0223	5.09
	0818	2.10		0907	1.62
	1346	3.43		1502	3.80
	1935	1.92		2048	1.80
7 SA	0219	4.68	22 SU	0323	4.81
	0933	2.16		1015	1.66
	1504	3.32		1621	3.78
	2045	2.11		2208	1.98
8 SU	0333	4.58	23 MO	0437	4.65
	1056	2.03		1127	1.56
	1639	3.42		1745	3.94
	2213	2.13		2332	1.96
9 MO ☾	0456	4.63	24 TU ☽	0551	4.64
	1209	1.72		1230	1.35
	1806	3.76		1849	4.24
	2340	1.95			
10 TU	0609	4.83	25 WE	0045	1.78
	1302	1.36		0650	4.72
	1904	4.21		1318	1.13
				1936	4.55
11 WE	0055	1.65	26 TH	0138	1.59
	0705	5.03		0735	4.77
	1345	1.02		1356	0.96
	1949	4.66		2013	4.82
12 TH	0152	1.36	27 FR	0223	1.45
	0750	5.15		0813	4.75
	1423	0.76		1431	0.85
	2028	5.06		2047	5.04
13 FR	0239	1.16	28 SA	0302	1.37
	0831	5.18		0848	4.67
	1458	0.56		1504	0.81
	2107	5.41		2120	5.22
14 SA	0323	1.03	29 SU	0340	1.34
	0910	5.13		0923	4.55
	1533	0.43		1537	0.80
	2145	5.69		2154	5.37
15 SU	0407	0.98	30 MO	0420	1.32
	0952	5.01		1000	4.43
	1608	0.37		1610	0.82
	2225	5.88		2230	5.49
			31 TU ○	0501	1.32
				1040	4.30
				1647	0.87
				2308	5.55

Figure 75.2 Tide tables (Based on information supplied by the Queensland Department of Harbours and Marine)

Exercise 76
Model for daily tides



This model is based on an original idea by Roy Jenkins from SA, who devised it for the FUSE project . Reproduced with permission— thanks Roy.

Method

1. Find the water in Part A of Figure 76.2 and colour it in blue.
2. Use scissors to cut out Part A as shown in Figure 76.2
3. Paste this onto the cardboard.
4. Colour in the land in Part B another colour and then use scissors to cut this out.
5. Push the paper fastener through the centre of part B so that the pointy bits are uppermost.
6. Very carefully position part B over part A and push down so that it can rotate around the centre point.

Questions

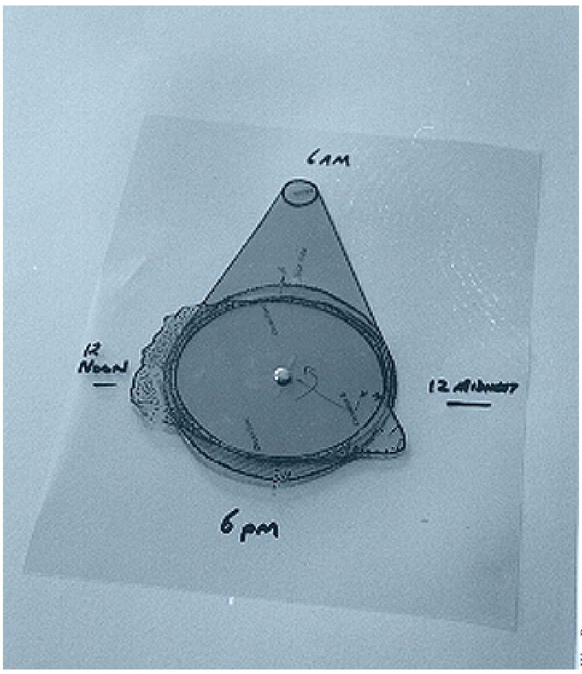
1. Line up H_1 and H_1. Is this high or low tide?
2. Slowly rotate H_1 to H_2 . Is this high or low tide? How can you tell?
3. Now rotate to H_3 then H_4. How many hours have elapsed?
4. Arrange an artificial sun and mark in sunrise and sunset. How many hours between tides?
5. Was the high tide on one side of the earth higher than the other? Look back to your graph in Exercise 75 part A.
   a. Does the model support the data obtained in the graph?
   b. Does the model explain why the two high tides are different ?
   c. When you swing a bucket of water over your head the water stays in the bucket due to centrifugal force.

      Use this idea to explain why one tidal bulge could be greater than the other and hence one high tide during the day higher than the other at night.
6. You go camping to an island and arrive at high tide at 2 p.m. Your boat is pulled up a few metres on the sandy beach.
   a. What approximate time will the next low tide occur?
   b. You wake up in the morning to find your boat missing. The island is deserted and there has been no wind. Give a possible explanation and use your model to explain to the insurance company that the boat was not stolen.

Materials and equipment (per group)

Equipment required

- two pieces of coloured paper
- glue
- scissors
- tracing paper
- cardboard
- paper fastener (as shown in photo)



Wet Paper

Figure 76.1 Completed tide model

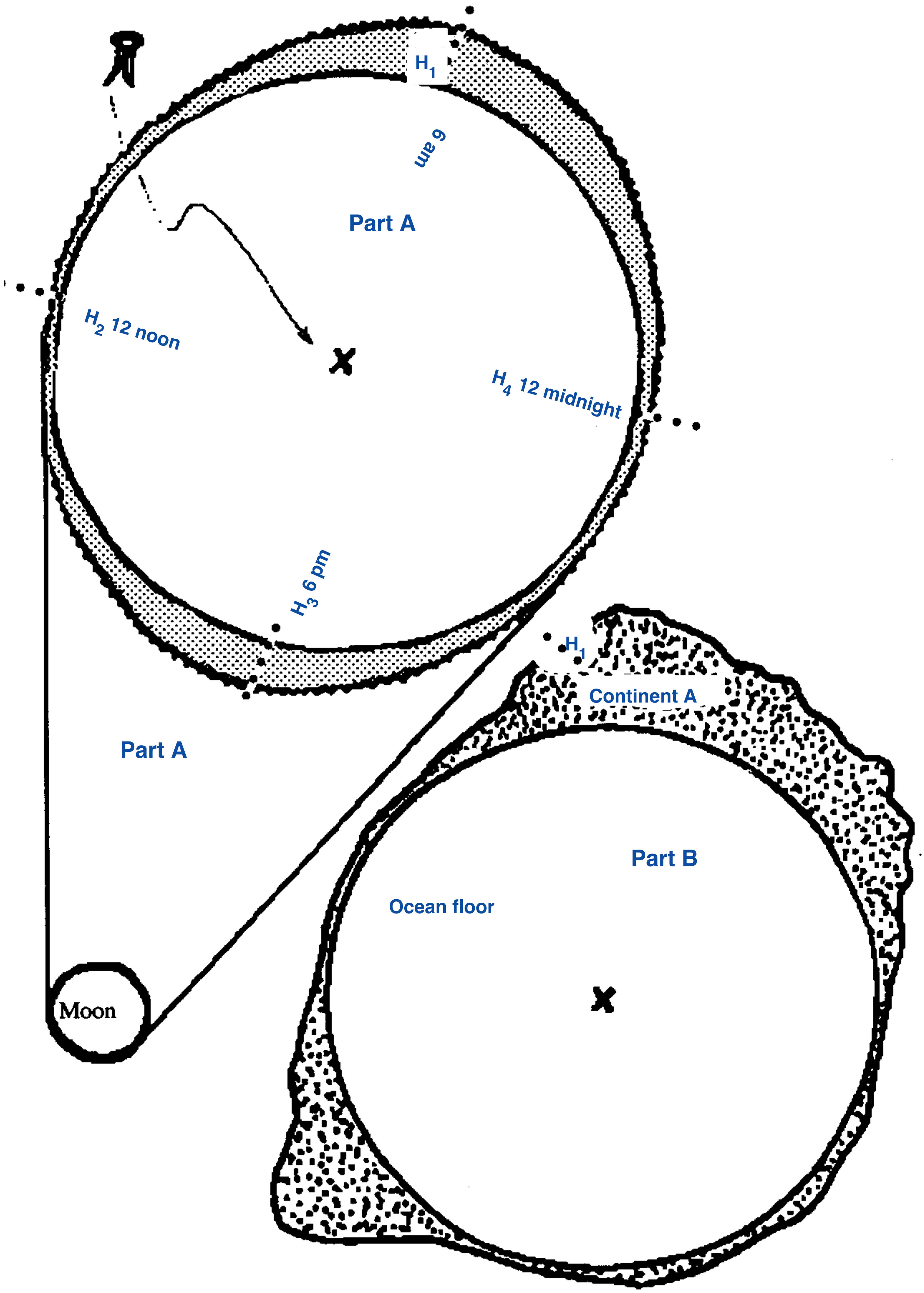


Figure 76.2 Template for model. Students may make one copy of this page so that they can make their model.

Exercise 77
Rule of Twelfths

Based on an example from AYF TL3 notes

Questions

Read the text block and answer the questions. Assume all areas have semi-diurnal tides.

1. If the tidal range at Gladstone was 4 m and the time of high tide was 1 p.m., predict the height of the tide at 3 p.m. on the same day.
2. An amateur fisherman is fishing in a depth of water of 6 m. It is 9 a.m. and the tide for that day is high tide of 4 m at 8 a.m. Calculate the depth of water at 12 midday.
3. A snorkeller is concerned by the tidal flow at a particular dive site. He checked the tides for the day and found:

Time	Height (m)
0417	0.61
1044	4.20
1710	0.73
2305	3.85

   Predict suitable times for dives on this day. Give reasons for your answers.

4. Bar crossing at a river mouth area is a problem when the tidal flow is great as this increases wave height. The tides for a day when ocean conditions were suitable for safe boating were as follows:

Time	Height (m)
0140	3.10
0744	0.74
1411	3.84
2044	1.00

   Predict possible safe crossing times.

5. Your vessel has a draft of 2.4 m and you wish to enter a channel that is shown on the chart as having a depth of 1.5 m. A check of the tide book reveals on that day a high tide of 3 m occurs at 8 a.m. You wish to have at least 0.5 m clearance for safety.

   Calculate the period of time (giving the times) when entry into the channel would be safe.

6. As this method is not as accurate as using graph predictions, suggest why it is still widely used.

Example

This rule is used as a guide to determine tidal height. Because the wave that the earth spins through is not symmetrical, the rise and fall of the tide is not equal. A simple rule has to be found to work out how much water is under a boat at a certain time in the tide.

This rule is called the **rule of twelfths** because it divides the time and height by 12.

The formula works on the tidal range.

- In the **first** and **sixth hour** of the tide the height will drop by 1/12
- For the **second** and **fifth hour** of the tide the height will drop 2/12
- During the **third and fourth** hours it will drop 3/12

If the tidal range is 6 m and you want to find out how much the tide has fallen 3.5 hours after HW, an approximate answer is as follows:

In the first hour

The tide falls 1/12 x 6 = 0.5 m

In the second hour

The tide falls 2/12 x 6 = 1.0 m

In the third hour

The tide falls 3/12 x 6 = 1.5 m

The tide falls 1/2 x 3/12 x 6 = 0.75 m

Total fall = 3.75 m

Hours	1	2	3	4	5	6
Fraction of tide rising or falling	1/12	2/12	3/12	3/12	2/12	1/12

Thanks John Wiley

Exercise 78
Bay of Fundy

Based on an original exercise by Tim Ryan, Maryborough State High School.

The purpose of this exercise is to discover about a tidal bore.

Questions

Read the article opposite and answer the questions below.

1. Locate the Bay of Fundy in an atlas.
2. In what country is it located? Draw a sketch of the bay.
3. What is a tidal bore and how is it created?
4. The type of tide the Bay of Fundy has is:
   a. diurnal
   b. semi-diurnal
   c. mixed
5. Calculate the height of the highest recorded tide in the Bay of Fundy in metres. 1 m = 3.281 ft.
6. Estimate the height of the ceiling in your room and predict how many times your room would be filled if an incoming tide of 52 ft. entered the building.
7. What effect do these tides have on local conditions?
8. If an area of the bay had an incline of 1/20 (1 m rise in 20 m), calculate the distance the water would cover. Calculate the speed at which the water would cover this area.
9. Discuss the tidal flow as a potential source of energy for the area. What problems may be encountered in tapping this energy resource?

The Bay of Fundy

The moon, with occasional help from the sun, is credited with the amazingly powerful and spectacular tides in the Bay of Fundy, a sight that must be seen to be believed.

These tides are responsible for widely separated natural attractions that have gained worldwide fame for New Brunswick: the strange flower pot rocks at Hopewell Cape, near Fundy National Park; the eerie echo caves at St. Martins; the world's second largest whirlpool—old sow—off Deer Island; the much-photographed Reversing Falls at St. John; the predictable tidal bore in the Petitcodiac River at Moncton.

It is impossible to imagine the tremendous force exerted by 100 billion tons of salt water being forced up the Bay of Fundy twice a day (every 12 hours and 30 minutes), creating the highest tides in the world. The highest measured tide at the eastern extremity of the bay, was recorded at 52.5 feet (that's the height the water rose).

There can be danger in such a tremendous and fast change in water level. From low tide level at Alma, on the border of Fundy National Park, the water rises as much as a foot in seven minutes, can reach your waistline in half an hour and an incredible 43 feet in a little more than six hours.

Be wary of being trapped in a cave at St. Martins or Hopewell Cape when the tide starts rising .

When the tide starts to rise, it enters Fundy at its widest point, then piles up as it moves up the funnel shaped bay, squeezed by narrowing sides. The low tide running out meets the incoming high tide, creating an even higher wave coming in—best viewed as the tidal bore on the Petitcodiac River.

Give the moon credit, or the blame, for these tremendous high tides. The pull of the moon does the lion's share of the work. The sun lends a hand twice a month, creating tides that are 20 per cent higher than usual.

Fundy tides are also responsible for the natural air conditioning which southern New Brunswick enjoys, both for visitors and residents. The chill water of the ocean is pushed up the bay to meet the warm air inland, and results in cooling of temperatures. This action is also responsible for the famous Fundy fogs.

The Bay of Fundy is at least a temporary home to a wide range of birds, fish and marine animals. It is a marvel to behold for visitors to New Brunswick.

Exercise 79
Tidal heights at secondary places

Based on an original exercise by Geoff Waterhouse, Immanuel College, Sunshine Coast.

Example

Tide heights and times are only given on tide tables for major places along the coast (also called *standard ports*).

For other secondary places, or *non-standard ports*, the tide heights and times can be calculated.

Consider, Figure 79.1 (Parts A, B and C) which shows you how to calculate the tide times and heights on 17 October for Inskip Point, a non-standard port some distance from Bundaberg, a standard port in Queensland. Using your tide book, and the example given in Figure 79.1, calculate the tide times and heights for a non-standard port in your area.

1. Draw up a table similar to that shown in Figure 79.1. From your local tide table, copy down the information for the standard port nearest to the port whose tide times and heights you wish to calculate.
2. Select a non-standard port from your tide tables.
    a. Record the date and place in part B of your table.
    b. Look up the tidal planes for non-standard places table in the tide book and find the port you are working with. (For Inskip Point, see Figure 79.2).
    c. Copy the standard port times from part A.
    d. Now find the average time differences from the tidal plane table and write them in under the standard port times.
    e. Subtract or add to find the times of the tides at your non-standard port.
3. Now copy the standard port heights from part A.
    a. Locate the ratio from column 9 of the tidal planes table for your non-standard port.
    b. Write this in your table and multiply each of the standard port values by this ratio.
    c. Find the adjustment constant from the table under column 10 and write it in your table.
    d. Add or subtract to calculate your non-standard port heights.
4. Finally to calculate the height of tide at a given time, write the *date, place and time* you want in the spaces provided.
    a. Find the nearest high water time and copy to the first table.
    b. Now copy its corresponding high water into the table to the right. Copy also the nearest low water and subtract to find the *range*.
    c. Write in the time you want and subtract to find the approximate hourly interval.
    d. In the last box in the table write the height of the nearest low water.
    e. In Figure 79.3, find the range which most suits your area. Find the hourly interval on the X axis and read up till you find the range you calculated. You may have to approximate the graph.
    f. Now go to the Y axis and read the height to be added to low water.
    g. Add the two and that is your tide height at the time you want.

A. Times of high and low water at standard port

Place: Bundaberg

Date: 17/10/93

Standard port times and heights

Time	Height
0336	-0.14
1002	2.85
1621	0.13
2213	2.15

B. Times of high and low water at non-standard port

Place ____________

Date ____________

Times

	Low		High		Low		High	
	Hours	mins	Hours	mins	Hours	mins	Hours	mins
Standard port times	03	36	10	02	16	21	22	13
Average time difference + − (From Table 2 Columns 2&1)	−	35	+	10	−	35	+	10
Secondary port times	03	01	10	12	15	46	22	23

Heights (in metres)

	Low	High	Low	High
Standard port heights from A	-0.14	2.85	0.13	2.15
Ratio (From Table 2 Column 9) .8 x	-0.11	2.28	0.10	1.72
Adjustment + − (From Table 2 Column 10)	+0.47	+0.47	+0.47	+0.47
Secondary port heights	0.36	2.75	0.57	2.19

C. Height of the tide at a given time 0830

	Hours	minutes
Nearest H.W.	10	12
Time required	8	30
Approx. hourly Interval	1	30

	Metres
Nearest high water	2.75
Nearest low water	0.36
RANGE	2.39

PLACE Inskip Point

DATE 17/10/93

TIME 0830

Height of low water	0.36
Height from Graph 1 or 2	2.20
HEIGHT AT 0830	2.56

Figure 79.1 Sample worksheet (Courtesy Geoff Waterhouse and Peter Hamlyn)

Questions

1. Select any three places closest to your school that are non-standard ports and calculate the tide heights for 8.00 am at the boat ramp.
2. Write a description of the method you used.

Tidal Planes for Secondary Places
Height Above Local Low Water Datum

TABLE 2

PLACE	Average Time Difference High Water	Average Time Difference Low Water	MHWS	MHWN	MLWN	MLWS	AHD	ML	Ratio	Constant	HAT	LAT
	1	2	3	4	5	6	7	8	9	10	11	12
	H.M	H.M.	m	m	m	m	m	m				
Brisbane Bar	Standard Port		2.2	1.8	0.7	0.3	1.24	1.25			2.7	0.0
Bundaberg												
Burnett Heads	Standard Port		2.5	1.9	0.8	0.2	1.35	1.34			3.2	−0.3
Boonlye Point	+1 09	+0 57	2.9	2.4	1.1	0.5		1.74	1.09	+0.27	3.8	0.1
Burrum River	−0 05	−0 05	2.6	2.0	0.6	0.0		1.28	1.18	−0.31		
Elbow Point	+0 35	+0 05	1.9	1.5	0.7	0.3		1.10	0.69	+0.17	2.4	0.1
Inskip Point	+0 10	−0 35	2.4	2.0	1.1	0.7		[illegible]	0.80	+0.47		
Maryborough	+1 57	+3 00	3.0	2.4	0.4	0.0	1.29	1.44				

Figure 79.2. Plane table showing tidal predictions for non-standard ports (Illustration courtesy Queensland Transport)

GRAPH 1. **Standard Tidal Curves — Tide Ranges up to 3m**

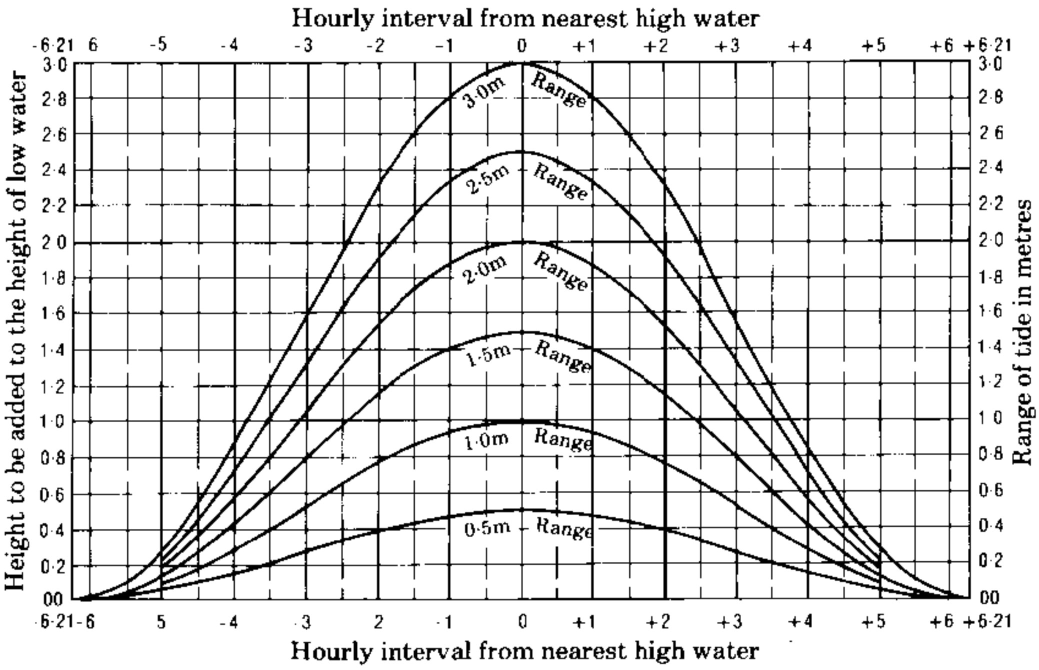


Figure 79.3. Tidal planes for non-standard ports (Illustration courtesy Queensland Transport)

Exercise 80
Cloud types

Clouds come in a variety of shapes and sizes and can allow us to predict weather.

Method

1. Use the textbook index to find the different cloud types.
2. Complete the table below as outlined.
3. Use a camera or make drawings in your notebook to draw any five cloud types and shapes.

Materials and equipment (per group)

Equipment required

- copy of worksheet below
- camera (optional)

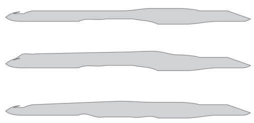
Cloud type	Symbol	Description	Effect on the weather
Cumulonimbus		High, vertical extent; fluffy clouds with thunderheads	Storms, hail
			Varies depending on other clouds they combine with
			
			

Figure 80.1 Students may make one copy of this page to help them with their assignment. Teachers do not have permission to make class sets of this page for inclusion in a booklet.

Exercise 81
Synoptic chart interpretations

Questions

Look at the synoptic chart below and answer the following questions.

1. Describe the location of the high and low pressure systems as shown.
2. Determine the highest and lowest air pressure labelled.
3. What is the air pressure at the following places?
   - Hobart
   - Darwin
   - Brisbane
   - Townsville
   - Alice Springs
   - Perth
4. Which areas of Australia received rain in the previous 24 hours?
5. How many fronts are shown on the weather map?
6. In which directions will the fronts move?
7. Determine the wind direction at the following places:
   - Hobart
   - Darwin
   - Brisbane
   - Townsville
   - Alice Springs
   - Perth
8. Which capital would expect a strong wind warning in the next 24 hours?
9. Write a paragraph explaining weather conditions in Perth and expected weather conditions in the next 2 – 3 days.
10. Describe the sea conditions for Port Hedland.
11. Imagine you took a flight from New Zealand to Perth on 25 April. Describe the weather conditions and cloud patterns observed on the flight. Suggest the text of the flight report on flight conditions the pilot may give.

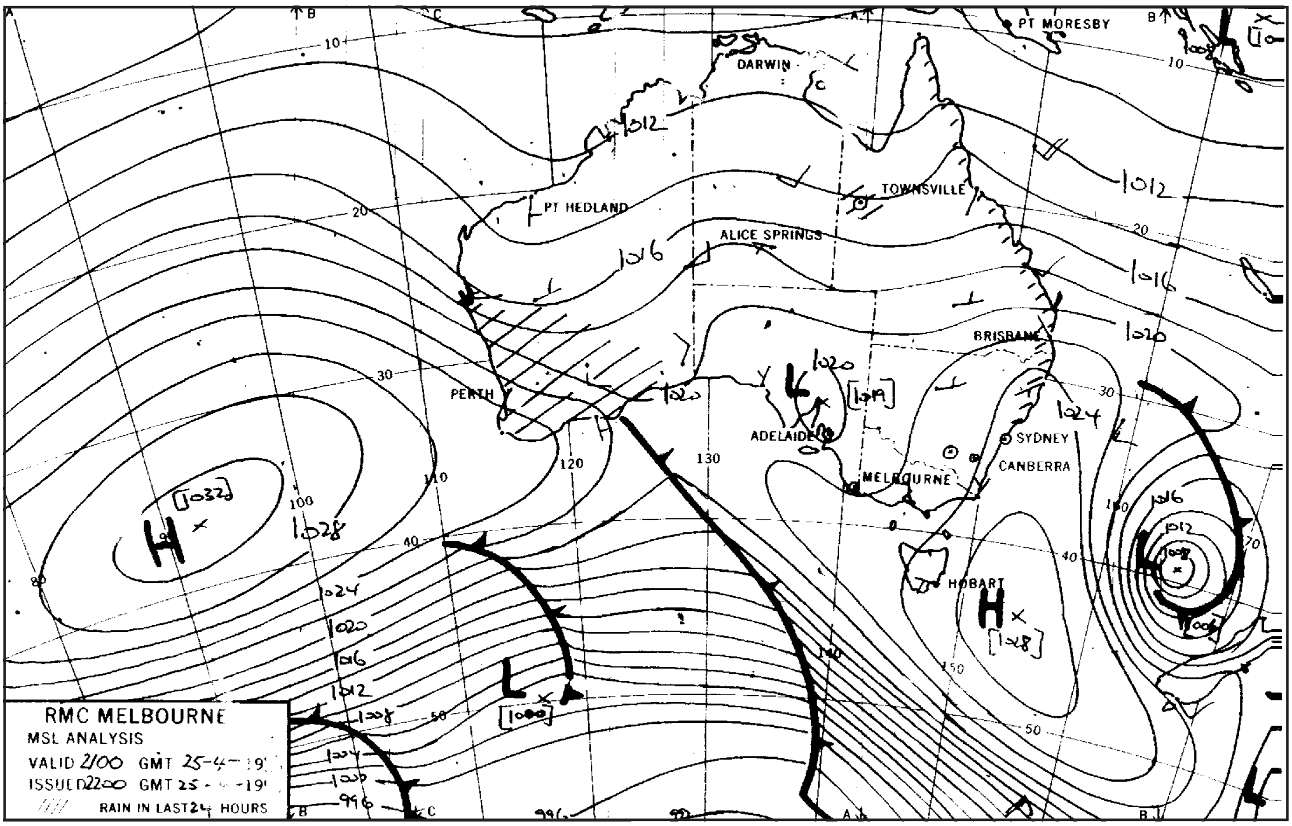


Figure 81.1 Weather map for 25 April (Courtesy Bureau of Meteorology)

Exercise 82
Weather
RECORD

Based on an idea by Geoff Jensen, Innisfail State High School and David Olreichs, Queensland Transport.

Research assignment

You are to prepare a profile of the week's weather .

1. a. Collect a series of weather maps from the daily papers and arrange them in date order.

   b. Write a description of how the major features of the maps have affected us throughout the week.

2. Watch weather reports on TV from Sunday night through to Thursday night or listen to the radio forecast. Write a paragraph summarising the weather report.

3. Write a paragraph noting the actual weather conditions for the day.

4. Take at least one photograph of interesting or dominant cloud formations on each day and write a comment underneath the photo, identifying the cloud type and its relevance to the forecast and the conditions.

5. Each day will need to include written work on:
   - major features of the weather map
   - wind and sea conditions
   - cloud cover
   - precipitation

6. Find out how storm cells form and their effects on boating.

Materials and equipment (per group)

Equipment required

- copy of Figure 82.1
- camera (optional)
- daily newspapers
- Queensland Tide Tables — section on Storm Cells

WEATHER RECORD

Name ______________________ **Teacher** ______________________

Place ______________________ **Date** ______________ **Time** ______________

Date/ day	temperature		cloud cover and type	wind		humidity	rainfall
	min °C	max °C		direction	km/h	%	mm

Summary

Figure 82.1 Students may make one copy of this page to help them with their assignment.

Exercise 83
Your weather map

Questions

1. Figure 83.1 shows the atmospheric pressures measured at different locations around Australia. Attempt to connect points that have the same pressure. These lines are called isobars.
2. Compare your placement of the isobars on your map with that of other class members.
   a. Is there good reason to believe that your placement of the isobars is any better than other class members?
   b. Is there any additional information that may assist you make a better judgement?
3. Label the high and low pressure systems.
4. Where might a cold front be located?
5. Suggest the wind direction at:
   - Perth
   - Brisbane
   - Hobart
   - Sydney
   - Adelaide
   - Melbourne
6. Suggest the sea conditions at:
   - Brisbane
   - Sydney
   - Perth
   - Adelaide
   - Melbourne
   - Hobart
7. How accurate do you believe your weather map is? What other information might assist in making better judgements?

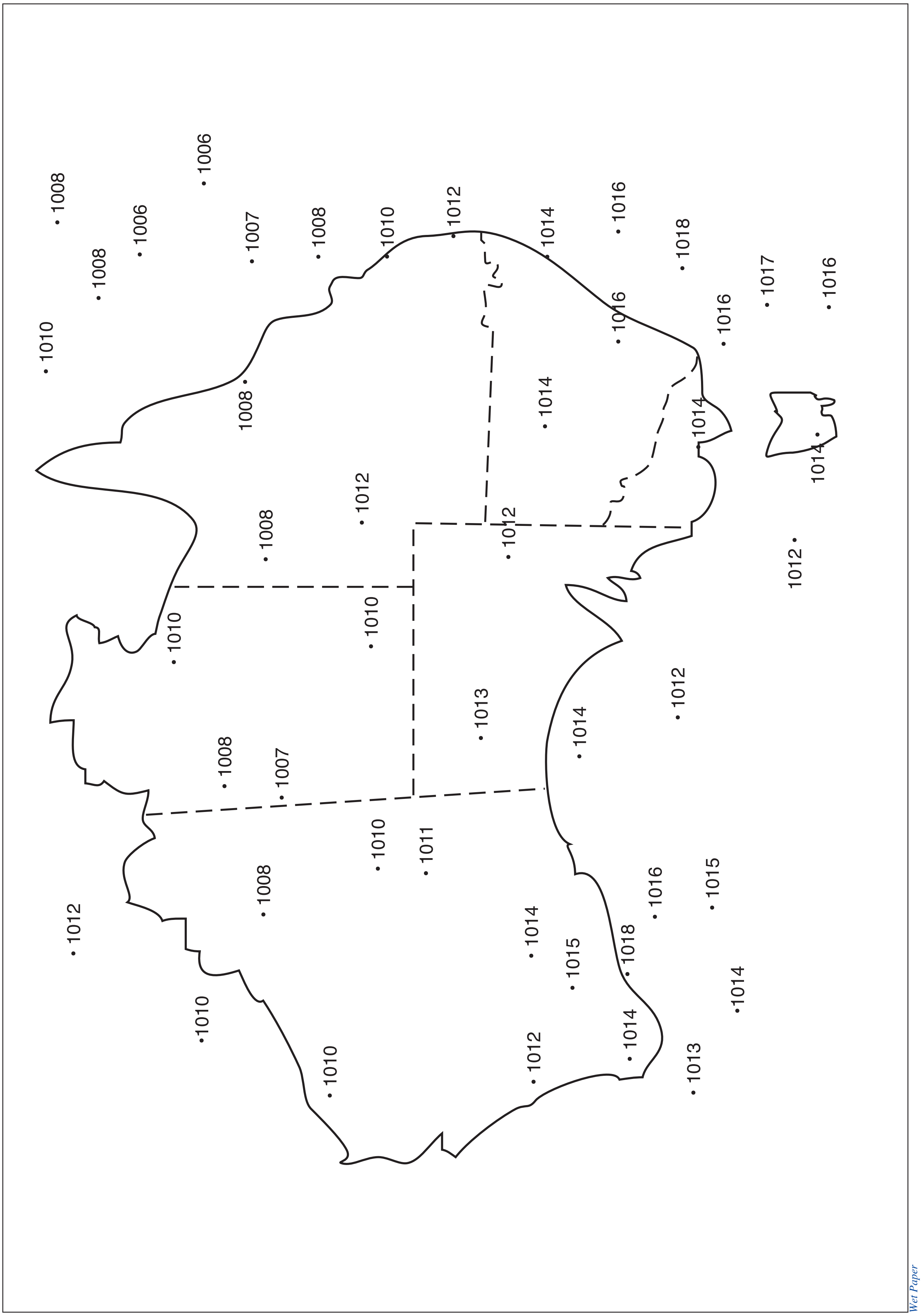


Figure 83.1 Students may make one copy of this page to help them with their assignment.

Exercise 84
Weather map

Based on an original exercise by Tim Ryan, Maryborough State High School.

Questions

Read the information box on weather satellites and answer the questions.

1. How have satellites with their unique vantage point far out in space contributed to developments in meteorology?
2. Discuss the two types of weather satellites.
3. When and where was the first satellite launched?
4. a. Geostationary meteorology satellites sent what type of data back to earth?

   b. At what speeds do satellites travel?
5. a. Suggest what the white patches on Figure 84.1 mean.

   b. Predict the type of meteorological disturbance associated with these white patches.
6. Predict the position of areas of high pressure and areas of low pressure over Australia.
7. Evaluate the information given and forecast the weather for Queensland in the next 24 hours.
8. Does this appear to be a winter or summer weather pattern? Explain your answer.
9. Predict the weather condition for Perth for the next 48 hours. How can you tell?
10. Attempt to draw a weather map from the information presented in the satellitephotograph in Figure 84.1. How confident are you of your predictions?
11. Draw a flow diagram showing how this information is finally passed onto the public.
12. Outline interest groups who would be very interested in receiving accurate and up to date weather information.

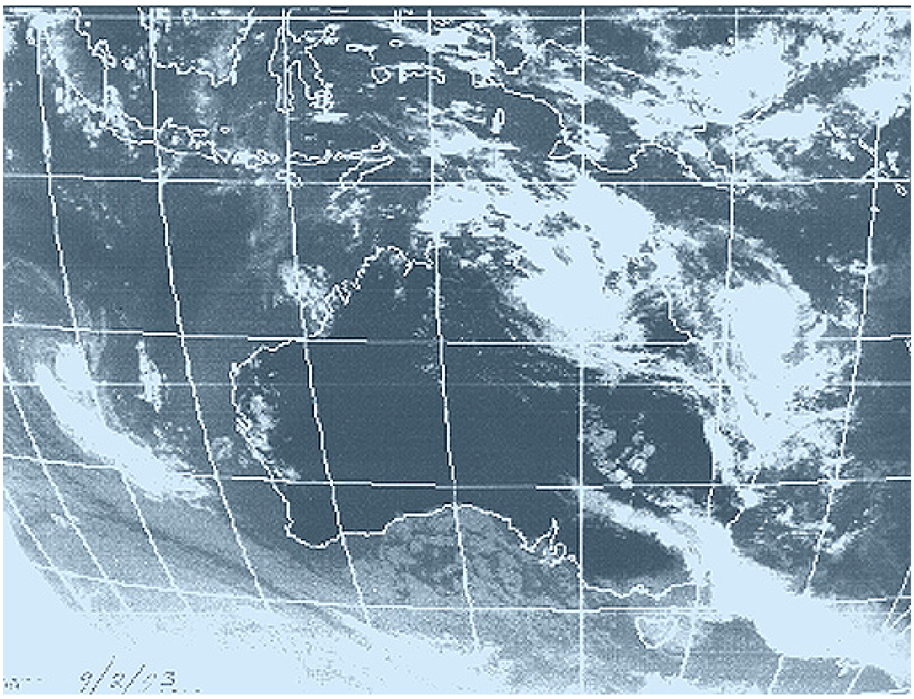


Figure 84.1 Satellite photograph for questions 5 and 10 (photograph courtesy Brisbane Weather Bureau)

Weather satellites

The most spectacular development, meteorologically, in the last twenty years is the use of weather observation satellites. Before the advent of satellites, meteorologists could only observe cloud patterns from the ground or from aircraft. There was no other way to follow the development of cyclones or cold fronts other than by these ground-based observations.

Weather satellites have changed all of this. From their unique vantage point far out in space, they can observe large sections of the earth and its oceans, areas for which conventional observations are very scarce. For this reason, satellite information is vital for Australia.

Weather satellites enable data to be obtained on clouds, temperature, humidity, wind speed and direction, sea surface temperature and ocean currents, atmospheric instability and rainfall.

In addition to routine weather forecasting, this information is used in locating and tracking cyclones, in assessing the likelihood of floods, severe storms and bushfires and in using meteorological balloons and automatic weather stations in remote areas.

There are two types of weather satellite. Polar orbiting satellites orbit the earth at altitudes of between 800 — 1500 km. Because of their relatively low altitudes, they survey only a narrow portion of the earth. A picture of the entire area of Australia requires four or five successive orbits each about 100 minutes apart. Geostationary satellites orbit above the equator at an altitude of 35 700 km. Their orbital speed is equal to the earth's rotation, so each satellite remains at a fixed point over the earth. Pictures from each satellite cover about one-third of the earth's surface.

The first satellite was launched in April 1960 by the United States National Aeronautical and Space Administration (NASA) and The United States Weather Bureau.

In 1977 Japan launched the Geo stationary Meteorologically Satellite 1 (GMS 1) above the equator at 140°E, directly north of Australia. GMS is one of five geostationary satellites (two from the United States, one from India and one from Europe) to give complete coverage of the earth as well as polar orbiting satellites from the United States and Russia.

GMS is 4 m high, weighs 303 kg and is powered by solar cells. Successive replacements to GMS-1 were sent into orbit in 1981 (GMS-2), 1984 (GMS-3) and 1989 (GMS-4).

GMS is ideally placed to observe weather in the Australian region. Signals from GMS are received directly using an antenna located on the roof of the Bureau of Meteorology head office in Melbourne. GMS transmits images every hour, day and night, and at half hour intervals four times a day.

Two kinds of images are produced. Visible images are obtainable only in daylight as they measure the amount of sunlight in the visible part of the spectrum reflected by clouds and the earth's surface. Infra-red images are obtainable day and night as they measure the infra-red (IR) radiation emitted by the earth and atmosphere.

From satellite observations, cloud images can be constructed and the temperature and moisture content of the atmosphere at different levels can be determined. This information allows meteorologists to monitor weather systems over the whole earth.

In addition to GMS, the Bureau of Meteorology also receives complimentary data from the United States National and Atmospheric (NOAA) satellites. These spacecraft are in relatively low-altitude polar orbits. They provide high resolution images over local areas for use in forecasting small-scale weather systems, and temperature and moisture data at various atmospheric levels for use in computer weather predictions models.

Figure 84.2 Weather satellite information (Courtesy Brisbane Weather Bureau)

Exercise 85
Records and extremes

Based on an original exercise by Tim Ryan, Maryborough State High School.

Questions

Use Figure 85.1 to answer these questions.

1. What was the lowest monthly rainfall recorded at the airport and in what month and year did this occur?
2. In which month was the highest monthly rainfall? How much rain fell?
3. Which month has the least difference between the highest rainfall and lowest rainfall?
4. Which month has the largest temperature range?
5. Graph the maximum and minimum temperatures for the 12-month period.
6. What is the maximum wind gust on the dates:
   a. 18 January 1985
   b. 16 December 1977
   c. 18 May 1955
7. What was the maximum wind speed during the period recorded? Give the month and year.
8. What was the maximum gust? Give the month and year.
9. Is there any evidence from this particular table to support the existence of the Greenhouse Effect? Explain your answer.
10. The city in which this data were recorded may have suffered floods in which years?

MONTH	HIGHEST MAX	LOWEST MIN	HIGHEST MONTHLY RAIN	LOWEST MONTHLY RAIN	AVERAGE RAIN	HIGHEST DAILY RAIN	MAX WIND GUST(DINES)
JANUARY	38.3 03/1985	16.1 27/1965	803.6 1974	33.4 1966	163.6	307.4 26/1974	202/100kt 18/1985
FEBRUARY	35.8 02/1958	15.8 23/1972	543.5 1954	24.1 1963	179.3	210.3 12/1972	135/75kt 28/1970
MARCH	38.3 13/1965	13.4 31/1970	413.6 1974	05.6 1980	144.4	224.5 28/1955	157/57kt 06/1985
APRIL	33.6 19/1973	07.6 29/1990	501.6 1989	03.0 1991	94.7	169.6 26/1989	157/46kt 08/1984
MAY	30.1 13/1953	04.7 20/1970	381.6 1980	02.6 1975	87.1	127.0 09/1980	247/53kt 18/1955
JUNE	28.3 01/1950	00.6 27/1971	701.1 1967	01.1 1968	74.8	294.9 12/1967	247/45kt 29/1956
JULY	29.6 29/1958	00.9 10/1972	399.0 1973	00.6 1951	56.0	217.7 20/1965	135/57kt 07/1973
AUGUST	28.6 27/1975	02.6 24/1990	126.3 1969	00.0 1991	43.3	67.3 26/1965	270/46kt 25/1964
SEPTEMBER	33.8 14/1974	03.5 14/1992	89.6 1978	00.2 1980	32.4	42.7 01/1966	360/54kt 11/1985
OCTOBER	39.1 11/1957	07.3 17/1976	405.6 1972	11.6 1988	98.4	132.1 25/1949	270/52kt 31/1963
NOVEMBER	39.4 19/1968	09.1 09/1971	408.4 1981	01.3 1951	95.3	166.9 08/1966	157/67kt 22/1980
DECEMBER	39.6 07/1981	12.1 05/1955	437.5 1970	29.6 1957	125.8	152.7 22/1956	090/67kt 16/1977

Fig 85.1 Airport climate records/extremes (Data courtesy Brisbane Airport)

Exercise 86

Wind speed and direction

Based on an original exercise by Tim Ryan, Maryborough State High School.

Questions

Use Figure 86.1 and the following note on the conversion from knots to nautical miles to answer the following questions:

1. Note 1 knot = 1 N. mile per hr; 1 N. mile = 1.852 km
   a. What was the maximum wind speed measured? (Answer in knots and km/hr.)
   b. At what time did it occur?
2. What was the direction of the wind in the hours leading up to the storm? In the hours following the storm?
3. Write a paragraph to describe the pattern of wind (speed and direction) between 4 p.m. and 8 p.m.
4. How would you describe the winds between midnight and 3 a.m?
5. What meteorological feature may have caused these winds?

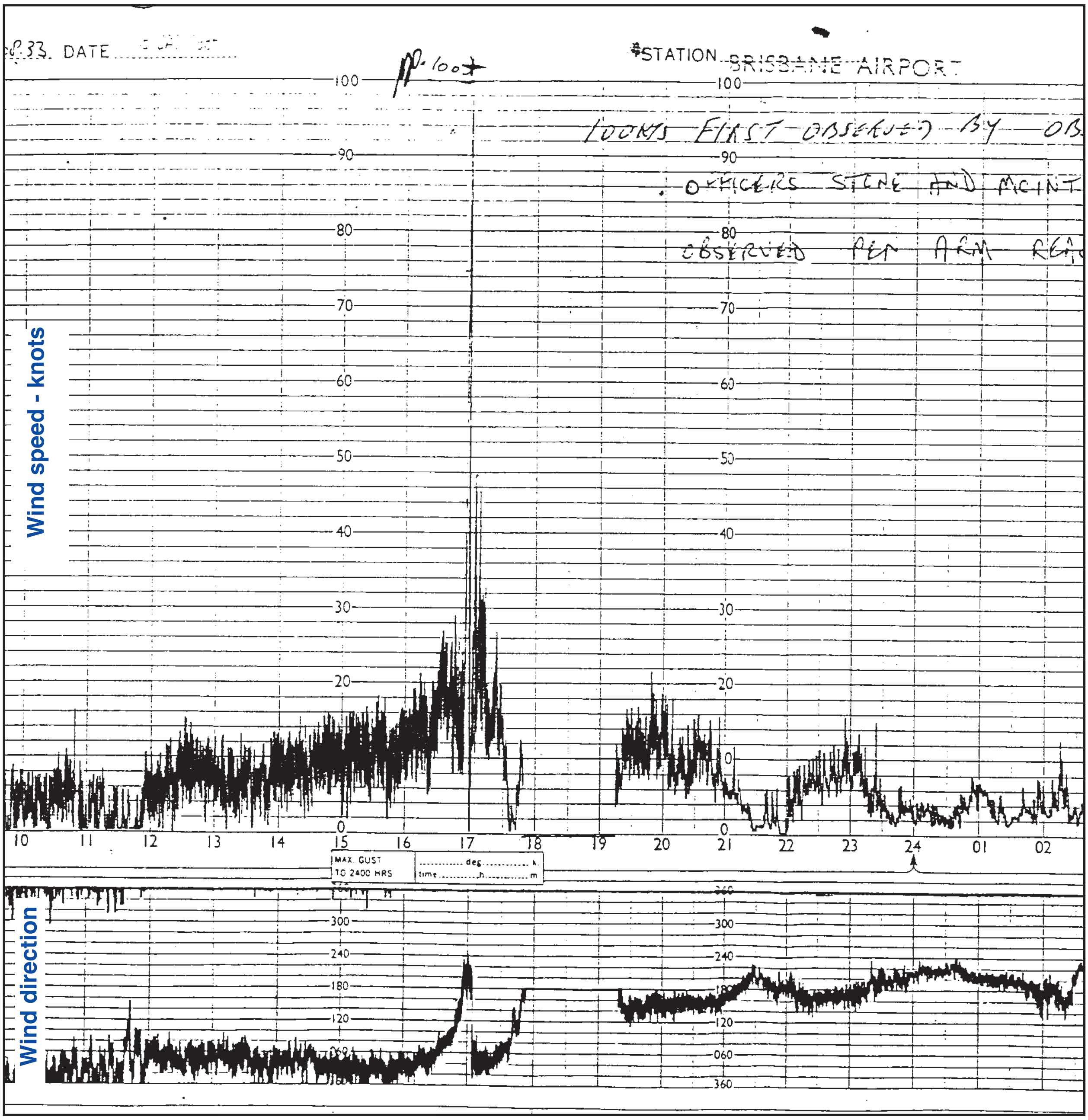


Fig 86.1 Airport storm data (Courtesy Brisbane Airport)

Exercise 87
Rainfall

Based on an original exercise by Tim Ryan, Maryborough State High School.

Questions

Read the box on the pluviograph, look at Figures 87.1 and 87.2 and answer the following questions.

1. Over what period of time is the first graph taken?
2. What is the connections between the three graphs?
3. What are the graphs indicating?
4. Is there any difference between the readings of a rain gauge and a pluviograph? Explain the difference.
5. How many millimetres does the pluviograph actually hold?
6. How much rain fell between 4 p.m. and 6 p.m. on 30 September?
7. How much rain fell between 7 p.m. and 10 p.m. on 3 October? Describe the time and amount of rain that fell on 3 October.
8. How much rain fell between 1 p.m. and midnight on 30 September?
9. In which hour was the greatest rainfall on the first two graphs?
10. Describe the weather during 30 September to 1 October and the 3 – 4 October.
11. How much rain fell between 3 p.m. and 4 p.m. on the 6 October?
12. Evaluate the advantages of a pluviograph over a rain gauge.

How a pluviograph works

1. A pluviograph, as shown in Figure 87.1, automatically records the amount of rain. The rainwater falls through the funnel A into chamber B.
2. Contained in this chamber is a hollow metal float C, to the upper axis of which is attached the pen arm D.
3. As rainfall enters the chamber the float rises and carries the pen arm with it.
4. The chamber is balanced on a knife edge E and when the float reaches a certain height, it releases the trip F and the weight of the water through the siphon G.
5. When the chamber is empty, the counter weight H is sufficient to restore the chamber to its original position.

   During the siphoning period, the pen is automatically lifted from the chart by the rod J (sometimes a trace is left on the chart).

   The pluviograph measures rainfall intensity and amount of rain over time intervals.

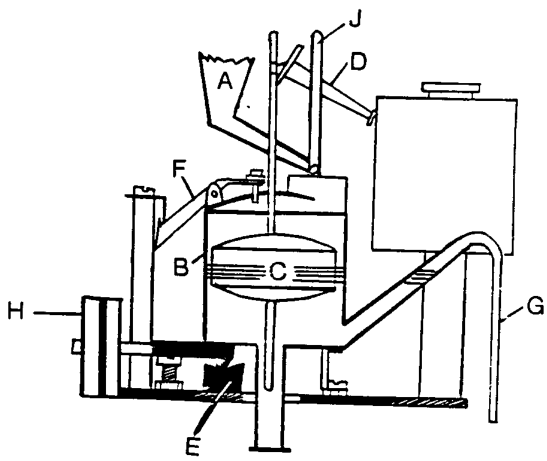
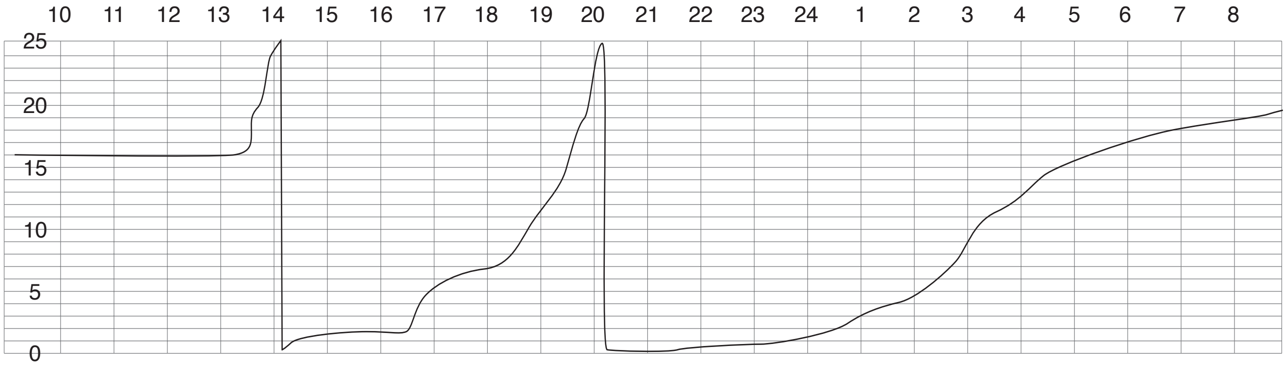


Figure 87.1 Pluviograph (Illustration courtesy Brisbane Airport)

PLUVIOGRAPH DINES

Drum revolves once 24 hours exactly

Time on: 0842 Date: 30 Sept 1994 129mm diameter collector Time off: 0844 Date: 1 Oct 1994 Station: Conneltown



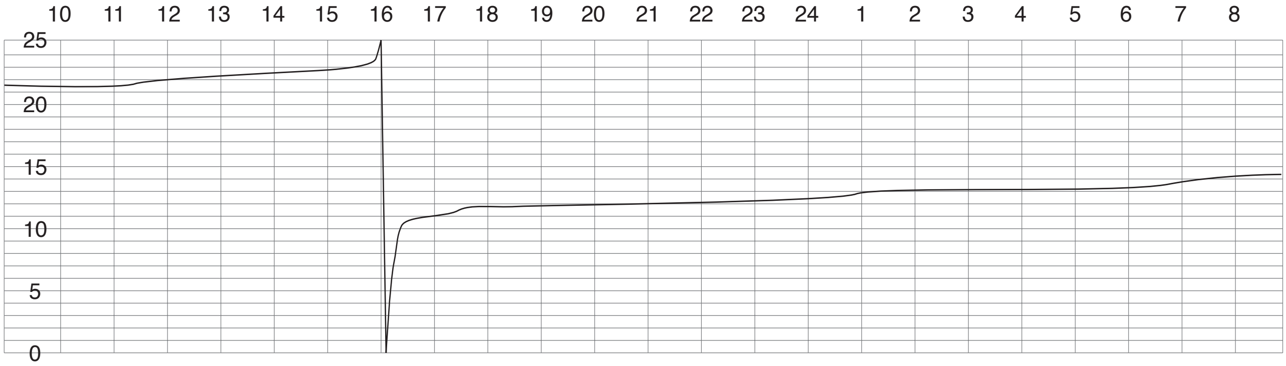
Total by pluviograph 53.8 Total by rain guage 53.8 mm measured on 1 Oct 1994 (date)

Scale: 25 mm of rain = 50mm 1 hour = 12.20 mm Clock-drum diameter 93mm For instructions see other side

PLUVIOGRAPH DINES

Drum revolves once 24 hours exactly

Time on: 0843 Date: 3 Oct 1994 129mm diameter collector Time off: 0847 Date: 4 Oct 1994 Station: Conneltown



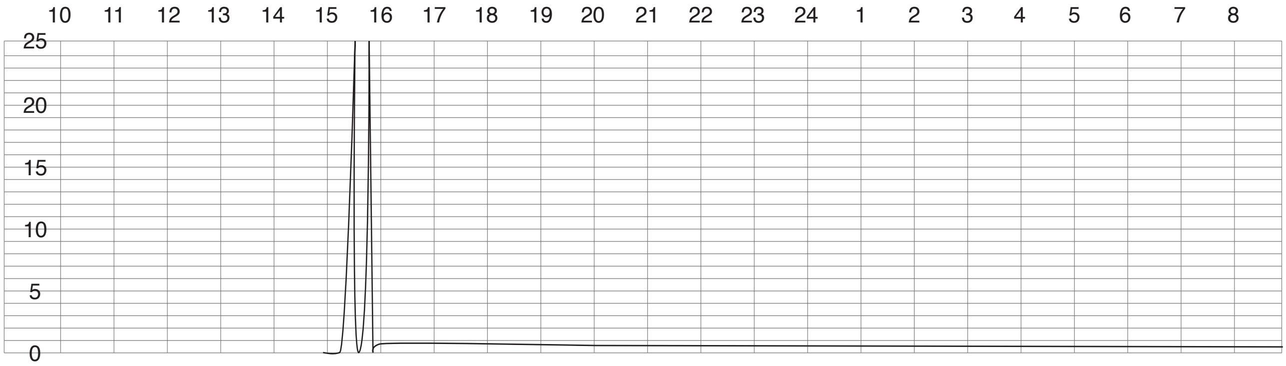
Total by pluviograph 17.4 Total by rain guage 17.0 mm measured on 4 Oct 1994 (date)

Scale: 25 mm of rain = 50mm 1 hour = 12.20 mm Clock-drum diameter 93mm For instructions see other side

PLUVIOGRAPH DINES

Drum revolves once 24 hours exactly

Time on: 0850 Date: 6 Oct 1994 129mm diameter collector Time off: 0843 Date: 7 Oct 1994 Station: Conneltown



Total by pluviograph 50.8 Total by rain guage 51.2 mm measured on 7 Oct 1994 (date)

Scale: 25 mm of rain = 50mm 1 hour = 12.20 mm Clock-drum diameter 93mm For instructions see other side

Figure 87.2 Pluviograph data (Adapted from data supplied by Brisbane Airport)

Exercise 88
Revision test

Time 30 minutes

35 Marks

Knowledge and understanding

1. In Australia, weather systems generally move:
   a. from west to east.
   b. towards the equator.
   c. in a cyclic motion between the seasons.
   d. from east to west.
2. Clouds form when:
   a. water vapour in the air condenses and forms small droplets.
   b. cold air rises as it meets a warm front.
   c. the cloud seeding temperature is reached.
   d. the relative humidity reaches the dew point of 65 per cent.
3. As a front approaches and passes over, you may notice all but one of following:
   a. a drop in temperature.
   b. a change in wind direction.
   c. an increase in relative humidity.
   d. clear skies.
4. An aneroid barometer is used to measure:
   a. humidity.
   b. wind direction.
   c. air pressure.
   d. relative humidity.
5. Lines which join places of the same atmospheric pressure are:
   a. isobars.
   b. hectopascals.
   c. contours.
   d. cospascals.
6. Which of the following statements is true ?
   a. Air moves from areas of low pressure to areas of high pressure.
   b. Winds blow in a clockwise direction out of lows.
   c. Sea breezes usually occur in the afternoon.
   d. The density of air is constant.
7. Wind velocities are most likely high:
   a. when school excursions to the beach are planned.
   b. when fog is present in an area.
   c. when the isobars are close together.
   d. when the relative humidity of the air is high.
8. To say the relative humidity on a certain day is 80 per cent means:
   a. the water vapour makes up 80 per cent of the air.
   b. the air holds 80 per cent of the total amount of water vapour of which it is capable at that temperature.
   c. if the air is cooled 20 per cent of the air will reach its dew point.
   d. a wet and dry bulb thermometer will have a temperature reading with a 20 per cent difference.
9. The instrument that measures and records both the speed of the wind and the direction from which it is coming is called:
   a. an anemograph.
   b. an anemometer.
   c. a wind vane.
   d. a calibrated anemometer.
10. Tide heights above the predicted levels are often associated with a combination of a low pressure system and cyclones. These two effects pile seawater up against a sloping coastal shelf causing:
    a. king tides.
    b. tidal surges.
    c. storm surges.
    d. atmospheric tides.

11. It is often useful to be able to recognise the more common types of clouds as it helps in weather forecasting. Wispy high white clouds showing fine weather are:
    a. cumulus.
    b. cirrus.
    c. stratus.
    d. alto stratus.
12. When the earth, sun and moon are in the position as shown in Figure 88.1, which of these statements is true?
    a. A spring tide occurs, the moon is full.
    b. A neap tide occurs, the moon is full.
    c. A spring tide occurs, the moon is in the first quarter.
    d. A neap tide occurs, the moon is in the first quarter.
13. A spring tide occurs every:
    a. 2 months.
    b. 2 weeks.
    c. 2 days.
    d. 2 years.
14. This question refers to the tide book.

    Use your local tide book to reconstruct the question. You need to refer to a specific month of tides

    Sample question only from Queensland Tide Tables Bundaberg August 1989.

    Use the following tidal information to find:
    a. the tide times and heights for Burnett Heads on 1 June.
    b. the tide times for Elbow Point on 1 July.
15. Define these terms:
    a. flood tide.
    b. tidal stream.
    c. tidal bulge.
    d. dew point.
16. Draw and label a diagram of a cold front.

Information processing and reasoning

17. Imagine that you are the news reader on Channel 5.

    Tonight you are giving the weather report and it is the policy of the TV station to explain the weather map to the viewers before giving the weather forecast.

    Write out what you would say in explaining the weather map in Figure 88.2.

    (6 marks)

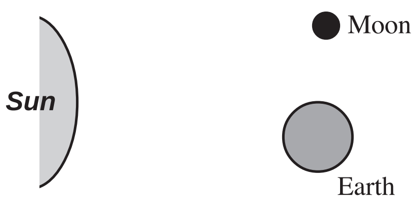


Figure 88.1 Sun, earth moon system

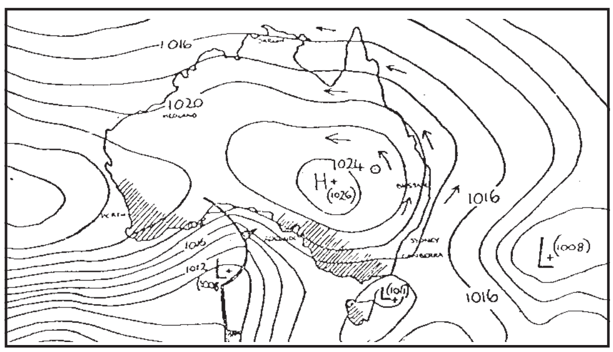
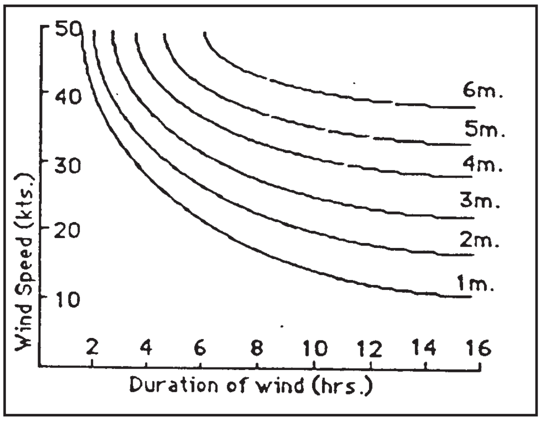


Figure 88.2 Chart for question 17

Use the graph below to answer Question 18



18. a. Find the wave height caused by a 30 knot wind blowing for 10 hours.

    b. Find the wave height caused by a 35 knot wind for a period of two hours.

    c. If waves are 3 m high and a 25 knot wind is blowing, calculate the fetch of the wave-forming wind.

(3 marks)

19. This question refers to the tide book. Use your local tide book to reconstruct the question.

    You need to refer to:

    - a specific month of tides
    - the table of tidal planes for secondary places.

    The standard tidal curves tide ranges up to 3 m.

    Sample question only from Queensland Tide Tables Bundaberg August 1989.

    A vessel wishes to enter the mouth of a creek at Tin Can Bay.

    The chart shows that the low water datum at the creek is 1 m.

    a. If the vessel draws 2 m, at what time on 2 August will the vessel be able to enter the creek ? Show all your working.

    b. What will be the tide height and times on this day? Use the information tables supplied.

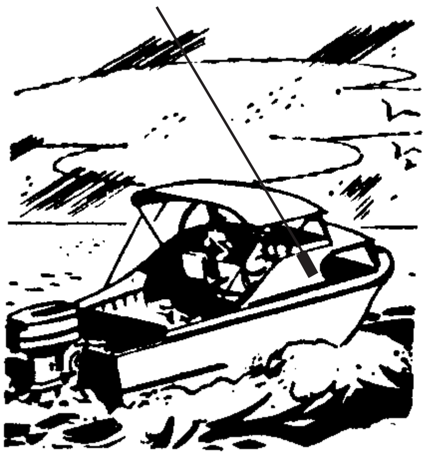
(6 marks)

Answers

1. a	8. b
2. a	9. a
3. d	10. c
4. c	11. b
5. a	12. d
6. c	13. a
7. c	14- see text

Section 7
Marine communications

Exercise 113
Make a reference card



Project

Often in the heat of the moment, you can forget simple things such as your call sign, a letter in the phonetic alphabet, the name of your boat, your home phone number etc.

1. Make up a small sticker like the one shown in Figure 113.1, writing down all information from the phonetic alphabet to use as a quick reference.
2. Redraw and colour in the radio silence circle as well to help remind you of the silence periods.
3. Research other information that may prove useful e.g. home, doctor, police, ambulance, hospital, rescue association phone numbers.

Local call sign for air sea rescue

____

Call sign of my boat

____

My boats name

____

Other details

____

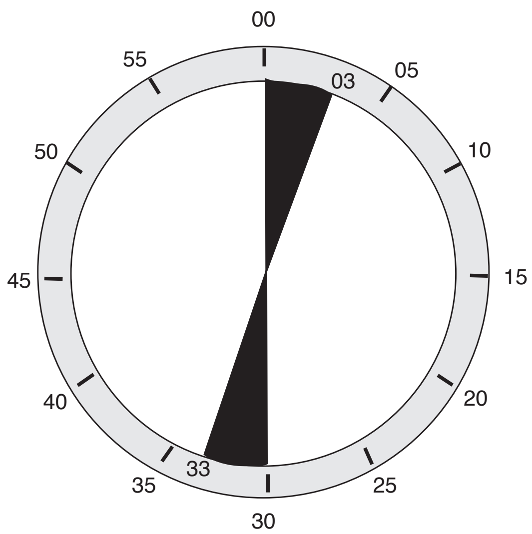
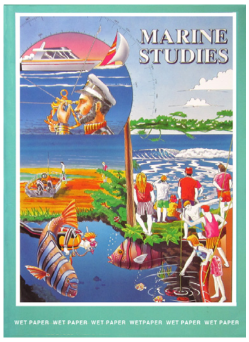


Figure 113.1 Sample quick reference sticker

Exercise 114 Parts of a radio



Note:

The textbook referred to in these worksheets is the 1992 Marine Studies Text

Questions

Use your textbook index to find the words *Transceiver controls* and use the pages to answer the following questions. You can use the information in the boxed section too.

1. Look at the illustration of the radio in Figure 114.2 and use your textbook to complete Figure 114.3 (Use the information in Figure 114.1 to assist)
2. What does the squelch control do?
3. The channel selector is adjusted. What will happen to the LED display?
4. What does the clarifier do?
5. The antenna or ATU has a special function. What is it?

Radio terminology

- **Channel selector.** This control is used to select the channel or frequency that you wish to transmit or receive on.
- **On/off and volume control.** Turns the equipment on or off and controls the volume of signals coming from the loudspeaker.
- **Squelch or mute control.** Stops the constant and annoying background hiss or roar from the receiver. The correct setting is so that the hiss or roar *just* cannot be heard. Further rotation of this control will progressively desensitise the receiver.
- **AM/SSB control.** Found on all MF/HF transceivers and some 27 MHz transceivers. It controls the mode of transmission and reception either AM (amplitude modulation) or SSB (single sideband).
- **RF gain.** Some transceivers have this control. It is used to vary the strength of the incoming signal, similar to the volume control. However it should normally be kept close to maximum and the volume control used to adjust signals to a comfortable level.
- **Noise limiter.** May be switched on to minimise the effect of loud static interference. Unfortunately, it will also have the effect of desensitising the receiver to *wanted* signals.
- **Power selector.** Controls the power of your transmitted signal. A good operator never uses more power than is needed to successfully communicate with the desired station. Additional power will only cause unnecessary interference and drain your battery faster.
- **Clarifier.** Found on MF/HF or 27 MHz equipment that uses the single sideband mode of transmission and reception. It varies the tuning of the incoming (received) signal. Should the incoming signal be difficult to understand then varying the clarifier control one way or the other should clarify that signal and make it intelligible. This control has no effect whatsoever on your transmitted signal.
- **Antenna or aerial tuning unit.** (ATU) This unit may be built into the transceiver or provided as an extra unit. It will be found only on MF/HF equipment. Its purpose is to adjust the electrical (not physical of course) length of the antenna so that the antenna is matched to the transceiver on each channel or frequency and maximum transfer of power can take place. The ATU may have one, two or three controls and will be provided with either a light or a meter. The control(s) should be adjusted to give maximum brightness of the light or in most cases, maximum deflection of the meter (Note: on some models, the controls should be adjusted for minimum deflection).
- **Alarm signal generating device (ASGD)** Found only on some MF/HF transceivers. Operation of this control will cause the radiotelephone alarm signal to be transmitted. A test position may also be provided which permits the function to be tested without transmission.
- **Press to talk control.** This spring-loaded control is located on the microphone. When pressed, it activates the transmitter section of the equipment permitting transmission of signals. When allowed to return to its normal position, the transmitter is deactivated and the equipment is restored to the receive mode.

Figure 114.1 Radio terminology

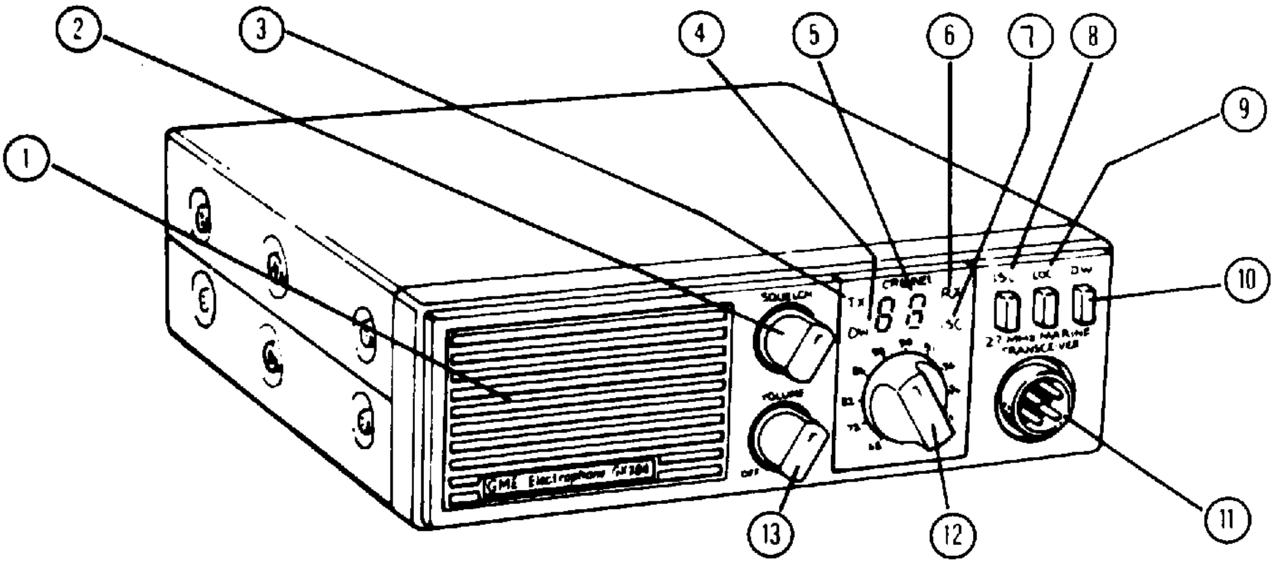


Figure 114.2 Parts of a marine radio (Illustration courtesy GME Electrophone)

Nº	Name	Function
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		

Figure 114.3 Table for Question 1. Students may make one copy of this page so that they can attach their answers before handing in for marking. Teachers do not have permission to make class sets of this page for inclusion in a booklet.

Exercise 115
Tuning a marine transceiver

by Mark Rickard, Benowa State High School

Method

1. Select appropriate power switch and turn receiver on.
2. Use the channel selection control to choose appropriate calling frequency (27.88/27.86, VHF 16/67)
2. Identify the squelch control and turn to maximum (Usually anticlockwise).

   Adjust volume control to audible level.

   Adjust the squelch until crackling noise is suppressed, ensuring that you fine tune this control to only just suppress interference so as to ensure maximum sensitivity.
3. Before transmitting, listen carefully for long enough to be satisfied that interference will not be caused to a station already using that channel.
4. Check the time to ensure a radio silence period is not operational.
5. You are now ready to transmit.

Safety

1. To protect your sea safety investment ensure that microphone and antenna connections are secured before proceeding
2. If constructing a mobile unit as shown in Figure 115.1, make sure the following are observed:
   a. Cover the tip of the antenna with a protective cap to prevent eye gouging.
   b. If marine batteries are used, make sure two people are involved in lifting to prevent back injuries.
   c. Make sure the unit does not fall over spilling the battery acid.
   d. Make sure connections are in good order and repair by checking each time the unit is used.

Figure 115.2 Tuning a marine radio

Exercise 116 Connecting a 27 MHz marine transceiver to a battery

by Mark Rickard and Kelvin Rodgers Benowa State High School

Questions

Study the safety instructions on this page, Figures 116.1 and Figures 116.2. Answer the questions below.

1. What are the three things to identify prior to connection?
2. The wiring harness has three leads. What are they and what are their respective colours?
3. What is a fuse?
4. What is an AMP rating on a fuse?
5. What does the term *spring loaded* mean and where may one come across it?
6. The connection plug to the antenna has two parts. What are they?
7. How should the plug be connected to the radio?
8. Why don't you connect the battery until the antennae is connected?
9. There is a rule for connecting 12 volt systems involving colours. What is it?
10. What terminal is the red harness lead connected to?
11. What terminal is the black earth connected?
12. When can you switch on the power?

Safety

Three major components must be considered when connecting a marine radio to a power source:

1. the wiring harness (Including earthing)
2. fuses
3. antennas

Wiring harness

1. Inspect the wiring supplied with the marine transceiver. Note the black lead, the earth lead and the red positive lead as shown in Figure 116.1.
2. The red positive lead must have a fuse holder connected close to the point where the positive lead will join the power source.
3. Do not connect the harness to battery at this stage.

Fuses

1. Manufactures will specify the AMP rating of the fuse to be used in conjunction with the positive lead. This fuse is designed to represent an electrical weak spot in the wiring harness so that should a fault develop in the power source, the fine wired fuse will blow to prevent damage to the circuitry within the transceiver.
2. Inspect the fuse holder and carefully dismantle it (usually spring loaded) to inspect the AMP rating of the fuse and to check its integrity. Return the fuse to the wiring harness when you are satisfied the fine wire is intact.
3. Do not connect harness to battery at this stage.

Antenna

1. Inspect the connection plug leading from the antenna. Note that the cable plug appears to have a central and outer core. This is referred to as co-axial cable.
2. Plugs are usually designed to be gently pushed into a receiving socket within the transceiver itself and then pulled into place by tightening a threaded sleeve over the cable and onto the socket. Seat the plug, but be careful not to cross thread the sleeve as you tighten the fitting.

Power source

(For negative earth systems)

1. Inspect antenna connection security. Do not turn power on without antenna connected.
2. Check security of wiring harness and fuse.
3. Attach red, positive harness lead to the positive (+) terminal of the 12-volt power source.
4. Attach the black earth lead to the negative (–).

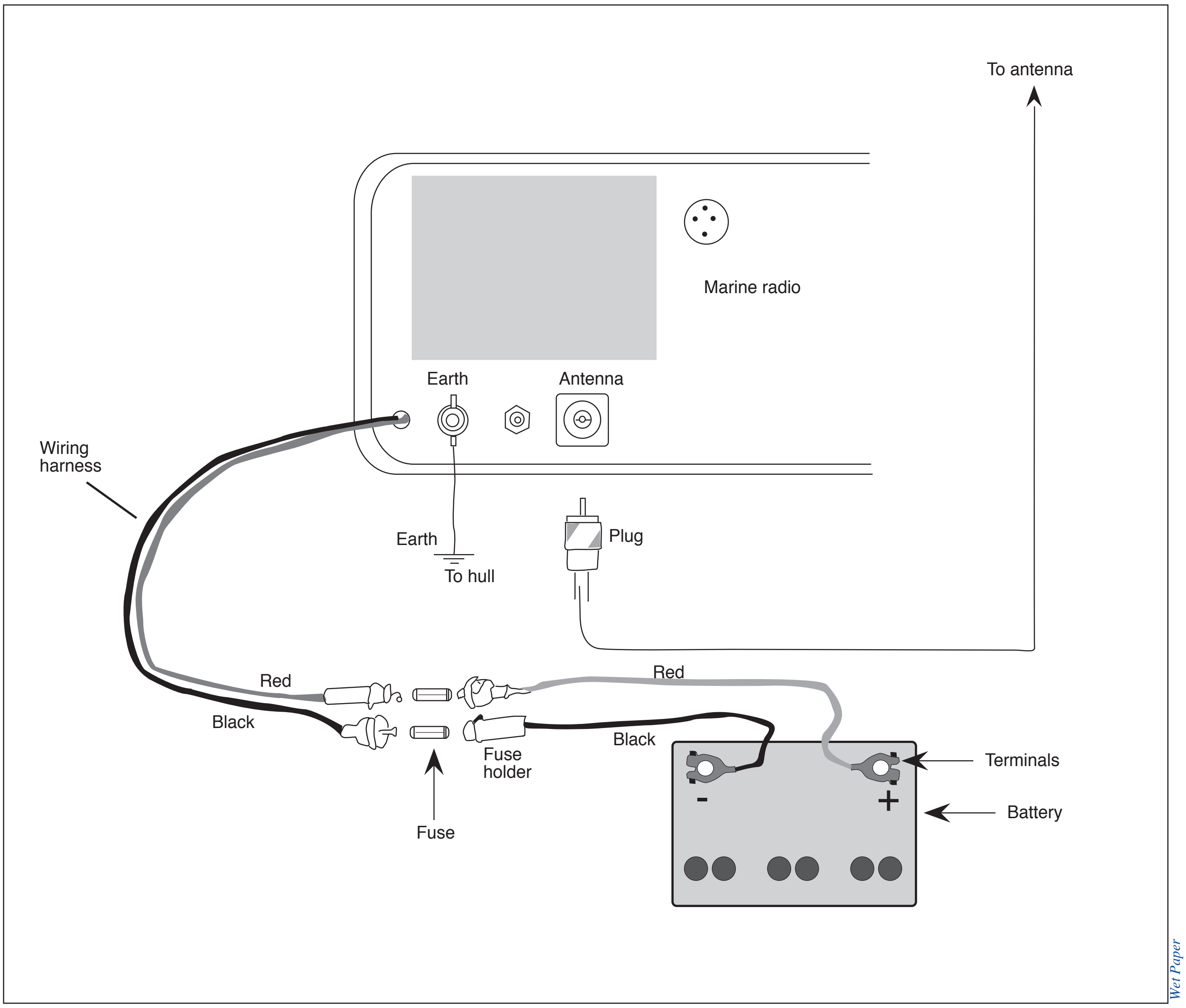


Figure 116.1 Connections of a 27 MHz to a battery

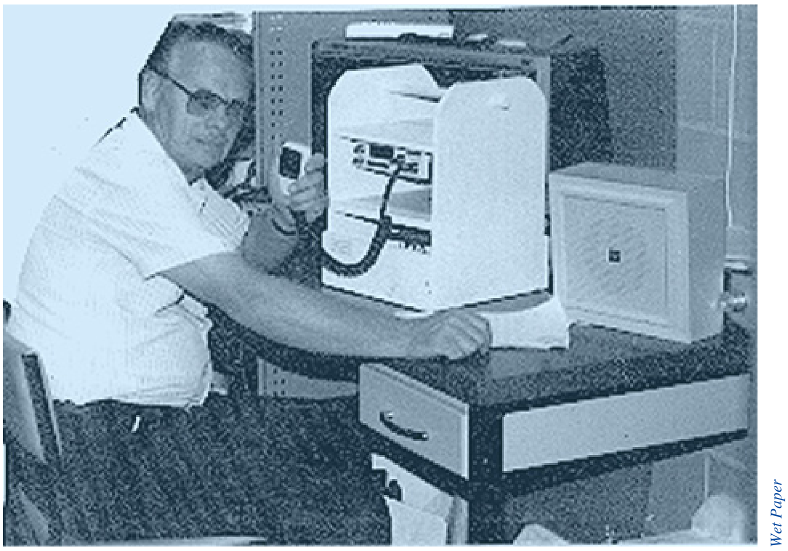


Figure 116.2 A simple school radio box with battery in lower section of cradle. The weight can be reduced by using lighter 12 V batteries. (Based on an original design by Kelvin Rodgers)

Exercise 117
Principles of transmission

Use the first section of the video, *Marine radio for the beginning skipper,* to help you answer the questions below.

Questions

Use your textbook index to find the section on *Principles of radio transmission* and complete the worksheet in Figure 117.1 as follows:

1. In Figure 117.1.a, label the diagram and distinguish between the roles of the transmitter and receiver.
2. Complete the table in Figure 117.1.b,
3. Show how a base station, transmitter, radio wave and receiver work in Figure 117.1.c.
4. In Figure 117.1.d, label the carrier wave, aerial, morse key, transmitter and power supply.
5. Use Figure 117.1.e to describe the difference between a carrier wave, amplitude modulated wave and frequency modulated wave.
6. What is Figure 117.1.f attempting to show?
7. Figure 117.1.g shows the limited distance of line of sight transmissions. How can the distance be increased?
8. A radio uses its microphone switch to transmit and receive. Label fully Figure 117.1h and then use it to describe why you cannot use a radio like a telephone.

Materials and equipment (per class)

Equipment required

- video player and monitor
- copy of *Marine Studies*
- copy of *Marine radio for the beginning skipper,* by Don Fee, Yeppoon News.

Available from:

Specialized Video

111 Paradise St.

Mackay 4740

Telephone 079 521991

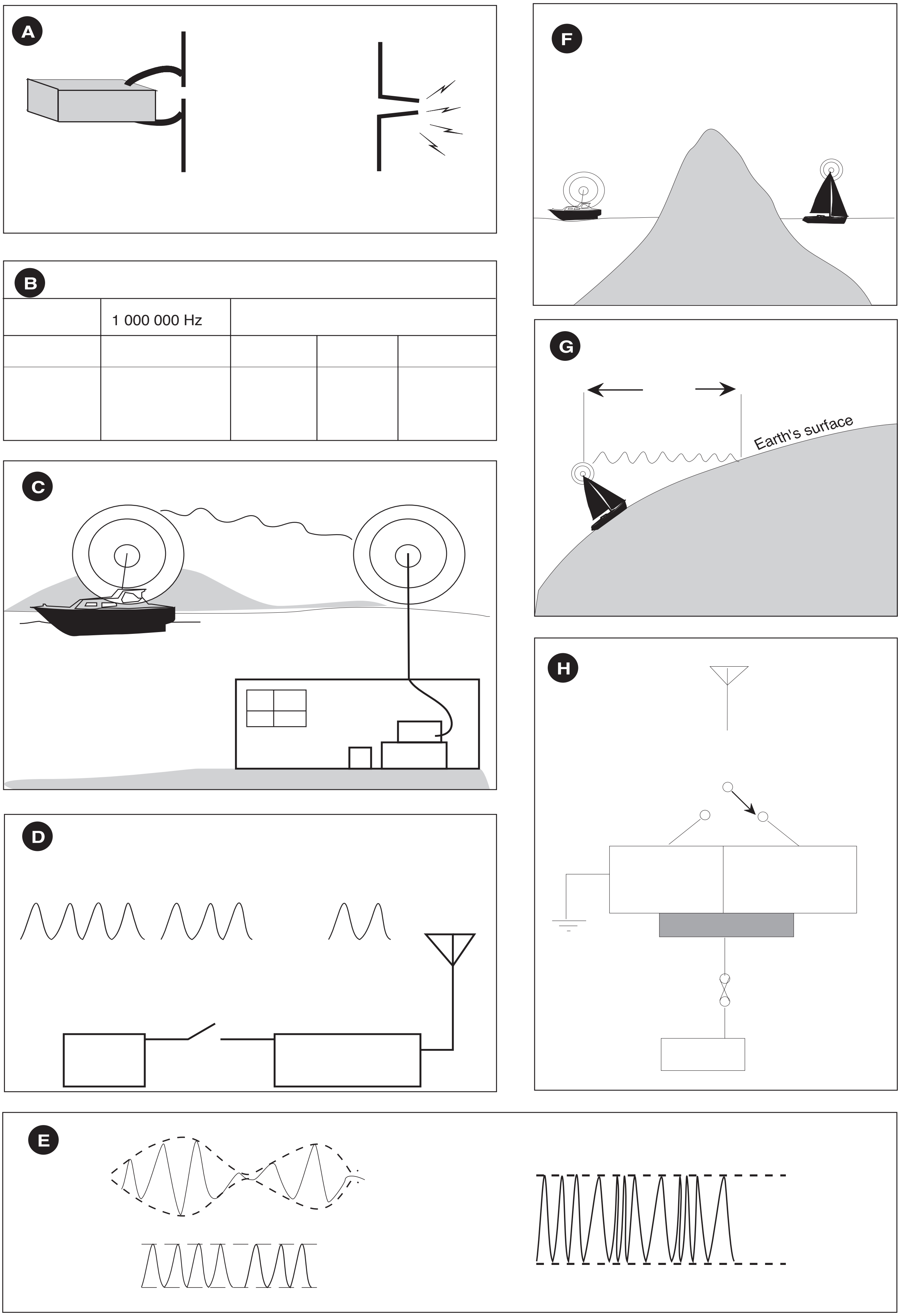


Figure 117.1 Worksheet for Exercise 117. Students may make one copy of this page so that they can attach their answers before handing in for marking.

Exercise 118
Sending a message

Method

A radio is different from a telephone in that you cannot hear the other person while you speak and there is no private line. To avoid chaos it is obvious that there must be some standard operating procedure.

In making a normal call to another ship or coast station the most important points to remember are:

- Say (the other vessel's name) three times.
- Say this is (your boat's name) three times.
- Say over
- When he/she answers, agree on a working frequency.
- After each transmission say over and then
- On completion of conversation say out

Questions

Watch the second part of the video *Marine radio for the beginning skipper* and answer the questions below.

1. Complete Figure 118.1 using the information supplied from the video.
2. Complete Figure 118.2 for sending a simple message between two boats.
   a. Why is it necessary to say the vessel's names three times?
   b. What is normal local radio procedure?

Materials and equipment (per class)

Equipment required

- copy of *Marine Studies*
- copy of *Marine radio for the beginning skipper*, by Don Fee, Yeppoon News.

Available from:

Specialized Video

111 Paradise St, Mackay 4740

Telephone 079 521991

3. What is the most commonly used radio frequency in your area for transmitting local traffic?
4. On what channel do operators listen in for messages?
5. To what channel do they normally transfer?
6. How would you say each of the following?

• 21	• 3.35 p.m.
• $131.34	• 10.25 p.m.
• 6.34	• 21 September
• 14	• 12 January
• 6 a.m.	• 16 March
• 12 noon	• 25 December

7. Complete Figure 118.3 for the following common situations:
   a. You are leaving port with three children and two adults on board. Your vessel is the *Tubby* and you are travelling 12 Nm to St. Bees Island. You intend getting there at 10.30 in the morning.

   Write out your message to the local rescue station in Figure 118.3.a.

   b. Your friend has birthday on 12 July and you wish to book a birthday call on a sea phone. Your local air sea rescue can transmit the message to the local radio OTC station.

   Write out your message to the local rescue station as shown in Figure 118.3.b.

   c. Today's date is 12 February. You have decided to camp overnight and want to relay a message back to your parents as well as log yourself in with the coast guard station. You intend returning in two days' time.

   Write out your message to the local rescue station in Figure 117.1.c.

13. You are fishing and decide to call your friend on the vessel *Reef Seeker*. You want to ask him where he is and what the fishing is like

Write out your message to your friend as shown in Figure 118.4.d.

Phrase	Meaning
	Yes
Negative	
	Estimated time of arrival
ETD	
	My transmission is ended and I expect a response from you
Out	
	Wait and listen till I re-transmit
Standing by	
	Message received and understood
	Let me know that you have received and understood the message
Go ahead	
I say again	
Say again	
That is correct	
	Check your information and advise me

Figure 118.1 Students may make one copy of this page so that they can attach their answers before handing in for marking.

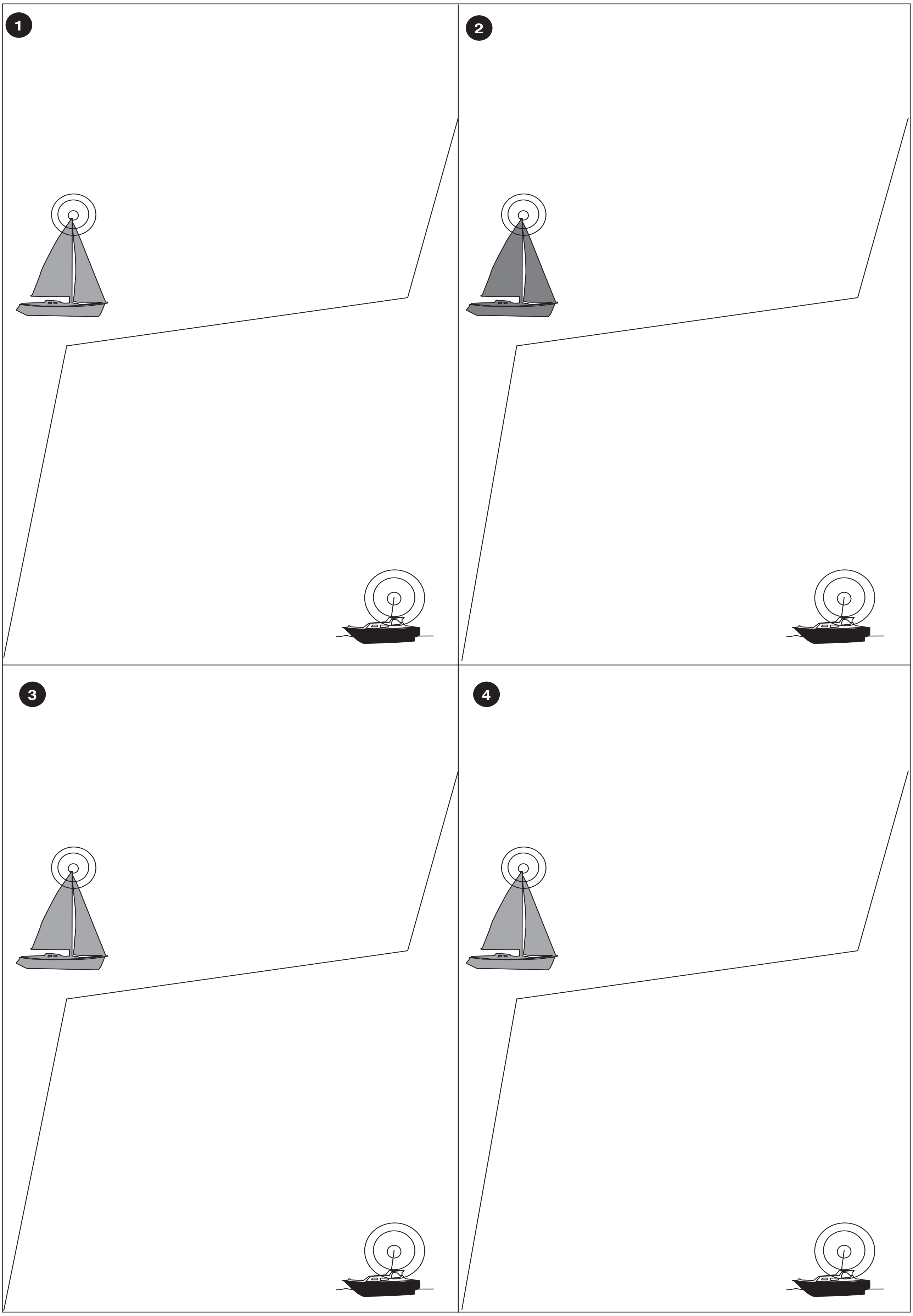


Figure 118.2 Normal radio operations worksheet. Students may make one copy of this page so that they can attach their answers before handing in for marking.

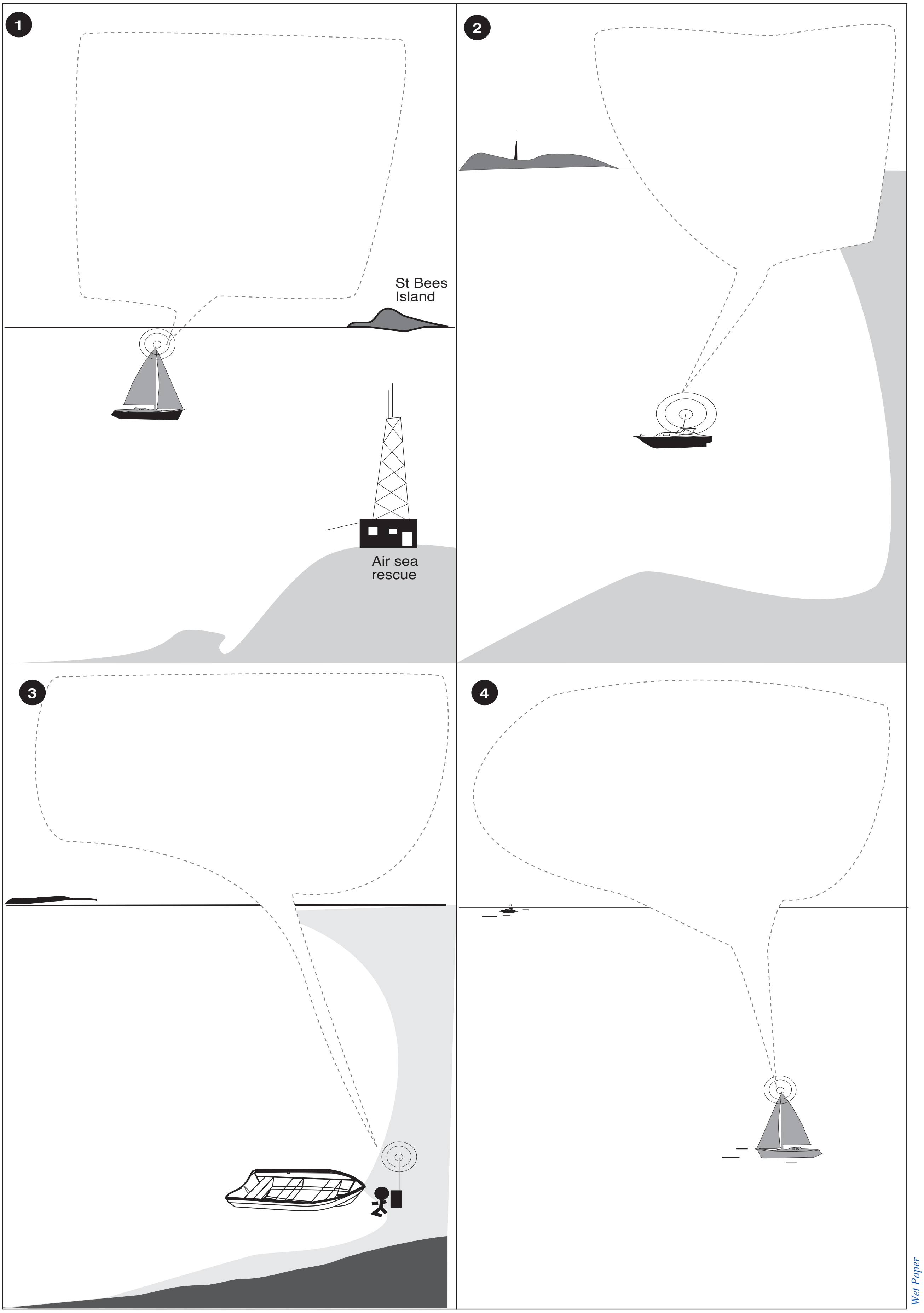


Figure 118.3 Common radio situations worksheet. Students may make one copy of this page so that they can attach their answers before handing in for marking.

Exercise 119
Securite

Method

This is a safety signal and is used when a station wants to pass information concerning safety such as navigational warnings or weather warnings and are identified by the word *Securite*.

The following sequence is how a Securite message is sent.

- SECURITE (three times)
- HELLO ALL STATIONS (three times)
- THIS IS (once)
- Indication of channel, SAFETY MESSAGE FOLLOWS — change channels
- Safety message, then out.

Now watch the Mackay Air Sea Rescue video segment on Securite and answer the questions below.

Questions

Complete the speech bubbles in Figure 119.1 for the following situation.

Sea Witch VL 1234 has just sighted a submerged log in the main shipping channel in Hypothetical Bay, 10 miles out from Lynch River.

1. Use the speech bubbles in Figure 119.1 to write out a securite signal.
2. Give two other examples of when you would send a Securite message.
3. Why are securite messages important?
4. Complete the sentence:

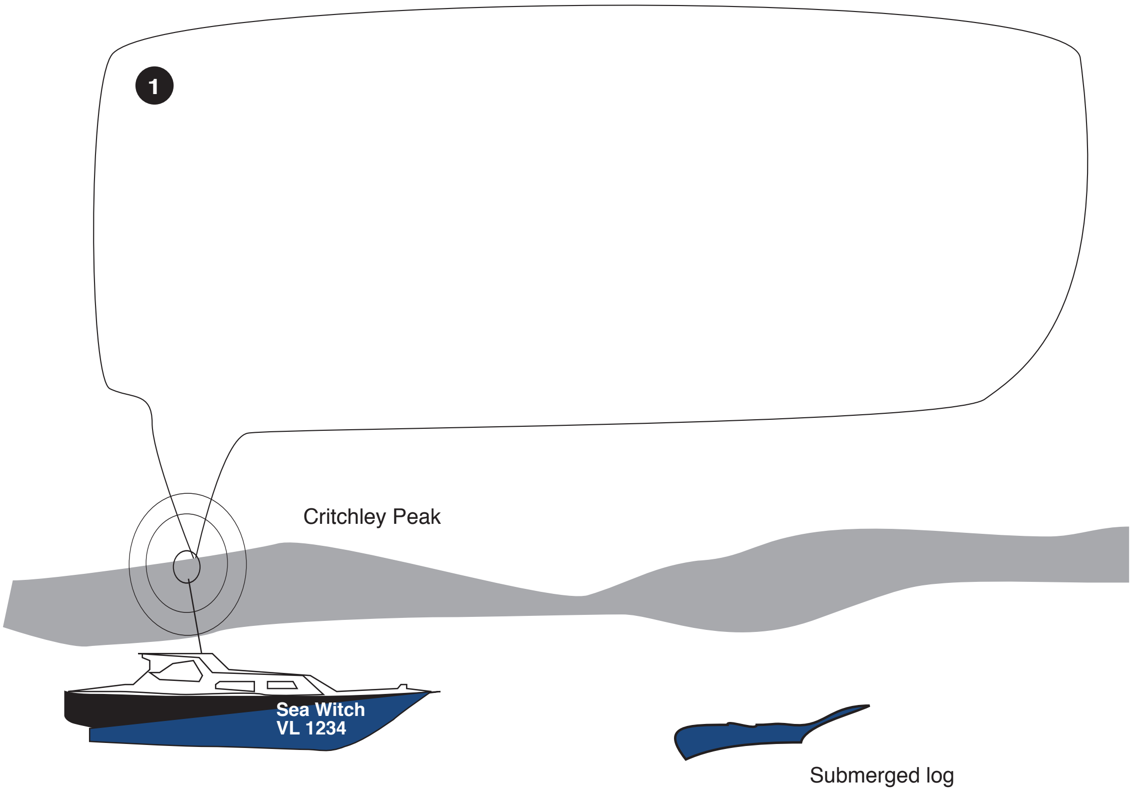
   A securite message is a .... signal.

Materials and equipment (per class)

Equipment required

- copy of *Marine Studies*
- copy of *Marine radio for the beginning skipper*, by Don Fee, Yeppoon News.

Securite



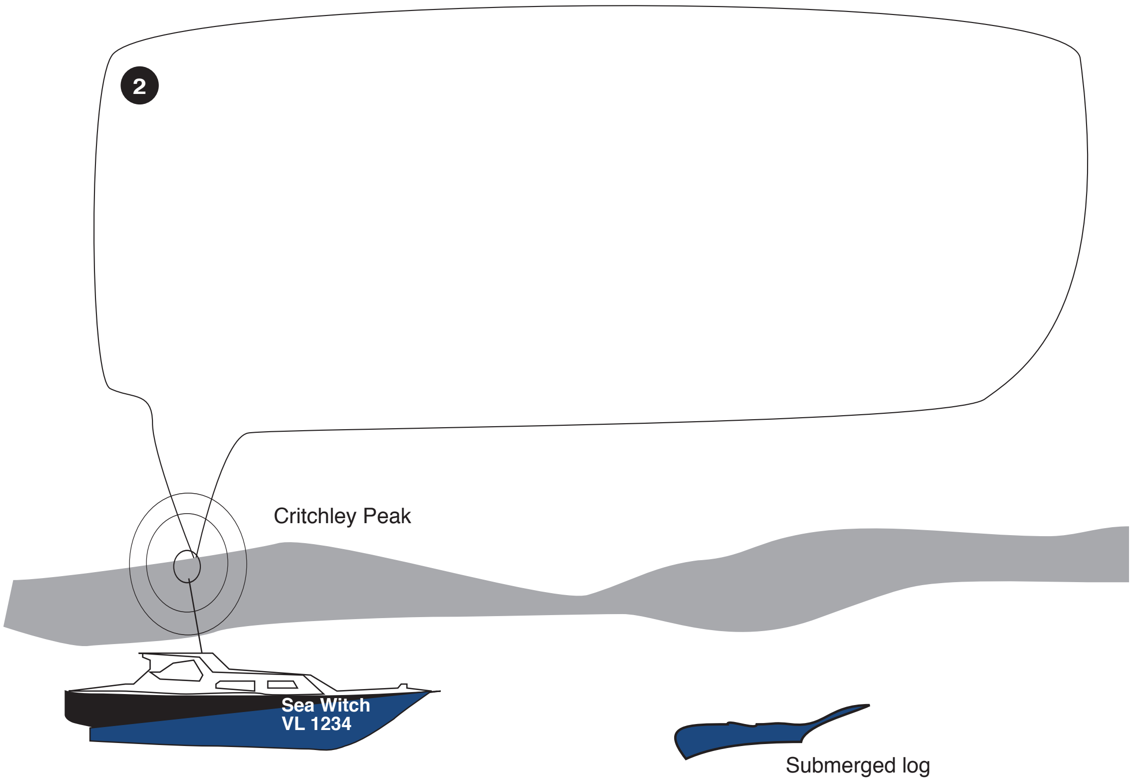


Figure 119.1 A Securite situation in Hypothetical Bay. Students may make one copy of this page so that they can attach their answers before handing in for marking.
Wet Paper

Exercise 120
Pan Pan

Method

This is a urgency signal which indicates that the station sending it has a very urgent message to transmit concerning the safety of a ship or aircraft, or the safety of a person.

Urgency messages are sent on all distress frequencies and are identified by the words PAN PAN - PAN PAN - PAN PAN

The following sequence is how a PAN PAN message is sent.

- PAN PAN (three times)
- HELLO ALL STATIONS (three times)
- THIS IS (once)
- Indication of channel, URGENCY MESSAGE (once)
- Then out.

Now watch the Mackay Air Sea Rescue video segment on Pan Pan and answer the questions below.

Questions

Complete the speech bubbles in Figure 120.1 for the following situation.

Sea Witch VL 1234 has just hit the submerged log and lost its propeller. She is drifting south towards Maclean Reef.

1. Use the speech bubbles in Figure 120.1 to write out a PAN PAN signal.
2. Give two other examples of when you would send a PAN PAN message.
3. Why are PAN PAN messages important?
4. Rewrite the following sentences by adding the correct word.

   A Pan Pan message is a .... signal concerning the safety of a .... or .... or the .... of a person.

Materials and equipment (per class)

Equipment required

- copy of *Marine Studies*
- copy of *Marine radio for the beginning skipper*, by Don Fee, Yeppoon News.

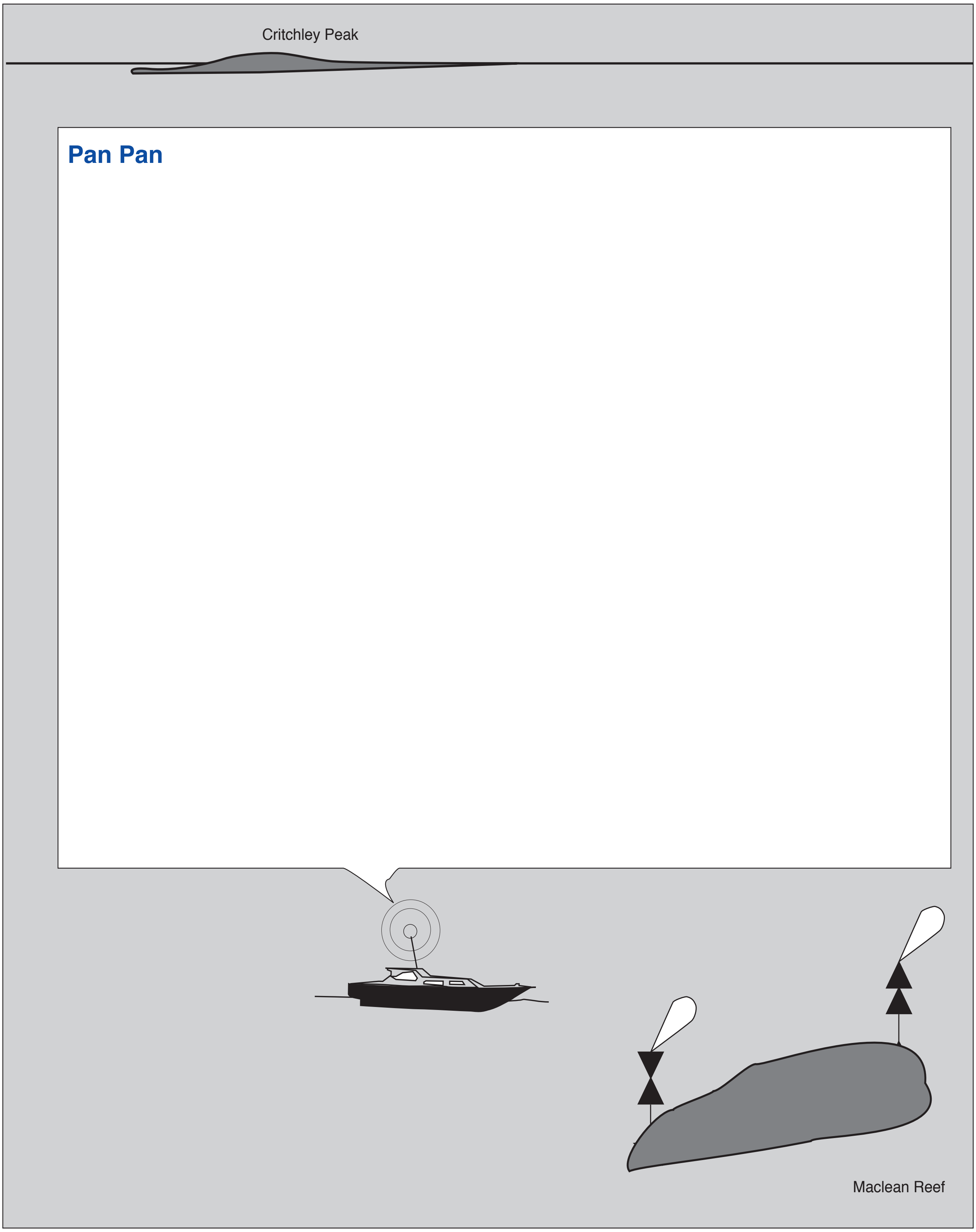


Figure 120.1 A Pan Pan situation in Hypothetical Bay. Students may make one copy of this page so that they can attach their answers before handing in for marking.

Wet Paper

Exercise 121
Mayday

Method

Mayday is a distress signals and is only sent when a vessel is in grave or imminent danger. In the vast majority of cases this means the vessel is either sinking, on fire or both. The use of Mayday is not to be entered into lightly. On receipt of this signal, coast radio stations swing into immediate action which may result in the expenditure of public money. For obvious reasons, distress calls take priority over all other calls and so if you hear anything that sounds even remotely like a distress call you should suspend your own calls immediately.

The skipper is the only person on board who can authorise a distress call. It is normal procedure to send distress calls on an official distress frequency, however in an emergency, any frequency may be used.

In an emergency, the vessel in distress has full control over all other calls and not the coast station or other vessels which may be involved unless control is delegated.

Usually coast stations will pick up Mayday signals, however if you hear a Mayday call and you cannot provide assistance you should relay the message in the hope that someone who can help will hear your relay. If you are close enough to provide assistance to the distressed vessel, you should acknowledge the call.

Example

The following sequence is how a MAYDAY message is sent.

- MAYDAY (three times)
- THIS IS (three times)
- State position as accurately as you can
- Describe the problem
- Say how many people are on board and time afloat

Materials and equipment (per class)

Equipment required

- copy of *Marine Studies*
- copy of *Marine radio for the beginning skipper,* by Don Fee, Yeppoon News.

If you are the only one to hear the Mayday, acknowledgement of a distress call should be made on the frequency on which the call was received and in the order outlined below:

- MAYDAY
- Sea Witch Sea Witch Sea Witch
- This is Baradine VL 2468. This is Baradine VL 2468. This is Baradine VL 2468.
- RECEIVED MAYDAY
- OVER

The following information in the order shown should be transmitted as soon as possible after the acknowledgement.

- MAYDAY
- Sea Witch Sea Witch Sea Witch
- This is Baradine VL 2468.
- I'm five miles north of your position. Speed 10 knots.
- Will reach your position in 10 minutes.
- OVER

Now watch the *Mackay Air Sea Rescue video segment on Mayday* and answer the questions below.

Questions

Use the illustrations in Figure 121.1 to answer the following questions.

Sea Witch VL 1234 has just drifted onto Maclean Reef and holes badly.

1. Use speech bubble A to write out your Mayday call.
2. The life raft is being deployed, the EPIRB is activated and attached to the life raft. The crew then abandon ship into the life raft.

   Describe how an EPIRB should be activated
3. You are the skipper of Wet Paper I and hear a MAYDAY call from Sea Witch and it appears no other vessel has responded. You are 10 nautical miles from Maclean Reef.

   Use speech bubble B to write out your response.
4. The crew are rescued and the danger has passed.

   Use speech bubble C to write out how to finish the distress situation

Mayday

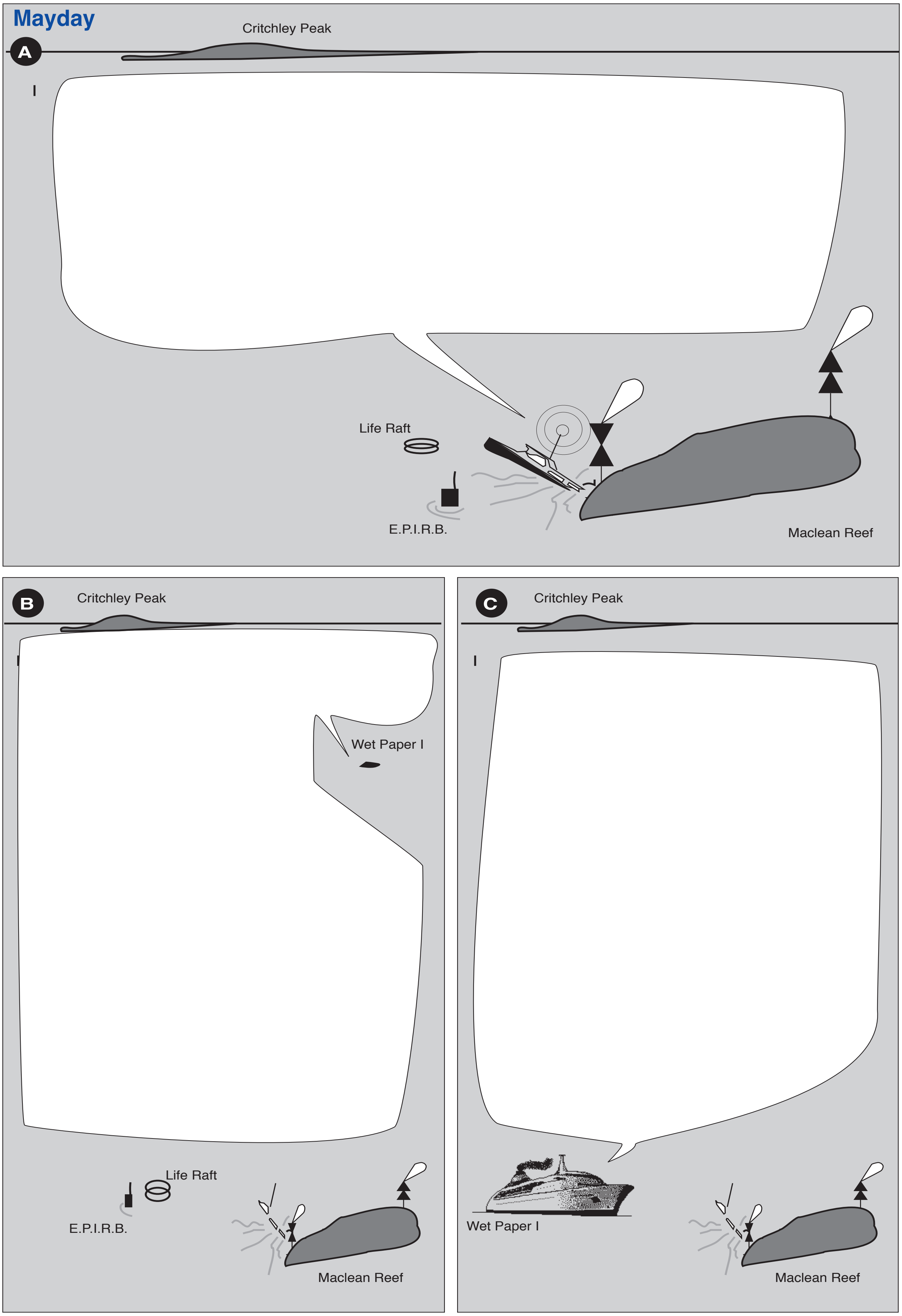


Figure 121.1 Mayday situation. Students may make one copy of this page so that they can attach their answers before handing in for marking.

Wet Paper

Exercise 122
Mayday video

by Mark Rickard, Benowa State High School

Mayday, mayday,

View the video, *Mayday, Mayday, Mayday,* and answer the following questions.

1. List equipment considered by the yachtsman as vital for safety during offshore passages.
2. 27 Meg Radio is most used by which marine groups?
3. VHF and HF, marine radio are preferred transmission systems for offshore use because of which direct links?
4. How is the EPIRP activated and deployed?
5. Why are EPIRPs still activated when vessels have sent distress messages by marine radio?
6. What other distress signals are commonly used by mariners in trouble?
7. The commentator says Mayday calls are reserved for vessels or crew in grave danger. Under what circumstances could this be incorrect and what is the appropriate call for assistance to help an injured mariner?
8. Why should abandoning ship be a last resort?
9. What are some of the features built into inflatable life rafts?
10. List the commentator's key survival tips on a life raft.
11. What is the function of the local user terminal in Alice Springs?
12. Complete this sentence:

    The satellites now take the _________ out of search and rescue.
13. What resources can the Maritime Rescue Coordination Centre call upon in emergency rescue situations?

Materials and equipment (per class)

Equipment required

- copy of video *Mayday, Mayday, Mayday*

Available from:

Sea Safety Education

Phone (06) 279 5972

Fax (06) 279 5858

PO Box 1108 Belconnen ACT 2616

AMSA
Australian Maritime Safety Authority

EXERCISE 123
STUDENT RADIO LOG

Student radio log

Station ______________________________

Date	Time	Operator	Station contacted	Position of station called	Frequency	Message

Figure 123.1 Sample radio log. Students may make one copy of this page so that they can use it to keep a log of radio calls during this unit or on camp.

Exercise 124 Simulation Mayday

Simulation game

You are the skipper of the vessel *Titanic* and are heading out for a week's whale watching. You leave Lynch River marina and make 10 knots.

You plan to overnight at Thelma's Point and then cruise the bay for the rest of the week.

Your business partner owns *Wet Paper I*. She is cruising with you to Perry Shoals on a fishing trip with a group of retired Marine Studies teachers.

1. You wish to send a message telling the local rescue association you are leaving with 24 adults and nine children for Thelma's point. Write out your message.
2. Fifty minutes out from the breakwater you spot a large fishing line that has come adrift from the shark nets off Steggles Beach.

   Outline your course of action, making sure you give the latitude and longitude of the net (you have no ability to recover the net).
3. A hour passes and bad weather sets in with the onset of a strong south-westerly wind. Rain squalls are frequent and all the crew are sick . Worse still your motor breaks down and your VHF radio fails to work. However your 27 Mhz, that you learnt how to use at school, can just pick up *Wet Paper I*.

   Outline your call and what you wish *Wet Paper I* to do.
3. Hours pass and unfortunately you can now hear the roar of breakers and see the reef off Wiley Island. Your boat still has no power and *Wet Paper I* is still some time off. You know she can travel at 30 knots regardless of weather conditions.

   You strike the reef. Life rafts are launched and you have to abandon ship with your EPIRB.

   a. Outline how you should abandon ship.

   b. Predict the likely course of action as a result of the activated EPIRB.

   c. Estimate how long the Maritime Rescue Co-ordination Centre will alert Lewisville airport.

   d. Predict which will be sent first, plane or rescue ship.

   e. Estimate time of arrival of a sea plane that travels at 150 Nm per hour.
4. Sam Watson is the sea safety officer at Lewisville airport and pick up the EPIRB signal. She also has had a call from the local air sea rescue to say that a vessel, *Wet Paper 1* has picked up a Mayday call.

   a. Outline her course of action based on her training from the Mayday video.

   b. Make a decision about the suitability of equipment and procedures she should follow given the situation.
5. *Wet Paper I* is on the way to help. Outline the decisions the skipper on *Wet Paper I* has to make.

   a. Plot a course for the *Titanic* and estimate your ETA.

   b. All your radios work so outline which one you probably would use and what type of messages you would be sending.
6. You end up rescuing all the survivors of the *Titanic* , the weather clears up and you have to alert the rescue stations that the emergency situation is over.

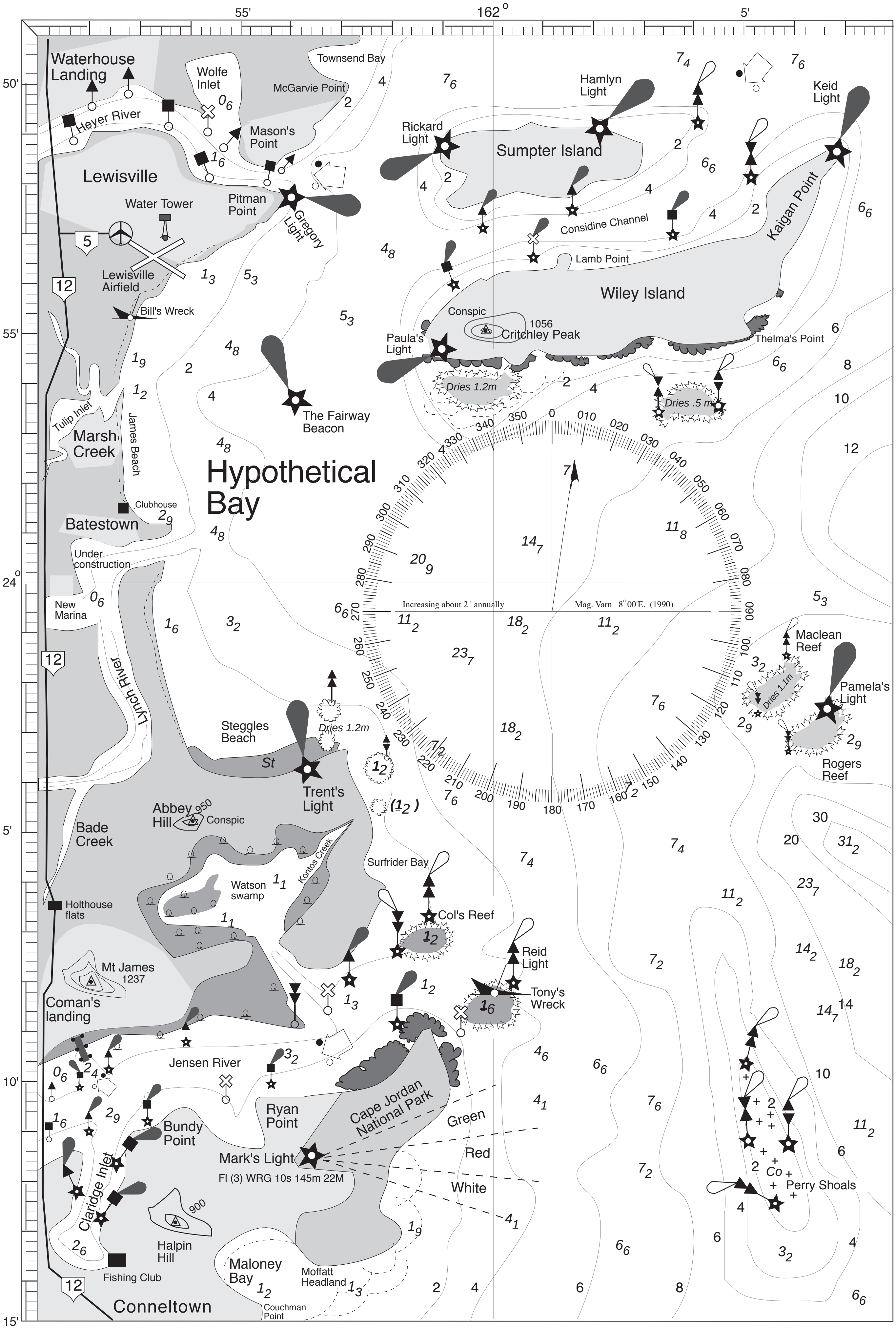
   a. Outline your radio signals and course of action.

   b. What communication should you make with Sam Watson?
7. Optional

   Use the radio log in Exercise 123 to illustrate your answer.

Research assignment

You may like to rewrite this scenario and present it as a research assignment writing and then answering your own hypothetical questions.



55'
162°
5'
50'
55'
24°
5'
10'
15'
Waterhouse Landing
Heyer River
Wolfe Inlet
Townsend Bay
McGarvie Point
Mason's Point
Lewisville
Water Tower
Pitman Point
Gregory Light
Lewisville Airfield
Bill's Wreck
Rickard Light
Hamlyn Light
Sumpter Island
Keid Light
Considine Channel
Lamb Point
Kaigan Point
Wiley Island
Conspic
1056
Critchley Peak
Paula's Light
Thelma's Point
Dries 1.2m
Dries .5 m
The Fairway Beacon
Tulip Inlet
Marsh Creek
James Beach
Clubhouse
Batestown
Hypothetical Bay
Under construction
New Marina
Increasing about 2' annually
Mag. Varn 8°00'E. (1990)
Maclean Reef
Pamela's Light
Dries 1.1m
Rogers Reef
Lynch River
Steggles Beach
St
Dries 1.2m
Trent's Light
Abbey Hill
950
Conspic
Bade Creek
Watson swamp
Kontos Creek
Surfrider Bay
Col's Reef
Holthouse flats
Reid Light
Tony's Wreck
Mt James
1237
Coman's landing
Jensen River
Ryan Point
Bundy Point
Cape Jordan National Park
Green
Red
White
Mark's Light
Fl (3) WRG 10s 145m 22M
Claridge Inlet
900
Halpin Hill
Fishing Club
Maloney Bay
Moffatt Headland
Couchman Point
Conneltown
Perry Shoals
Co
Wet Paper

Exercise 125 Checking and cleaning radio components

Questions

1. Make a copy of the table opposite and use the information in the box below to complete the table.
2. Are their any other aspects of radio maintenance not covered in the table? If so write a paragraph on each.

There are six main areas that can cause problems with radio communications.

Faulty aerials

If the aerial was broken by wind or water, there would be no signals coming in or going out. If the aerial had a bad connection, you would see the output needle flickering, there would be crackle from the speaker and incoming signals would be cutting in and out. A salt build up on the aerial results in poor reception and transmission. Regular wiping of the aerial reduces this problem. Using the incorrect aerial affects performance so it is important to match the aerial with the radio and have it tuned properly

Blown fuses

A blown fuse is easy to diagnose because there will be no transmission or reception and no dial lights.

Flat batteries

A battery with low charge will not be obvious. The dial lights will show up and incoming signals will register, however when the microphone switch is pushed, all signs of power will disappear. If there is a loose connection from the battery to the radio, the whole set will flicker on and off.

Faulty earth

All MF/HF radios must have an electrical earth connection to the water surrounding the vessel. If this connection becomes faulty, an operator may experience a sharp burning sensation from metallic parts of the transceiver during transmission.

Faulty microphones

If the microphone is faulty we can expect the receiver to work perfectly but transmission to be poor or non existent. Usually a spare microphone can be plugged in.

Incorrect power supply

The radio is totally dependent on the power supply. There are five main points to know about lead acid battery.

- Checking the charge level.

  This is checked by a hydrometer which measures the specific gravity of the electrolyte. A reading of 1150 is considered flat whereas a reading of 1250 is considered charged. Measuring the on-load (i.e. when the battery is supplying current) terminal voltage will also provide an indication of the amount of charge in a battery. For a 12 volt battery the on-load terminal voltage should not fall significantly below 11.4 volts when transmitting.

- Topping up the electrolyte.

  When topping up the electrolyte you should always use distilled or demineralised water. The electrolyte should be kept about halfway between the top of the plates and the filler hole.

- Charging.

  Batteries can be damaged by long periods of heavy charging. Short periods of discharging followed by a total recharge is the best way to use a battery. A battery will only take about 10 total discharges.

- Hazards.

  Batteries give out hydrogen during charging and should be well ventilated to avoid an explosive gas-air mixture.

- Location.

  Should be chosen to ensure that the battery is-

  - protected from the elements
  - accessible for maintenance
  - close to transceiver
  - as high as practicable

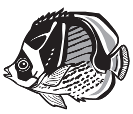
Component	Where component is located	Care that needs to be taken
Aerial and fittings		
Microphone		
Radio earth		
Fuse box		
Battery acid level		
Battery terminals		
Battery charging		

Figure 125.1 Radio faults table. Students may make one copy of this page so that they can attach their answers before handing in for marking. \

Wet Paper

Exercise 126 Phonetic alphabet

When it is necessary to spell out words, when communication is difficult, or when speaking to a station not fluent in English, use the code as shown in Figure 126.1.

The syllables to be emphasised are underlined

When it is necessary to spell out figures or marks, use the code as shown in Figure 126.2.

Questions

1. Explain why the use of phonetic alphabet is recommended at times when radio communications is difficult. Why not ask the operator simply to spell the words?
2. When a figure or mark is to be transmitted, why replace a simple number such as four with the code word Kartefour?
3. Suggest a reason for the emphasis of the underlined syllables when using certain words.
4. Divide the following into syllables:
   - Preparation
   - Communication
   - Radio
   - Station
5. Your boats name is *Sea Witch 2* and you have been requested to use the phonetic alphabet to give your boat name. Give your boat name.
6. Write your own name on the front of your notebook using the phonetic alphabet.
7. Write a message to the student next to you using the phonetic alphabet.
8. It has been suggested by a fellow student to change the word for the letter B from Bravo to Boat. Could this be done and could there be problems with this.
9. Common radio terms are ETA and ETD. What do these terms stand for and where might they be commonly used?
10. Suggest why the phonetic alphabet was developed and why some of the words were selected.

Letter	Word	Spoken as
A	Alfa	AL-FAH
B	Bravo	BRAH-VO
C	Charlie	CHAR-LEE
D	Delta	DELL-TAH
E	Echo	ECK-OH
F	Foxtrot	FOKS-TROT
G	Golf	GOLF
H	Hotel	HOH-TELL
I	India	IN-DEE-AH
J	Juliet	JEW-LEE-ETT
K	Kilo	KEY-LOH
L	Lima	LEE-MAH
M	Mike	MIKE
N	November	NO-VEM-BER
O	Oscar	OSS-CAH
P	Papa	PAH-PAH
Q	Quebec	KEH-BECK
R	Romeo	ROW-ME-OH
S	Sierra	SEE-AIR-RAH
T	Tango	TAN-GO
U	Uniform	YOU-NEE-FORM
V	Victor	VIK-TAH
W	Whisky	WISS-KEY
X	X-Ray	ECKS-RAY
Y	Yankee	YANG-KEE
Z	Zulu	ZOO-LOO

Figure 126.1 Phonetic letters

Figure or mark to be transmitted	Code word to be used	Spoken as
0	Nadazero	Nah-dah-zay-roh
1	Unaone	Oo-nah-wun
2	Bissotwo	Bees-soh-too
3	Terrathree	Tay-rah-tree
4	Kartefour	Kar-tay-fower
5	Pantafive	Pan-tah-five
6	Soxisix	Sok-see-six
7	Setteseven	Say-tay-seven
8	Oktoeight	Ok-toh-ait
9	Novenine	No-vay-niner
Decimal point	Decimal	Day-see-mal
Full stop	Stop	Stop

Figure 126.2 Phonetic numbers

EXERCISE 127
REVISION SHEET

Compiled by
Dave Dawson
Spectrum Management Agency, Brisbane.

METHOD

1. Turn to the questions at the end of the Radio chapter.
2. Use a piece of paper to cover up this page.
3. Answer each question one at a time and then uncover the answer to see if you were right.

ANSWERS

1. In 1888 Heinrich Hertz demonstrated that energy could be transmitted through space by using a generator to accelerate electrons to a frequency of approximately 50 million cycles per second. He applied this energy to a transmitting aerial. A receiving aerial at some distance away was observed to emit sparks.

   Electrons which are accelerated to a sufficient frequency will cause energy to be transmitted through free space. This energy is known as radio frequency energy.

2.

Low freq	med freq	high freq	very high freq	ultra high freq
100 kHz	1 MHz	10 MHz	100 MHz	1000 MHz

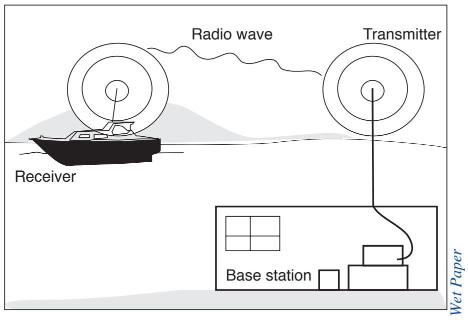
   Additional information not in text:

   - Very Low Frequencies (VLF): 3 to 30 KHz
   - Low frequencies (LF): 30 Hz to 300 KHz
   - Medium frequencies (MF): 3 KHz to 3 MHz
   - High frequencies (HF): 3 MHz to 30 MHz
   - Very High Frequencies (VHF): 30 MHz to 300 MHz
   - Ultra High Frequencies (UHF): 300 to 3000 MHz

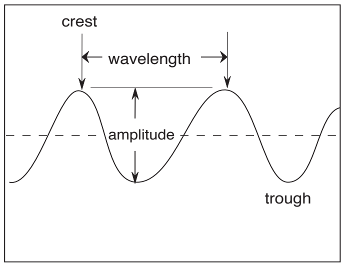
   Note:

   - 1 Kilohertz (KHz) = 1000 Hertz (Hz)
   - 1 Megahertz (MHz) = 1000 000 Hertz = 1000 Kilohertz

3. Radio frequency energy travelling between a transmitter and a receiver within sight of each other. As a general rule, radio frequency energy generated at VHF travels no further than radio line of sight which is slightly further than visual line of sight.



4. See diagram below

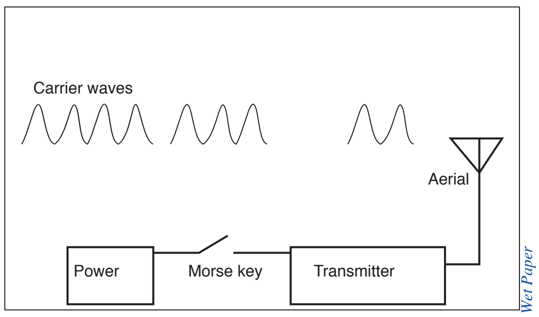


5. A carrier wave is like a wave in the ocean. It has a crest and a trough. The distance between crests is known as the wave length and the distance between each crest and trough as the amplitude.

   The time between successive crests measures the wave's frequency — one wave per second is known as one cycle per second or 1 Hertz (two crests per second, 2 Hertz and so on) Obviously the greater the distance between crests, the lower the frequency and vice versa.

   The carrier wave gets its name because it carries the information which is to be conveyed between transmitter and receiver. This information is impressed onto the carrier wave by altering (or modulating) either its amplitude or its frequency.

6. Morse code may be transmitted by simply turning on and off a carrier wave in accordance with the international code devised by Samuel Morse.

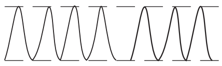


7. Radiotelephony is the term used to describe the exchange of information by radio using voice signals.

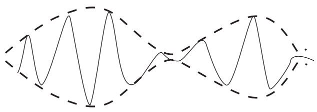
   The exchange of information by radio using morse code is termed radiotelegraphy.

8. Modulation is the process of altering (or modulating) the carrier wave in synchronisation with the information which is to be carried between transmitter and receiver.

9. Amplitude modulation is achieved when a carrier wave has its height (or amplitude) altered in synchronisation with the information to be carried between transmitter and receiver



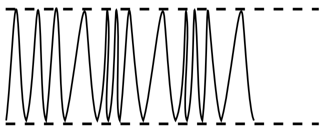
Carrier waves - note that these have the same amplitude



Modulated waves - note the different amplitudes

10. Frequency modulation is achieved when a carrier wave has its frequency altered in sympathy with the information to be transmitted.

FM Frequency modulation - note that these have the same amplitude but different wave length.

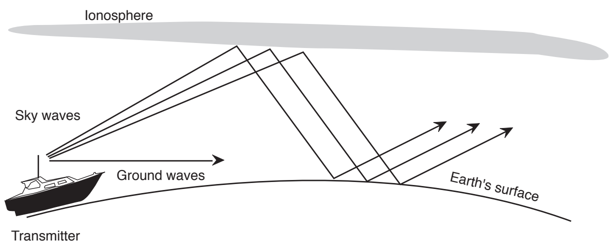


11. When radio frequency energy is radiated from the antenna of a marine radio transceiver, it can travel through space in two ways: ground waves and sky waves.

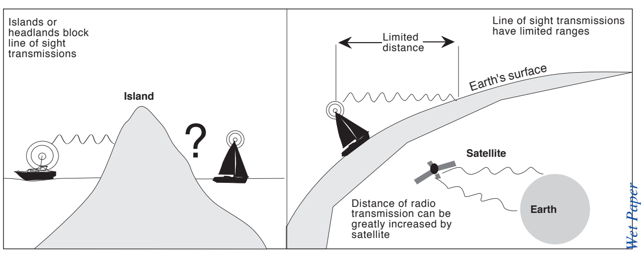
    Ground wave energy travels over the earth's surface and uses up its energy quickly, particularly when travelling over large land masses. Ground waves are normally effective only for short range communications.

    Sky wave energy travels up until it reaches the ionosphere. The ionosphere causes this radio energy to be bent or reflected back to the earth's surface. Sky waves make long distance radio communications possible.

12.



13.



14. Ground wave communications are the only reliable method of communicating at 27 MHz.

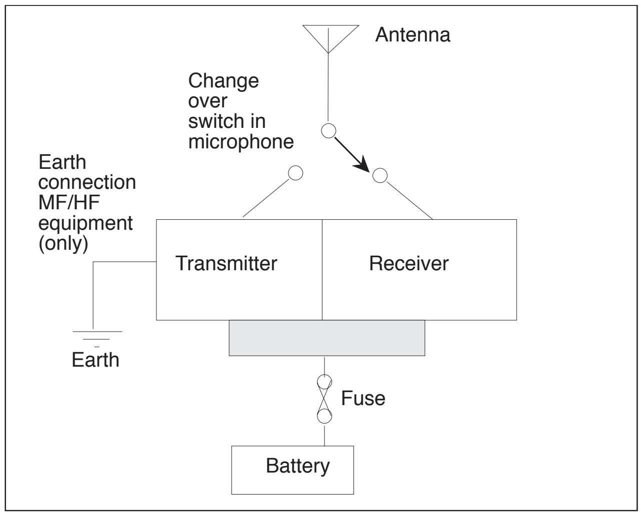
15. Skip occurs when certain atmospheric conditions cause 27 MHz radio energy to be bent back towards the earth's surface allowing communications over long distances.

16. The antenna, the transmitter and receiver (transceiver) and the power supply.

17. The function of the radio transmitter is to turn voice signals spoken into a microphone into energy that can travel long distances through space. It does this by producing radio frequency carrier waves. These carrier waves are modulated with the voice signals, amplified and passed to an antenna for radiation.

18. The function of the radio receiver is to select from all the radio energy signals received by its antenna only those which are required by the listener. The receiver recovers the voice signals from these carrier waves (the process of de-modulation) and amplifies them. The amplified voice signals are reproduced by a loudspeaker in the normal way.

19.



20. At medium and high frequencies (MF and HF), reliable use can be made of both ground and sky wave energy components, allowing communications over both short and long distances.

21. During transmission, the antenna is connected to the transmitter and radiates radio frequency energy into space.

    During reception, the antenna gathers radio frequency energy from space and passes it to the receiver.

22. The task of the power supply is to supply electrical energy to the transmitter and the receiver to enable them to perform their functions.

23. a. 27 MHz (normally called 27 Meg) marine equipment

  b. VHF marine equipment

  c. MF/HF marine equipment

24. EPIRB -Emergency Position Indicating Radio Beacon. An EPIRB is a small, buoyant, self-contained, battery-operated transmitter. Its essential purpose is to assist authorities determine the position of survivors in search and rescue operations.

25. a. obtaining weather forecasts

  b. reporting departure and arrival times

  c. obtaining fishing information

  d. communicating and other vessels

  e. obtaining information concerning marine emergencies

26. Channel 88 (27.88 MHz) to monitor for routine and priority calls from shore stations and other vessels.

27. Channel 16 to monitor for routine and priority calls from shore stations and other vessels.

28. International and Australian regulations require anyone using VHF marine or MF/HF marine equipment to hold a radio operator's certificate of proficiency.

29. Transceiver controls:

  a. Channel selector — selects required channel or frequency

  b. On/off & volume control — turns equipment on and off, and controls loudspeaker volume

  c. Squelch or mute control — stops constant and annoying background roar from receiver

  d. AM/SSB control — controls mode of transmission; AM (amplitude modulation) or SSB (single sideband)

  e. RF gain — varies strength of incoming signals

  f. Noise limiter — minimises effect of static interference

  g. Power selector — controls the power of transmitted signals

  h. Clarifier — varies the tuning of incoming SSB signals

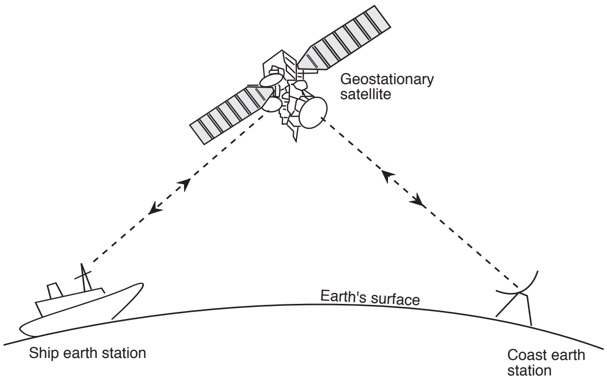
  i. Antenna or aerial tuning unit — adjusts the electrical length of an antenna to ensure the best possible transfer of power from the transmitter to the antenna

  j. Alarm signal generating device (ASGD) — operation causes the radiotelephone alarm signal to be transmitted

  k. Press to talk switch — located on the microphone this control changes the transceiver from the receive to the transmit mode and vice versa

30. Satellite equipment on ship — ship earth station. Shore stations using satellites to communicate with ships — coast earth stations

31.



32. In Australian waters the signals from an activated EPIRB are detected by orbiting satellites and relayed to a ground receiving station (termed a local user terminal or LUT) located at Alice Springs. The LUT computes the position of the EPIRB and this information is passed directly to the Maritime Rescue Coordination Centre in Canberra.

33. MAYDAY, MAYDAY RELAY, PAN PAN, SECURITE

33. (second question 33)

- TUBBY TUBBY TUBBY
- THIS IS
- REEF SEEKER REEF SEEKER REEF SEEKER
- CHANGE TO CHANNEL 96

34. Table similar to that shown

LETTER	PHONETIC	*Spoken as*	LETTER	PHONETIC	*Spoken as*	Number	*Spoken as*
A	ALPHA	*Al fa*	B	BRAVO	*Brah vo*	0	*Zero*
C	CHARLIE	*Char lee*	D	DELTA	*Dell tah*	1	Wun
E	ECHO	*Eck oh*	F	FOXTROT	*Foks trot*	2	Too
G	GOLF	*Golf*	H	HOTEL	*Hoh tell*	3	Thuh-ree
I	INDIA	*In dee ah*	J	JULIETT	*Jew lee ett*	4	Fo-wer
K	KILO	*Key loh*	L	LIMA	*Lee mah*	5	Fi-yiv
M	MIKE	*Mike*	N	NOVEMBER	*Novem ber*	6	Six
O	OSCAR	*Oss cah*	P	PAPA	*Pah Pah*	7	Se-ven
Q	QUEBEC	*Keh bek*	R	ROMEO	*Rohme oh*	8	AIT
S	SIERRA	*See air rah*	T	TANGO	*Tang go*	9	Niner
U	UNIFORM	*You nee form*	V	VICTOR	*Vik tah*	DAY-SEE-MAL	
W	WHISKEY	*Wiss key*	X	X-RAY	*Ecks ray*		
Y	YANKEE	*Yank key*	Z	ZULU	*Zoo loo*		

35.

Radio terminology

Based on information supplied by Department of Transport and Communications

★ AFFIRMATIVE	Yes
★ NEGATIVE	No
★ ETA	Estimated time of arrival
★ ETD	Estimated time of departure
★ OVER	My transmission is ended and I expect a response from you
★ OUT	My transmission is ended and no response is expected
★ STAND-BY	Wait and listen till I re-transmit
★ STANDING -BY	I am waiting for you to call me again
★ ROMEO	Message received and understood
★ ACKNOWLEDGE	Let me know that you have received and understood the message
★ GO AHEAD	Proceed with your message
★ I SAY AGAIN	Self explanatory
★ SAY AGAIN	Repeat your message
★ THAT IS CORRECT	Self explanatory
★ VERIFY	Check your information and advise me

Avoid CB terms such as: Come in please, over and out, come back, ten-four etc.

36. Numbers are transmitted by pronouncing each digit separately; for example, 153 becomes one five three. It is normal to use the twenty-four hour clock system. For example, 5.42 pm becomes 1742, 5.15 am becomes 0515

    If the date as well as the time is to be transmitted, a six-figure group should be used. For example, 4 p.m. on the 12 becomes 121600, 11.35 a.m. on the 3rd becomes 031135.

37. A silence period is a period of three minutes during which, with the exception of distress messages, all transmissions from all stations must cease. Silence periods occur twice each hour - at the hour and at the half hour. Diagram as Figure 20 *Marine Studies* 1st Edition.

38. SECURITE SECURITE SECURITE
    - HELLO ALL STATIONS HELLO ALL STATIONS HELLO ALL STATIONS
    - THIS IS
    - BRIGAND VL 9876 BRIGAND VL 9876 BRIGAND VL9876
    - WEATHER WARNING FOLLOWS ON CHANNEL 72

39. SECURITE (pronounced SAY-CURE-E-TAY), spoken three times, is the international safety signal and is used to attract attention to a broadcast of a navigational or weather warning.

40. The international urgency signal is PAN PAN spoken three times. It is used when the use of a distress signal is not justified but when a station has a very urgent message to transmit concerning the safety of a vessel, aircraft or person.

41. PAN PAN PAN PAN PAN PAN
    - HELLO ALL STATIONS HELLO ALL STATIONS HELLO ALL STATIONS
    - THIS IS
    - TEMPEST VLQ 1234 TEMPEST VLQ 1234 TEMPEST VLQ 1234
    - 25 MILES DUE EAST OF POINT DANGER
    - SERIOUSLY INJURED CREW MEMBER
    - REQUIRE URGENT MEDICAL ASSISTANCE

42. The international distress signal is MAYDAY (from the French m'aidez — help me) spoken three times. The signal indicates that the ship using it is threatened by grave and imminent danger and requests immediate assistance.

43. MAYDAY MAYDAY MAYDAY
    - THIS IS
    - SEA SIREN VMQ 3456 SEA SIREN VMQ 3456 SEA SIREN VMQ 3456
    - MAYDAY SEA SIREN VMQ 3456
    - POSITION 42 NAUTICAL MILES EAST-NORTH-EAST OF CAPE MORETON
    - VESSEL ON FIRE
    - 3 PERSONS ON BOARD
    - EPIRB ACTIVATED

44. Rebroadcast the original distress message using the MAYDAY RELAY procedure to ensure that stations hearing your message understand that you are relaying on behalf of the vessel in distress.

45. The control of distress traffic is the responsibility of the ship in distress unless delegated to another station. Silence may be imposed on stations interfering with distress traffic by the use of the instruction SEELONCE DISTRESS.

46. By broadcasting the following message:
    - MAYDAY
    - HELLO ALL STATIONS HELLO ALL STATIONS HELLO ALL STATIONS
    - THIS IS
    - Name and call sign of station controlling distress traffic
    - Time that message originated
    - Name and call sign of vessel that was in distress
    - SEELONCE FEENEE

47. The AUSREP system is a ship-reporting system which monitors the movements of vessels undertaking lengthy voyages anywhere within Australia's search and re□scue area. The AUSREP system is administered by the Australian Maritime Safety Authority from its Maritime Rescue Coordination Centre in Canberra.

48. Search and rescue operations in Australia - main points:

- Coordination of search and rescue operations may be handled by the Maritime Rescue Coordination Centre (MRCC) in Canberra if outside the resources of State police.
- When search and rescue operations are handled by State police, the MRCC is often asked to provide expert advice and information.□□
- When the MRCC takes over a search and rescue operation, the senior coordinator assumes total control.
- Each year the MRCC handles hundreds of marine incidents: searches, medical evacuations, rescues, tracing overdue yachts, investigation of unexplained flare sightings, etc.

49. The network of SOLAS (Safety of Life at Sea) maritime communications stations (also termed coast stations) operated by OTC Maritime has a number of functions including:

- monitoring distress frequencies
- providing search and rescue operations in co-ordination with the Maritime Rescue Coordination Centre in Canberra
- receiving position reports from ships at sea and passing them to the Maritime Rescue Coordination Centre in Canberra (AUSREP reports)
- broadcasting weather and navigational warnings
- facilitating the exchange of radiotelex and radiotelephone calls between ships and addresses ashore

50. A radio check is a brief on-air call from a vessel to a shore station to confirm correct radio equipment operation. It is usually made shortly before the vessel puts to sea.

51. A antenna or aerial can become faulty in a number of ways:

- physical damage by wind or water
- poor, intermittent, or broken connections between it and the transceiver
- salt build-up on an antenna may result in reduced performance

52. A blown fuse is one which no longer completes the electrical connection between circuits. A fuse will blow when a current in excess of its rating is passed through it. A fuse protects expensive equipment and wiring from serious damage and the possibility of fire. A blown fuse is evident by total loss of transmission and reception and no dial lighting.

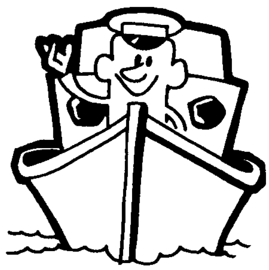
53.
- A failing battery is evident by a dimming dial light when the transmitter button is pushed. A flat battery is evident by total loss of transmission and reception and no dial lights.
- A faulty earth on a MF/HF transceiver will be evident by reduced transmission efficiency and, possibly, during transmission, may cause metallic parts of the transceiver to become live.
- This is not dangerous but a burning sensation may be felt when in contact with these parts.
- A faulty microphone will be evident by non-existent or poor transmission.

Note: the question regarding an incorrect power supply is flawed and should be ignored.

54. Batteries are normally used to provide the electrical power to marine radio equipment. To maintain batteries in good working condition, the following points should be observed:

- the batteries must be kept correctly charged
- the batteries must be kept topped up with distilled water
- the batteries must be kept clean and dry
- the battery terminals must be kept free of corrosion

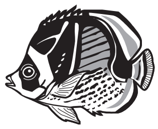
A poorly maintained battery will quickly fail and prevent transmission.



EXERCISE 128
REVISION TEST

Time 30 minutes

35 Marks



Knowledge and understanding

1. In an emergency at sea a vital link for being rescued or obtaining assistance is a radio. A radio wave was first produced by

   a. Isaac Newton

   b. Ernest Rutherford

   c. Heinrich Hertz

   d. Albert Einstein

2. Carrier waves may alter to carry speech information by altering the size of the wave. This is known as

   a. amplitude modulation

   b. radio telephony

   c. morse code

   d. tremometer imbalance

3. Which of the following radio types would normally be used by international yachts whilst on long distance voyages?

   a. VHF

   b. MF/HF

   c. 27 MHz

   d. AM

4. Which band is not reflected by the ionosphere and consequently is by ground wave only ? It is effective for short ranges only and is a 'line of sight' band.

   a. VHF

   b. HF

   c. VHF

   d. 27 MHz

5. Which of the following statements concerning radio waves is true?

   a. Sky waves travel much further than ground waves before they lose their energy.

   b. Sky waves lose their energy faster than ground waves.

   c. Ground waves are more effective for long distance broadcasting.

   d. Radio wave energy can radiate from the receiver as x-rays.

6. Some radio sets can be connected into the land telephone system and hence the name seaphone service. A radio operator's certificate of proficiency is required to operate these sets. The sets are:

   a. 27 MHz

   b. S.S.B.

   c. VHF

   d. HF

7. Annoying background noise and interference can be eliminated by adjusting the:

   a. clarifier

   b. squelch control

   c. noise limiter

   d. RF gain

8. The effect of loud static interference can be minimised by the use of which control ? Unfortunately, the control knob can also have the effect of desensitising the receiver to wanted signals. The control is

   a. clarifier

   b. squelch control

   c. noise limiter

   d. RF gain

9. An EPIRB is

   a. a marine communication system

   b. a small battery operated floating transmitter

   c. an emergency voice transmitter and receiver

   d. an emergency positional indicating and responding buoy

10. What word should you say if your transmission is ended but you expect a response from the other party ?

   a. out

   b. over

   c. romeo

   d. securite

11. Sometimes when radio reception is poor it may be necessary to spell words or use the phonetic alphabet. The word used for 'D' is

   a. december

   b. danna

   c. data

   d. delta

12. Safety signals are used when a station wants to pass information concerning safety such as navigation warnings or weather warnings and are identified by the word/s:

    a. Seelonce feenee

    b. Pan Pan

    c. Securite

    d. Hello all stations

13. An urgency signal indicates that the station sending the message has a very urgent message to transmit concerning the safety of a ship or person. Urgency messages are sent on all distress frequencies and are identified by the word/s

    a. Securite

    b. Pan Pan

    c. Mayday

    d. Help

14. Before using a radio, the operator should always glance at a watch or clock to see if it is an official radio silence period. These periods are:

    a. three minutes before the hour

    b. three minutes beginning every hour and every half hour

    c. five minutes after every hour

    d. not required for uses of 27 MHz radio

15. On transmitting a message, we see the output needle flickering and there is a crackle from the speaker. Incoming signals are cutting in and out. The most probable fault would be:

    a. a blown fuse

    b. the aerial has been broken

    c. the aerial had a bad connection

    d. the battery is low on charge

16. A radio wave is like a wave in the ocean.

    Label the following parts of the wave in Figure 128.1.

    (1 mark)

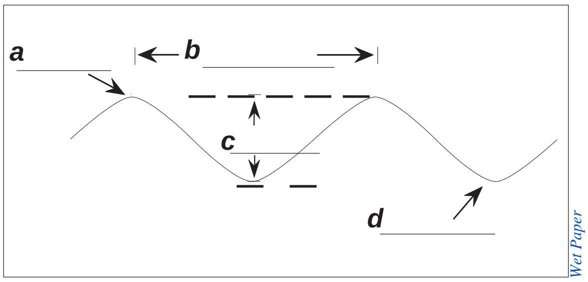


Figure 128.1

17. You have been in control of distress traffic and the May Day situation is finished. Write the message you would give to tell other radio traffic the May Day is over.

    (2 marks)

18. To send a Mayday there are five simple steps. What information should a May Day message contain ?

    (2 marks)

Information processing and reasoning

1. Your vessel is *Seascape*. You have broken down 5 miles south-west of Double Island Point and require a tow urgently.

   Write down an appropriate priority radio message.

   (2 marks)

2. A transmitter emits radio waves of a frequency of 27.00 MHz. What is the wave length of these waves in air if the speed of sound is 340 m/sec ? Use formula v= f λ:

   v = speed of sound

   f = frequency

   l = wavelength

   (3 marks)

3. Refers to Figure 128.2. You also need to know that a ten decibel (1 bel) sound delivers ten times as much energy as a zero decibel sound, while a sound of 20 decibels (2bel) delivers 100 times as much energy.

   a. For a person to hear a sound of 50 Hz what intensity will it have to be ?

   b. What is the range of frequency the human voice can produce ?

   c. What is the lowest frequency a musical instrument can make ?

   d. At what intensity of sound will 5000 Hz reach its threshold of pain ?

   e. How much more energy of sound is needed for you to hear a 100 Hz sound as compared to a 50 Hz sound?

   f. What is the highest frequency of sound that a human can hear and at what level of intensity does it have to be ?

   g. What is the lowest intensity note a musical instrument can make and is it possible to hear this note?

   (10 marks)

Answers			
1.	c	9.	b
2.	a	10.	b
3.	b	11.	d
4.	a	12.	c
5.	d	13.	b
6.	c	14.	b
7.	b	15.	c
8.	c	16 – See text	

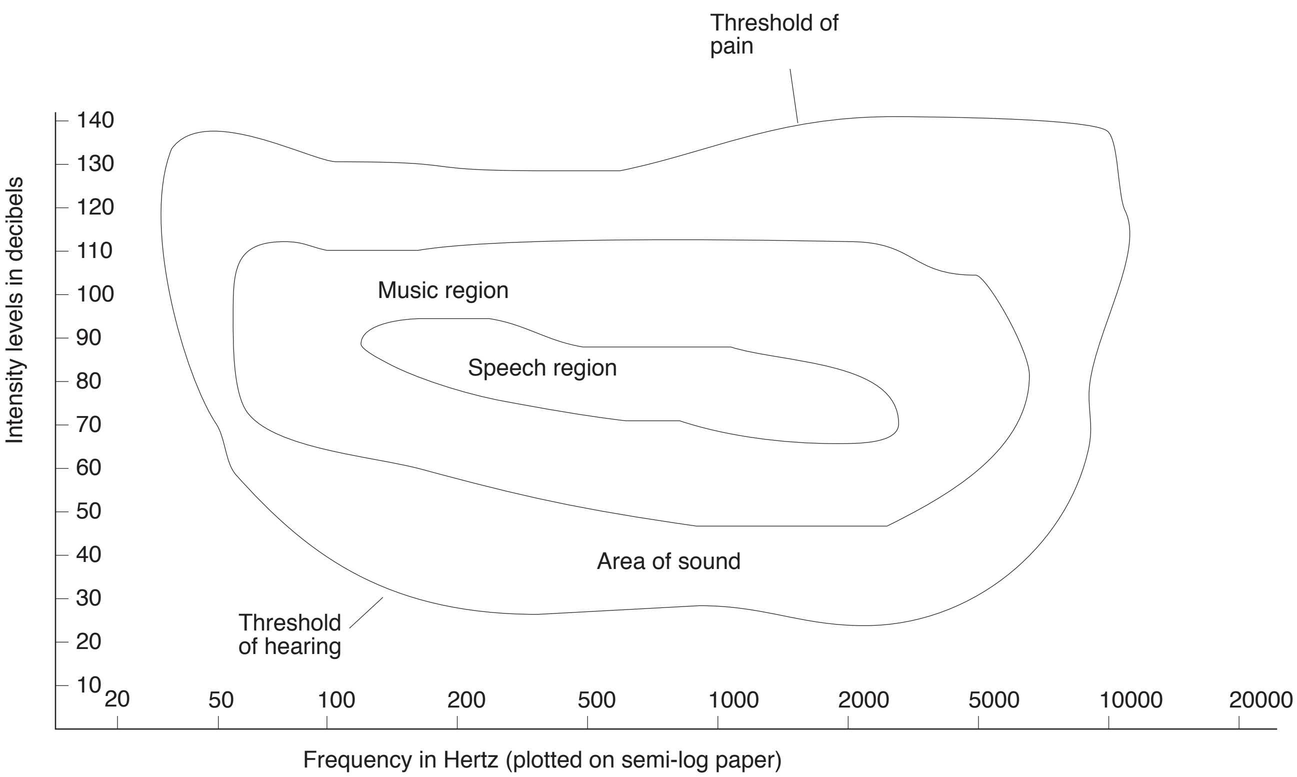


Figure 128.2 Graph for Question 3

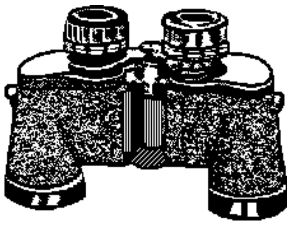
Wet Paper

SECTION 5

NAVIGATION

EXERCISE 89

MAKING A COMPASS ROSE



METHOD

1. Using the circle in Figure 89.1 as a guide, make a compass rose with your protractor.
2. Starting at the top of the circle, mark in 0° to indicate North, and then 10°, 20°, 30° to 360° around the compass.
3. On the inside of the circle mark off the compass points:

   N, NE, E, SE, S, SW, W, NW
4. Draw a map of the classroom marking in the main features: clock, corners, doors, where you are sitting.
5. Using the scissors, cut out the compass rose you have made and with your hand-bearing compass, align your compass rose till it faces magnetic north.
6. Glue the rose in position.
7. Now take three bearings in the room and write them down.
8. Using a ruler and your compass rose, see if you can plot your position in the room.

MATERIALS AND EQUIPMENT (PER GROUP)

Equipment required

- protractor
- pencil, ruler and rubber
- hand-bearing compass
- glue
- scissors

QUESTIONS

1. How accurately can you read your hand-bearing compass?
2. How close did you get to where you are sitting?
3. What are the types of things that will affect your hand-bearing compass?

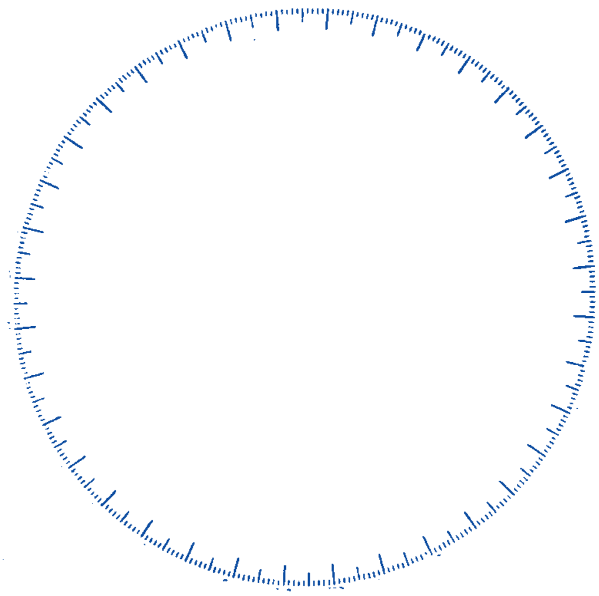


Figure 89.1 Template for compass rose

Wet Paper

Exercise 90 Hypothetical Bay

Based on an original idea by Bob Moffatt

There are many things to learn about navigation. To navigate outside of the classroom requires skills and knowledge that come later in this set of notes. However for the present let us look at how to use a *chart*. The one we will use will be Hypothetical Bay.

Questions

Use the atlas to find a map of Australia showing a mercator projection.

1. What are the northern most and southern most latitudes?
2. What are the eastern most and western most longitudes?
3. Where is Greenwich? What line of longitude passes through it?
4. Name any three places the equator passes through.
5. What is the difference between a mercator projection and other projections of the world? (e.g. Find out what a gnomic projection tells us.)
6. Look carefully at the latitudes and longitudes of Hypothetical Bay.
   a. Is the bay in the Northern Hemisphere or Southern Hemisphere (refer to Figure 90.1)?
   b. Off what continental shelf is the bay located?
   c. How big is the bay approximately in kilometres?

Look carefully at Hypothetical Bay opposite and answer the questions below.

7. List any six chart features that are not found on a map.
8. Use Exercise101 on page 188 to make drawings of each of the following features in your notebook.
   - wreck
   - light
   - sectored light
   - hill
   - airport
   - coral reef
   - sounding
   - sounding line
   - beacon
   - direction of buoyage
   - water tower
   - special mark
   - rocky headland
   - breaking waves
   - stony beach
   - mangrove area
   - starboard lateral unlit mark
   - shoal that is never covered with water
   - sandy beach
9. Where are the deepest part and the shallowest parts of the chart?
10. What is the depth of water at the entrance to Jensen River?
11. What is the difference between pilotage and buoyage? Use your textbook index to write a definition of each.
12. What is the depth of water in Claridge Inlet?
13. Who is a pilot and what does he or she do at sea?
14. Where is Thelma's Point?
15. What is found in Watson Swamp?
16. Describe the coastline features around the mouth of Lynch River?
17. Name any three hills over 500 m.
18. Name the two islands in the bay.
19. What is the speed of the ebb tide off Maclean Reef?
20. What is the sea floor made of in Perry Shoals?
21. What is the speed of the current between Wiley Island and O'Connor Reef?
22. What is the sea floor and surrounding coastline made of around Langley Reef?
23. Describe the coastline features surrounding, and on the seafloor of Maloney Bay.

Note: Students may make one copy of Hypothetical Bay so that they can attach their answers before handing in for marking. Teachers do not have permission to make class sets of this page for inclusion in a booklet.

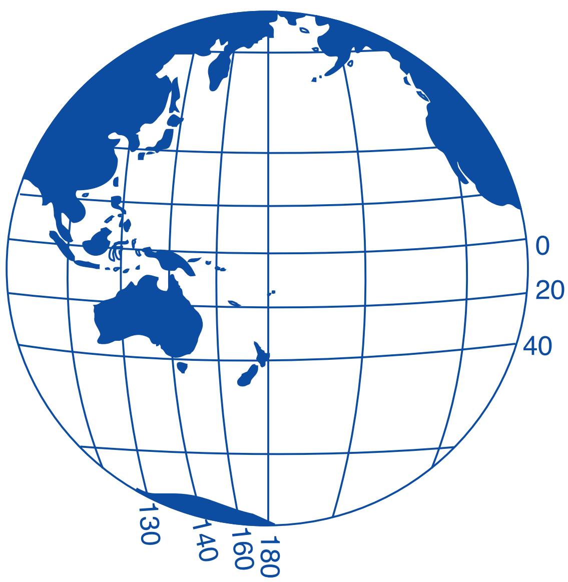
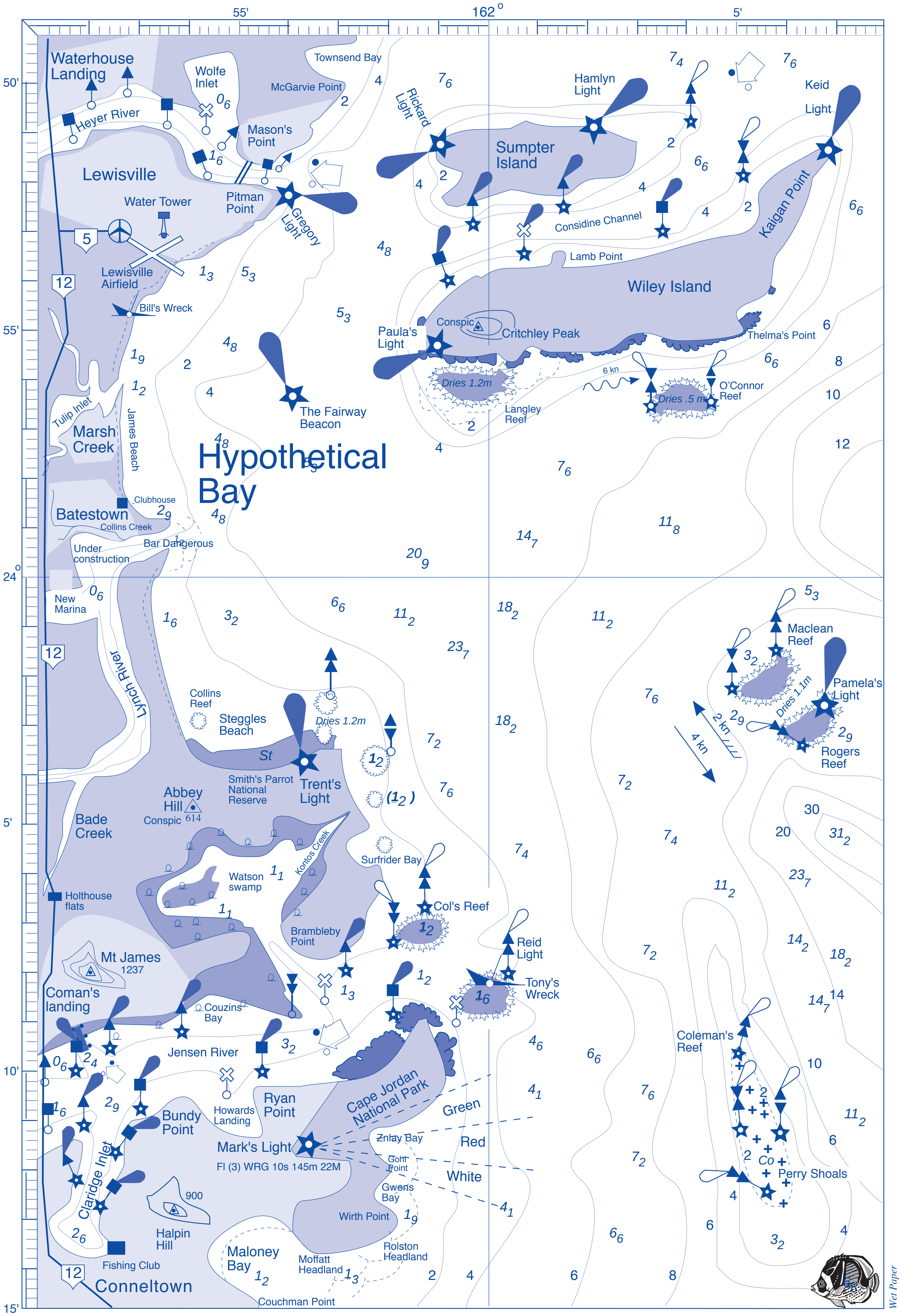


Figure 90.1 Where in the world is Hypothetical Bay?

Wet Paper


55'
162°
5'
50'
55'
24°
5'
10'
15'
Waterhouse Landing
Wolfe Inlet
Townsend Bay
McGarvie Point
Heyer River
Mason's Point
Rickard Light
Hamlyn Light
Keid Light
Sumpter Island
Lewisville
Water Tower
Pitman Point
Gregory Light
Considine Channel
Kaigan Point
Lamb Point
Wiley Island
Lewisville Airfield
Bill's Wreck
Conspic
Critchley Peak
Paula's Light
Thelma's Point
Dries 1.2m
6 kn
Dries .5 m
O'Connor Reef
Langley Reef
The Fairway Beacon
Tulip Inlet
Marsh Creek
James Beach
Hypothetical Bay
Clubhouse
Batestown
Collins Creek
Bar Dangerous
Under construction
New Marina
Lynch River
Maclean Reef
Pamela's Light
Dries 1.1m
2 kn
4 kn
Rogers Reef
Collins Reef
Steggles Beach
Dries 1.2m
St
Smith's Parrot National Reserve
Trent's Light
Abbey Hill
Conspic 614
Bade Creek
Kontos Creek
Surfrider Bay
Watson swamp
Holthouse flats
Col's Reef
Brambleby Point
Reid Light
Tony's Wreck
Mt James 1237
Coman's landing
Couzins Bay
Jensen River
Coleman's Reef
Cape Jordan National Park
Green
Red
White
Bundy Point
Howards Landing
Ryan Point
Mark's Light
Fl (3) WRG 10s 145m 22M
Znlay Bay
Golf Point
Gwens Bay
Wirth Point
Claridge Inlet
900
Halpin Hill
Fishing Club
Conneltown
Maloney Bay
Moffatt Headland
Rolston Headland
Couchman Point
Co
Perry Shoals
Wet Paper

Exercise 91 Latitude, longitude and nautical miles

Notes: In these early exercises the compass rose has been left off the map of Hypothetical Bay. A nautical mile is one minute of latitude.

Questions

Use a ruler to find the latitude and longitude of the following places. Remember lines of latitude run down from the equator and lines of longitude run east or west of Greenwich as shown in Figure 91.1 below.

1. Find the latitude and longitude of the following points:
   a. Gregory River Light
   b. Paula's Light
   c. Rogers's Light
   d. Tony's Wreck
   e. Fishing Club on Claridge Inlet
   f. Airport at Lewisville
   g. Rickard Light
   h. Hamlyn Light
   i. the mouth of Kontos Creek
   j. Ryan Point
   k. the peak of Halpin Hill

2. Name the charted features at the following positions of latitude and longitude.
   a. 23° 54' S, 161° 53' E
   b. 23° 52' S, 161° 56' E
   c. 24° 02' S, 162° 06' E
   d. 24° 11' S, 161° 54' E
   e. 24° 02.5' S, 162° 06.8' E
   f. 24° 11.6' S, 161° 56.2' E
   g. 24° 6.6' S, 161° 51.2' E

3. Find two features at different latitudes but the same longitude.

4. Find two features at different longitudes but the same latitude.

5. What is the safest navigable distance between the following places for a deep draft vessel?
   a. Gregory Light and the Fairway Beacon
   b. the Fairway Beacon and Trent's Light
   c. Gregory Light and Keid Light
   d. Keid Light and Maloney Beach
   e. The north mark on Maclean Reef and Bundy Point in Jensen River.
   f. the Southern Mark on Perry Shoals and Waterhouse Landing

6. Calculate the size of the following places:
   a. Watson Swamp
   b. the new marina in Lynch River
   c. Roger's Reef
   d. Wiley Island
   e. The length of the north-eastern runway at Lewisville Airport

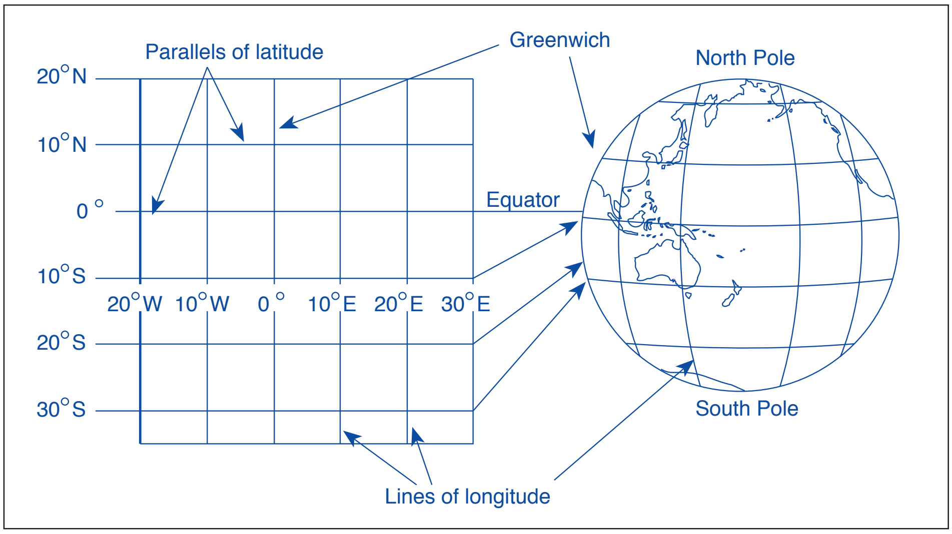
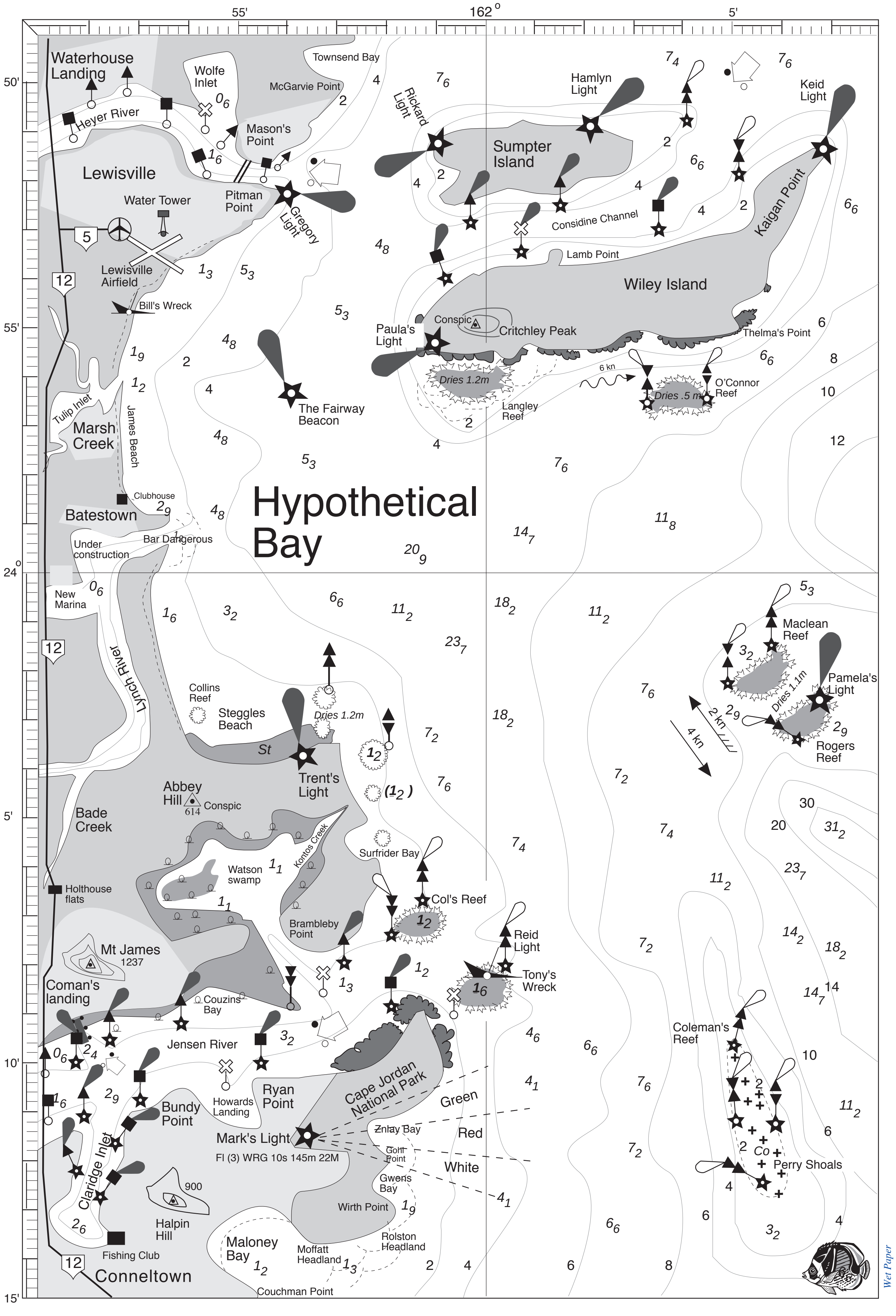


Figure 91.1 Latitude and longitude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Water Tower
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Rickard Light
Hamlyn Light
Sumpter Island
Keid Light
Considine Channel
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Langley Reef
6 kn
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James Beach
Clubhouse
Batestown
Under construction
Bar Dangerous
Hypothetical Bay
New Marina
Lynch River
Collins Reef
Steggles Beach
Dries 1.2m
St
Trent's Light
Maclean Reef
Pamela's Light
Dries 1.1m
2 kn
4 kn
Rogers Reef
Abbey Hill
614
Conspic
Bade Creek
Kontos Creek
Watson swamp
Surfrider Bay
Col's Reef
Holthouse flats
Brambleby Point
Reid Light
Tony's Wreck
Mt James
1237
Coman's landing
Couzins Bay
Jensen River
Coleman's Reef
Howards Landing
Ryan Point
Bundy Point
Cape Jordan National Park
Green
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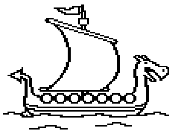
White
Mark's Light
Fl (3) WRG 10s 145m 22M
Znlay Bay
Golf Point
Gwens Bay
Wirth Point
Claridge Inlet
900
Halpin Hill
Perry Shoals
Co
Maloney Bay
Moffatt Headland
Rolston Headland
Fishing Club
Conneltown
Couchman Point
5
12
Wet Paper

Exercise 92 Distance, speed and time



Resources available

Classroom Navigation for the Beginning Skipper, by Don Fee, Yeppoon Newsagecy.

Available from:

Specialized Video
111 Paradise St, Mackay, Q 4740 Telephone: (079) 521991

Geoff Toghills exercises for the Whitsunday Charts are also a good reference.

Method

This exercise allows you to practice using the nautical mile to determine speed and time.

Remember one knot is equal to one nautical mile per hour.

Worked examples

a. How fast am I travelling if I cover 100 Nm in 5 hours?

S = D/T = 100 Nm/5 hrs = 20 Nm/hr or 20 knots

b. How far can I travel in 2 hours and 30 minutes, if I am travelling at 10 knots?

D = S x T = 10 knots x 2.5 hrs = 25 Nm

c. How long is it going to take me to travel 75 Nm of my boat travels at a constant speed of 10 knots?

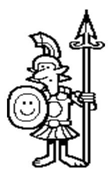
T = D/S = 75 Nm/10 Nm per hr = 7.5 hrs = 7 hrs and 30 minutes

Questions

1. How far can I travel in 10 hours if I am travelling at 9 knots?
2. How far can I travel in 6 hours at a constant speed of 4 knots?
3. For 2 hours I travel at 10 knots, and for the next 3 hours my boat can only make 5 knots. How far have I travelled?
4. My boat travels 10 Nm in two hours. How fast did she go?
5. I left harbour at 7 a.m. and travelled 5 Nm by 10 a.m. How well did my speed boat perform?
6. If I set out in my sailing boat at 10.30 a.m. and reached my destination at 2 p.m. after travelling 35 Nm, what was my average speed for the trip?
7. How long did it take a mariner to travel 20 Nm at an average speed of 5 knots?
8. Your sailing boat is travelling at 4 knots and your navigator predicts 32 Nm to go. How many hours will it take to reach your destination?
9. How far is it from the fishing club in Conneltown to the 4 m line off Col's reef? My boat can do 6 knots and draws 2.9 m. When can I leave the fishing club on the morning of 4 January and how long will it take to get to Col's reef? Use the tide tables in Figure 92.1 to help you.
10. How far is it from the port mark at the mouth of Heyer River to Lamb Point on Wiley Island?
11. *Wet Paper I* leaves the new marina on Lynch River at 0800 hrs and travels to 24° 01'S, 161° 59'E. She can do 25 knots, but a 15 knot S/E is blowing and she can only make 12.
    a. How long will she take to get there?
    b. Whales have been spotted off Thelma's Point. Can *Wet Paper I* make it in time for lunch? Show all working.
12. Another vessel, *Whyamber*, can make 5 knots and travels from the same marina. How long will she take?
13. If you were running a coach company and wanted to tap into the growing market of whale watching tourists from Hypothetical Bay, and your cousin has a restaurant at Marsh Creek, what bus schedule would you draw up for your operation? Lewisville airport can take direct flights from Tokyo and Sigatoka.

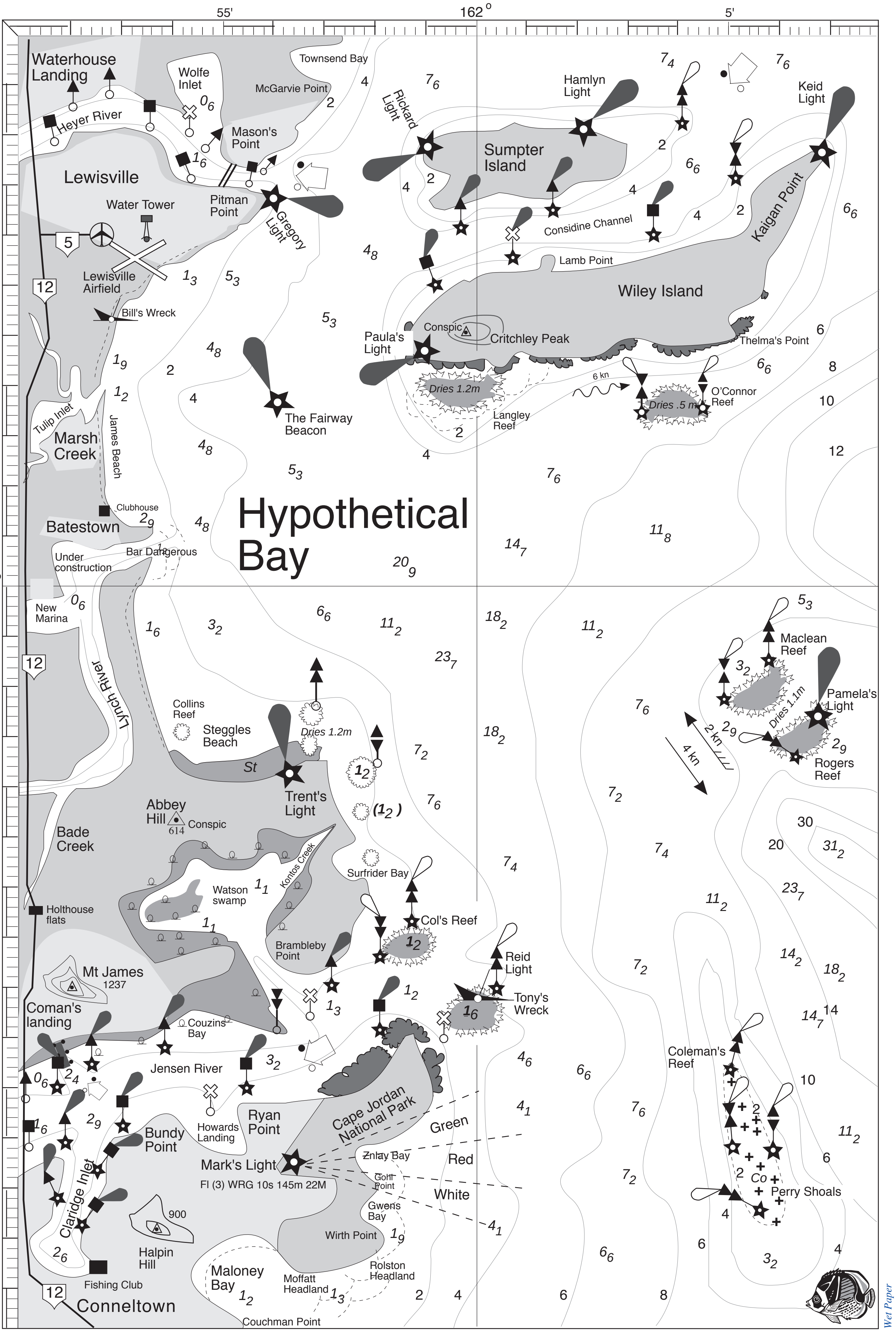
Tide tables for Jensen River

Date	Time	m
Jan1	0221	0.99
	0515	2.32
	1424	0.51
	2101	2.55
Jan 2	0252	1.15
	0535	2.22
	1452	0.49
	2133	2.58
Jan 3	0321	0.99
	0715	2.32
	1524	0.51
	2201	2.55
Jan 4	0221	0.95
	0515	2.32
	1424	0.54
	2101	2.66
Jan 5	0221	1.99
	0515	3.32
	1424	0.71
	2101	3.55



Wet Paper

Figure 92.1 Tides for Jensen River



55'
162°
5'
50'
55'
24°
5'
10'
15'
Waterhouse Landing
Wolfe Inlet
Townsend Bay
McGarvie Point
Heyer River
Mason's Point
Rickard Light
Hamlyn Light
Keid Light
Sumpter Island
Lewisville
Water Tower
Pitman Point
Gregory Light
Considine Channel
Kaigan Point
Lamb Point
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Bill's Wreck
Conspic
Critchley Peak
Paula's Light
Thelma's Point
Dries 1.2m
6 kn
O'Connor Reef
Dries .5 m
Langley Reef
Tulip Inlet
Marsh Creek
James Beach
The Fairway Beacon
Clubhouse
Batestown
Hypothetical Bay
Under construction
Bar Dangerous
New Marina
Maclean Reef
Pamela's Light
Dries 1.1m
Rogers Reef
2 kn
4 kn
Lynch River
Collins Reef
Steggles Beach
Dries 1.2m
St
Trent's Light
Abbey Hill
Conspic
614
Bade Creek
Kontos Creek
Surfrider Bay
Watson swamp
Holthouse flats
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Zinlay Bay
Red
Goff Point
White
Claridge Inlet
900
Gwens Bay
Perry Shoals
Wirth Point
Halpin Hill
Rolston Headland
Maloney Bay
Moffatt Headland
Fishing Club
Conneltown
Couchman Point
Wet Paper

Exercise 93
Parallel rules, set squares and the compass rose

The compass rose allows us to navigate at sea. As there are no road signs, traffic lights or highways, the chart has a compass rose which allows us to go safely from place to place.

Read pages 99 – 101 of the first edition of *Marine Studies*.

Method

Obtain two 90^0 set squares (or parallel rules) and complete the following tasks on the Hypothetical Bay chart.

1. 'Walk' the instruments from the top of the chart to the bottom, keeping the sides parallel.
2. 'Walk' the squares from one corner to the other, keeping the bases parallel.
3. Place one of the squares so that the hypotenuse lies over the Fairway Beacon and Paula's Light. Draw a light line between the two (remember that you will have to rub out all lines at the end of the exercise).
4. Now place the side of the other square opposite the side of the first square.

   Slide the second set square down the page until the hypotenuse of the second square is over the centre of the compass rose (as shown in Fig. 21 *Marine Studies first edition*).

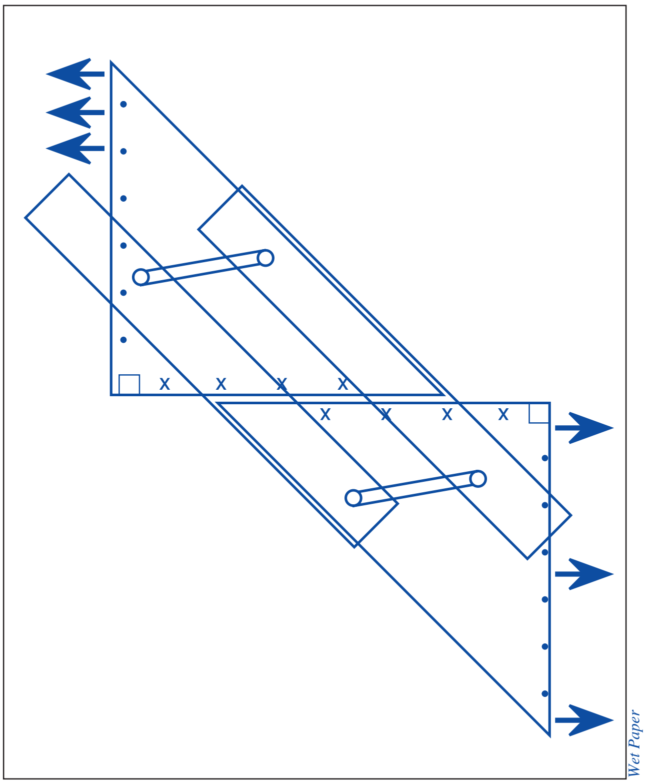


Figure 93.1 Walking a pair of set squares is the same as using a pair of parallel rules

5. The bearing from Paula's Light to the Fairway Beacon can now be read from the number of degrees shown on the compass rose. What did you get? Discuss with your teacher the level of accuracy required in this exercise.

Hand-bearing compass

Use the compass to take bearings on the corners of the room as outlined in the table under the chart on the next page. Record your results in your notebook.

Questions

For each of these exercises, draw a faint line on the chart opposite using either your squares or parallel rule. In each case, use your instruments to read off the following true bearings on the chart. In the next exercise we will look at errors in the compass you are using.

Give the true bearings for the following:

- From Rickard Light to Gregory Light
- From Trent's Light to the Fairway Beacon
- From Trent's Light to Critchley Peak
- From Hamlyn Light to McGravie Point
- From Trent's Light to Paula's Light
- From the 20.9 sounding to the clubhouse
- From the Fairway Beacon to the Water Tower at Lewisville Airport
- From The Clubhouse to Critchley Peak
- McGarvie Point to Critchley Peak
- Hamlyn Light to Lamb Point on Wiley Island

Materials and equipment (per group)

Equipment required

- small hand bearing compass
- pair of 90^0 set squares or parallel rules
- HB pencil and HB rubber
- copy of *Marine Studies*

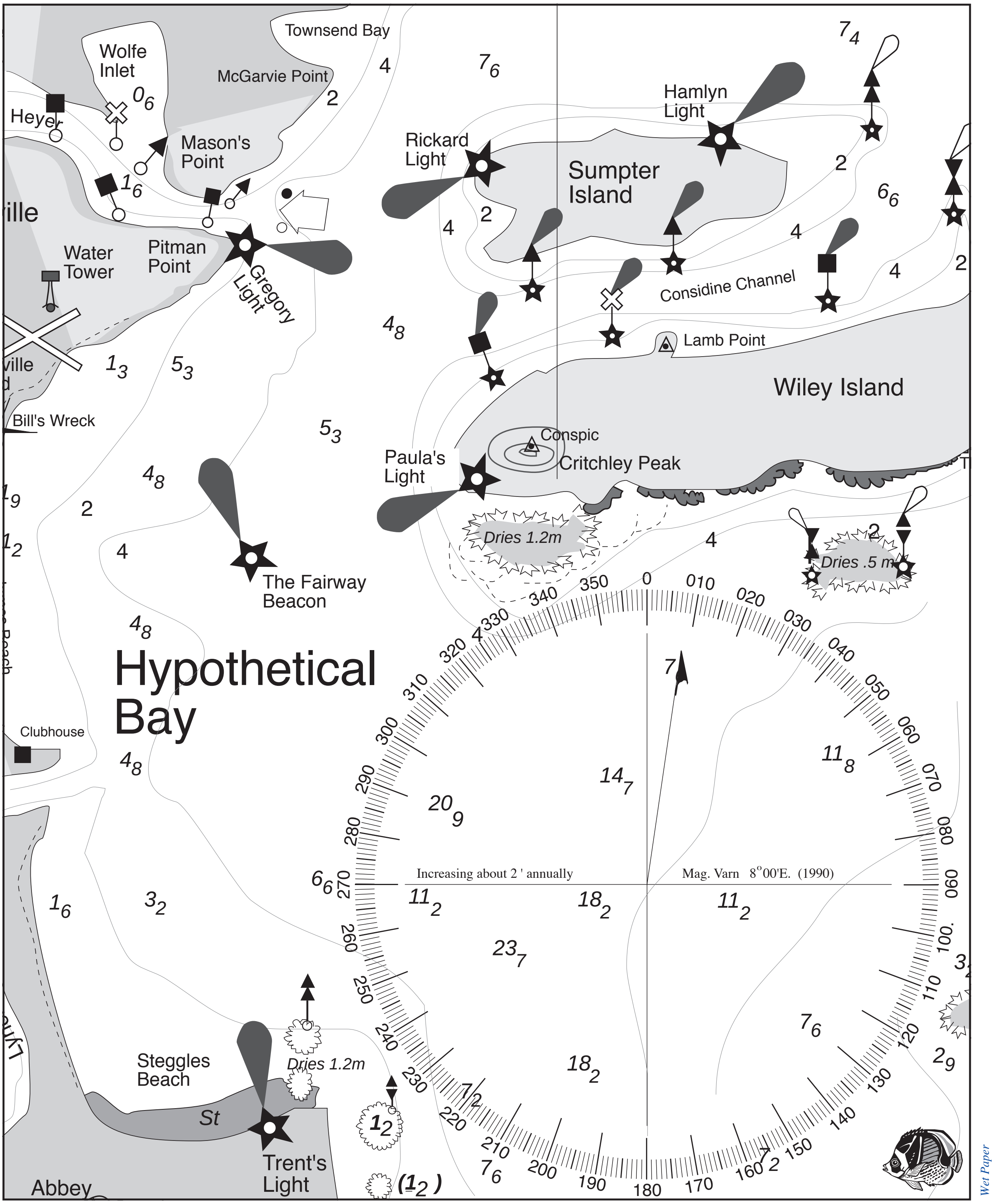


Figure 93.2 Hypothetical Bay with compass rose added

Compass bearings in room

From where you are sitting to the front left corner __________ °

From where you are sitting to the front right corner __________ °

From where you are sitting to the back lefthand corner __________ °

Exercise 94 Taking compass bearings

Method

1. Fix the orienteering compass on the cardboard with sticky tape.
2. Use the paper cutting knife to cut out and bend a section of cardboard as shown in Figure 94.1
3. Make holes in your cardboard as shown in Figure 94.1 and push two satay sticks through.
4. Take the third satay stick and fix it to the other two as shown.
5. You can now use your home made hand-bearing compass to take bearings by sighting thought the sticks and looking up and down at the compass dial.
    a. Take bearings on the corners of the room or other conspicuous points around the classroom.
    b. Use the good quality compass to compare our accuracy.
    c. Draw up a data table to record compass bearings.
    d. Make a plan of the classroom and add a compass rose. Now see if you can find your position using the compass.

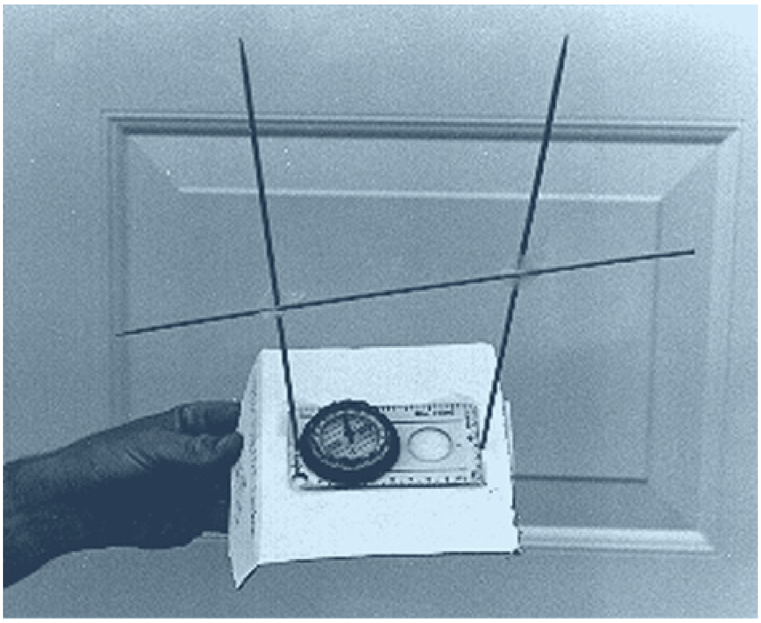
Materials and equipment (per group)

Equipment required

- three satay sticks
- orienteering compass
- cardboard
- sticky tape
- paper cutting knife

(per class)

- good quality, hand-bearing compass as shown in Figure 94.2



Wet Paper

Figure 94.1 A simple hand-bearing compass made from satay sticks, a orienteering compass, sticky tape and a piece of stiff cardboard.

Wet Paper

Figure 94.2 Good quality hand-bearing compass

EXERCISE 95 DOING COMPASS CONVERSIONS

In a perfect world, geographic north and magnetic north would be the same. All ships compasses would always point to true north and any bearings you took with your hand-bearing compass would be relative to true north.

Errors in compasses due to variation

In any location, the earth's magnetic field is at an angle to the meridians of longitude, and so your compass (either steering or hand-bearing) does not point to the true north of the longitude lines on the chart.

We end up with three types of angular bearing:

1. True bearings

   These are relative to true north and are taken off the compass rose on the chart or measured with a protractor against the grid lines of the chart. These are usually written with a T after the angle, e.g. 32°T means an angle of 32° to the true north of the chart.

2. Compass bearings

   These are relative to the earth's magnetic field lines in the area, and are read off the hand bearing compass or the steering compass. Usually written with a C after the angle, e.g. 165°C means an angle of 165° to the earth's magnetic field in that area.

3. Variation

   This is the local *variation* (for the particular year). It is taken off the compass rose information on your chart, and is always given in the direction of east or west to indicate which way the magnetic field lines are pointing as well as how far, e.g. 8° east in our Hypothetical Bay example as shown opposite (in 1990, but will be still closer to 8° than 9° until 2005).

   You can look up variation in the index of your textbook to locate the magnetic north pole in Hudson Bay Canada.

4. To convert between true and compass bearings we use the rule:

   Error East - Compass Least

   Error West - Compass Best (best means the bigger number)

   - The word Error is used here to mean variation error. Later on it will include deviation error and combined error.
   - Figure 95.1 shows some examples of conversion.

Conversions of compass bearings to true bearings

When you make an observation with a hand-bearing compass, and transfer it to a chart as an LOP (line of position), you have to convert a compass bearing to a true bearing to be able to plot it off the compass rose on the chart.

Example

1. Suppose you are out on Hypothetical Bay somewhere to the north of Trent's Light and east of Batestown. You are looking through your hand-bearing compass at Critchley Peak as shown in Figure 95.2.
2. The hand-bearing compass is reading 30°C. Because of the 8°E variation, you need to add 8° to get 38°T before you may plot your line of position on the chart. (Error east, compass 30° is less than 38°T).
3. See Figure 95.3.
4. Note. Two LOPs will fix your position on the chart, and three LOPs will not only fix your position, but also the size of your cocked hat will tell you how accurate or reliable the bearings were (see exercise 96).

Conversions of true bearings to compass bearings

When you draw a line on a chart to indicate where you want your boat to go ,— that is a course to steer, you read off the chart the true bearing of the course to steer.

Before the skipper can start moving the boat, this must be converted to a compass course to steer, so you know what numbers to be reading on the steering compass.

Example

1. You have just come out of Heyer River, and want to go straight to the clubhouse at Batestown.
2. On the chart you have drawn the course (see Figure 95.3) and with your parallel rule have found from the compass rose that the course is 210°T.

   Now you must subtract the 8°E to get the compass course to steer of 202°C.

   Error east, compass of 202° is least/less than 210°. (You yell to the helmsperson to steer 202° by the compass).
3. Note that once you have your course to steer marked on the chart, you can use it for deduced reckoning, better known as *ded. reckoning* or simply DR.

   You simply measure along your course the distance you have travelled from your log, or your speed x time calculations.

   This is where you would be if there were no current, drift or errors in your steering ability.

   It gives a good idea of your approximate position so you can identify objects and use them for LOPs to fix your position.

Example	a.	b.	c.	d.	e.
True bearing	40°T	85°T	243°T	5°T	356°T
Variation (error)	8°E	5°W	10°E	10°E	12°W
Compass bearing	32°C	90°C	233°C	355°C	8°C

In example d. think of 5°T as 365°T before you subtract the 10°.

In example e. 356° + 12° = 368°, which becomes 8°C.

Figure 95.1 Example of compass conversions

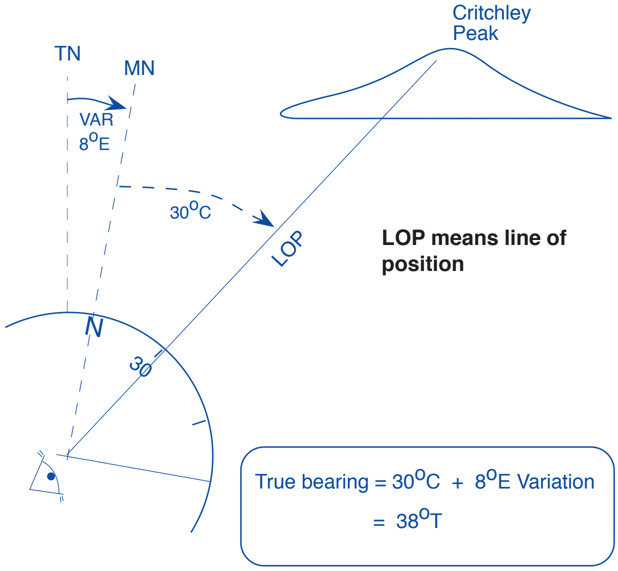


Figure 95.2 Eye looking through hand-bearing compass at Critchley Peak

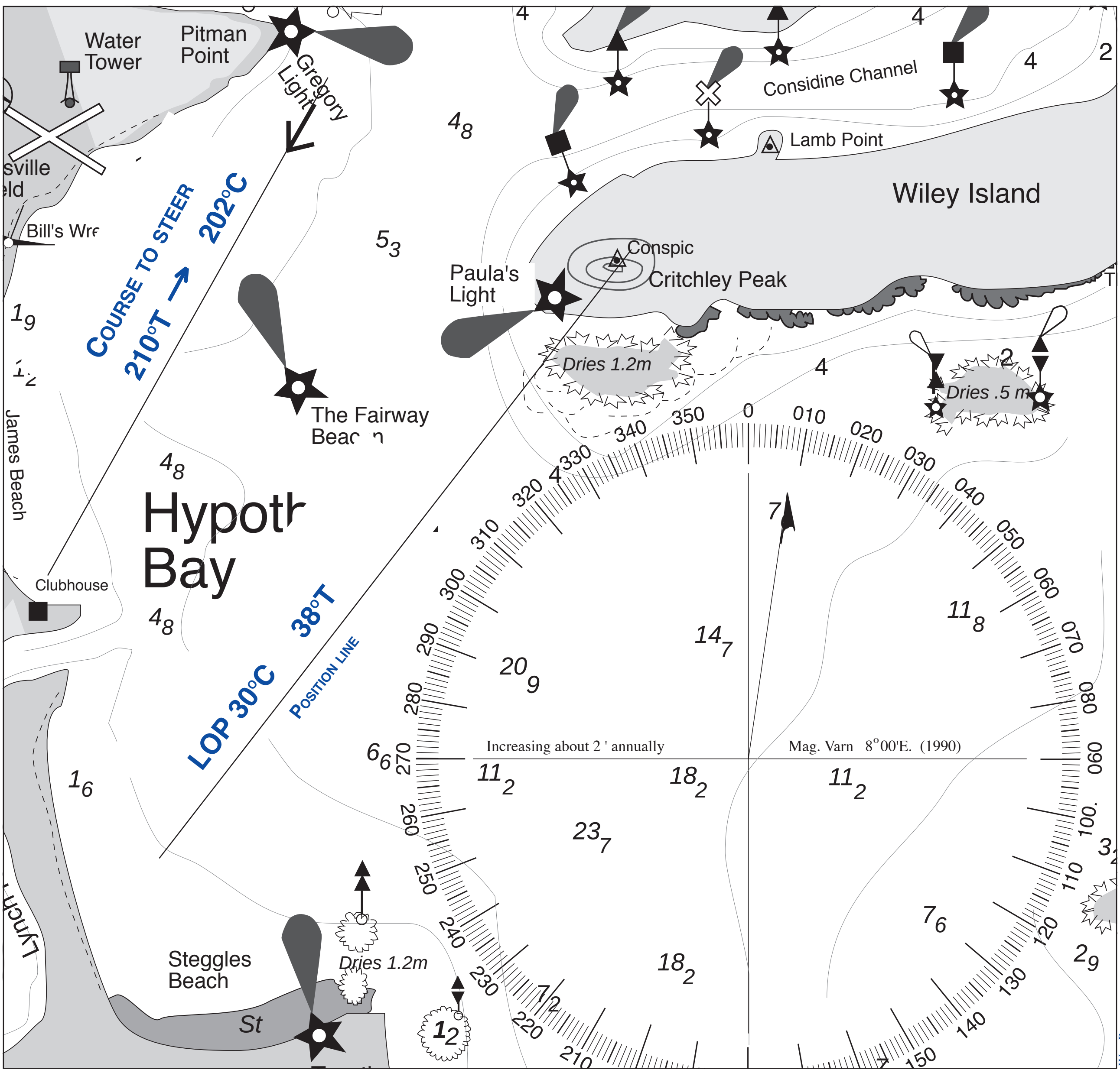


Figure 95.3 Conversion from compass to true and vice versa

Questions

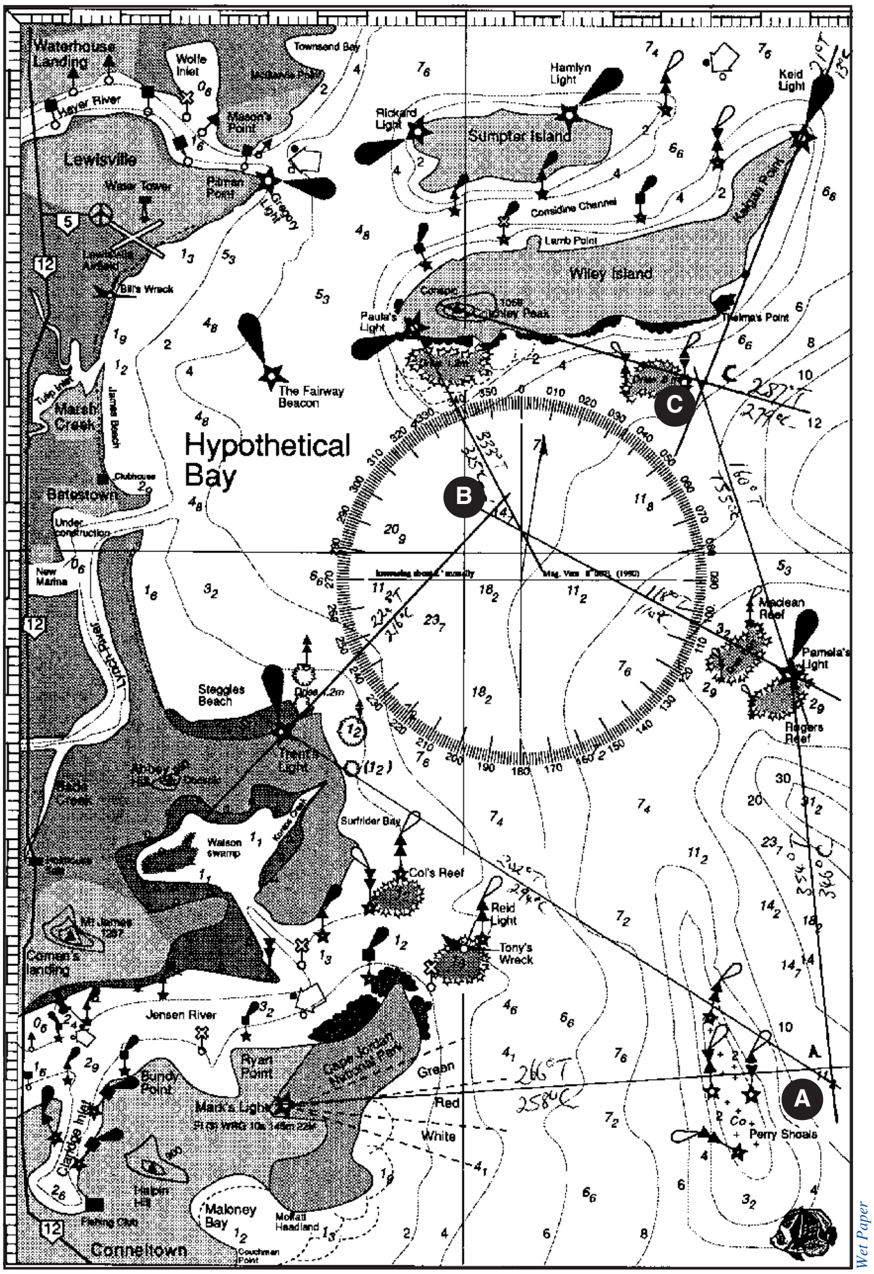
1. Calculate the compass course to steer to go between the following places:
   a. Fairway Beacon to Gregory River Light
   b. Gregory Light to Rickard Light
   c. Batestown Clubhouse to northern tip of Maclean Reef
   d. Pamela's Light to Keid Light
   e. Keid Light to Hamlyn Light

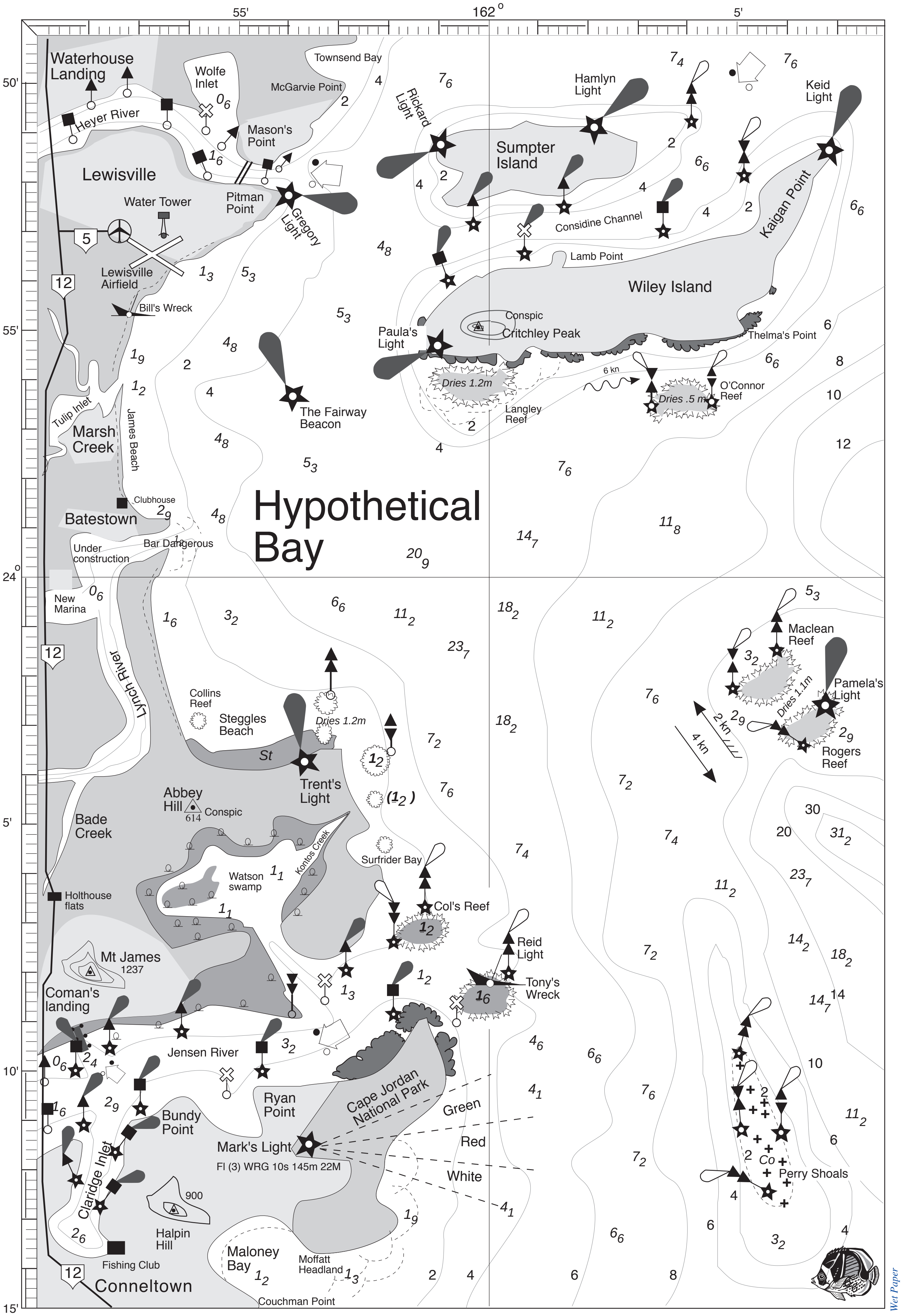
2. Draw in LOPs for the following hand bearing-compass observations. Each set of three gives a cocked hat position fix.
   a. Mark's Light 258°C, Trent's Light 294°C, Pamela's Light 346°C
   b. Trent's Light 216°C, Paula's Light 325°C, Pamela's Light 110°C
   c. Critchley Peak 279°C, Keid Light 13°C, Pamela's Light 155°C

Answers

1 a. 352°C, b. 63°C, c. 94°C, d. 353°C e. 267°C

2. a. Cocked hat on the 11.2 m depth east of Perry Shoal
   b. Cocked hat on 14.7 depth inside compass rose
   c. Fine cocked hat south of Thelma's Point, just east of the E cardinal mark.

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Claridge Inlet
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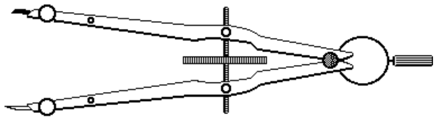
Fishing Club
Conneltown
Couchman Point
Wet Paper

Exercise 96
Position fixing



Its nice to know where you are and this exercise lets us use our chart to find out where we are.

Method

Having travelled out for 45 minutes from the marina in Lynch River, the skipper of *Wet Paper I* wants her first mate to plot their position. She takes three bearings, as follows, using a hand-bearing compass.

Bearing 1 to Pamela's Light CB =88^0C

Bearing 2 to Trent's Light CB = 163^0C

Bearing 2 to Mt James CB = 202^0C

These convert using error east compass least rule.

Step 1 Do conversion for bearing 1

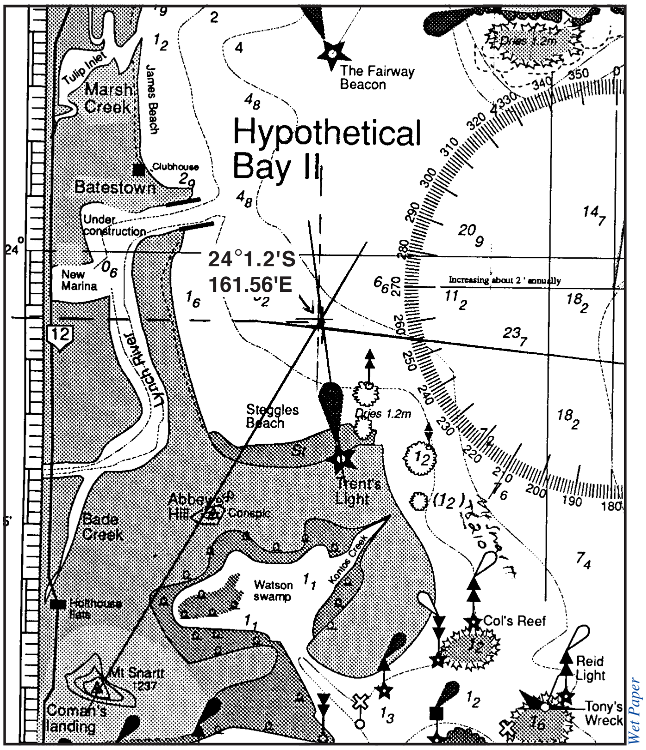
To Pamela's Light CB =88^0C TB = 96^0T

Step 2 Place rule or square on compass rose from the centre to Pamela's light.

Step 3 Walk rule or square to Pamela's Light and draw a line back towards the mainland.

Step 4 Do conversions for bearings 2 and 3 respectively and repeat as described in steps 2 and 3.

Step 5 Shade in your cocked hat as described in your textbook.



Questions

Find the latitude and longitude of the following positions and mark them on your chart.

Note all bearings have been made with a hand-bearing compass.

1. Position A.

   Bearing to Pamela's Light 20^0

   Bearing to Mark's Light 257^0

   Bearing to Trent's Light 314^0

   (Answer $24^0$11' S, $162^0$02'E)

2. Position B.

   Bearing to Pamela's Light 20^0

   Bearing to Paula's Light 147^0

   Bearing to Keid Light 72^0

   (Answer $24^0$11'S, $162^0$02'E)

3. Position C.

   Bearing to Halpin Hill 178^0

   Bearing to Mt James 306^0

   Bearing to Trent's Light 013^0

   (Answer $24^0$10' S, $161^0$54'E)

4. Position D.

   Bearing to Keid Light 358^0

   Bearing to Pamela's Light 175^0

   Bearing to Critchley Hill 263^0

   (Answer $23^0$55' S, $162^0$07'E)

5. Position E.

   Bearing to Mark's Light 357^0

   Bearing to Trent's Light 281^0

   Bearing to Paula's Light 320^0

   (Answer $24^0$07' S, $162^0$06'E)

6. Position F.

   Bearing to Halpin Hill 302^0

   Bearing to South Cardinal Mark Perry Shoals 74^0

   Bearing to Mark's Light 20^0

   (Answer $24^0$14' S, $161^0$55'E)

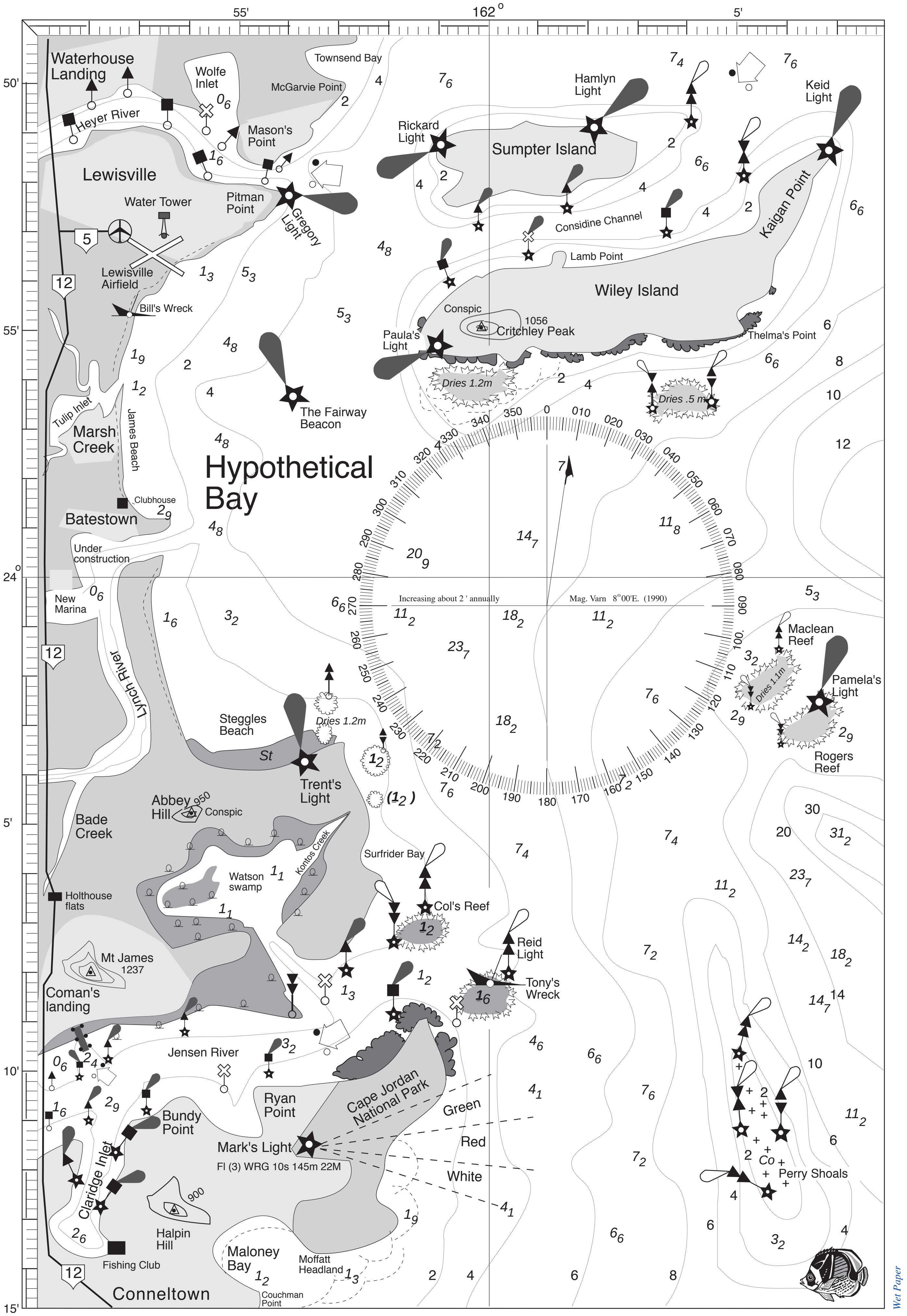
7. Position F.

   Bearing to Trent's Light 242^0

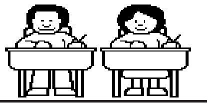
   Bearing to Fairway Beacon 310^0

   Bearing to Clubhouse at Batestown 285^0

   (Answer $24^0$02' S, $162^0$01'E)


55'
162°
5'
50'
55'
24°
5'
10'
15'
Waterhouse Landing
Wolfe Inlet
Townsend Bay
McGarvie Point
Heyer River
Mason's Point
Lewisville
Water Tower
Pitman Point
Gregory Light
Lewisville Airfield
Bill's Wreck
Rickard Light
Hamlyn Light
Sumpter Island
Keid Light
Kaigan Point
Considine Channel
Lamb Point
Wiley Island
Conspic
1056
Critchley Peak
Paula's Light
Thelma's Point
Dries 1.2m
Dries .5 m
The Fairway Beacon
Tulip Inlet
Marsh Creek
James Beach
Hypothetical Bay
Clubhouse
Batestown
Under construction
New Marina
Increasing about 2 ' annually
Mag. Varn 8°00'E. (1990)
Maclean Reef
Dries 1.1m
Pamela's Light
Rogers Reef
Lynch River
Steggles Beach
Dries 1.2m
St
Trent's Light
Abbey Hill
950
Conspic
Bade Creek
Kontos Creek
Watson swamp
Surfrider Bay
Col's Reef
Holthouse flats
Reid Light
Tony's Wreck
Mt James
1237
Coman's landing
Jensen River
Ryan Point
Cape Jordan National Park
Bundy Point
Green
Red
White
Mark's Light
Fl (3) WRG 10s 145m 22M
Claridge Inlet
900
Halpin Hill
Fishing Club
Maloney Bay
Moffatt Headland
Couchman Point
Conneltown
Co
Perry Shoals
Wet Paper

Exercise 97
Laying off and Plotting



Which course do you steer , how long will it take to get there and are you on course? This exercise lets you practice the skills in laying off and plotting a course.

Method

A day's outing and whale watching is planned off Thelma's Point. You live at Waterhouse Landing and are planning the trip.

From Gregory Light, you decide to go around Paula's Light and Wiley Island Reef as shown in the chart of Hypothetical Bay opposite.

1. You decide to avoid all water below 4 metres and draw four lines with changes in direction at A, B, C and D (as shown).
2. You calculate your distances in nautical miles for each course and the total distance. You figure you can make at least 10 knots and so decide that this is safe for the day.
3. Using your parallel rule and compass rose, you find the true course from Gregory River Light to point A is 153°T.

   This converts to 145°C (Error east, compass least)
4. You will need to know when you are at point A. From the chart you find that it is 6 miles from Gregory River Light.

   At 10 knots, this will take 0.6 hours, or 36 minutes, give or take a bit depending on currents, etc. and instrument error. (Your speedo might be slightly out).
5. From the chart you can see that Critchley Peak should be on your port beam quarter when you are at A, if you stayed on your intended track.

   It is far more reliable to use a hand-bearing compass reading, so on the chart you find that the bearing of Critchley Peak should be 25°T, which is 17°C when you are at point A.

On the day

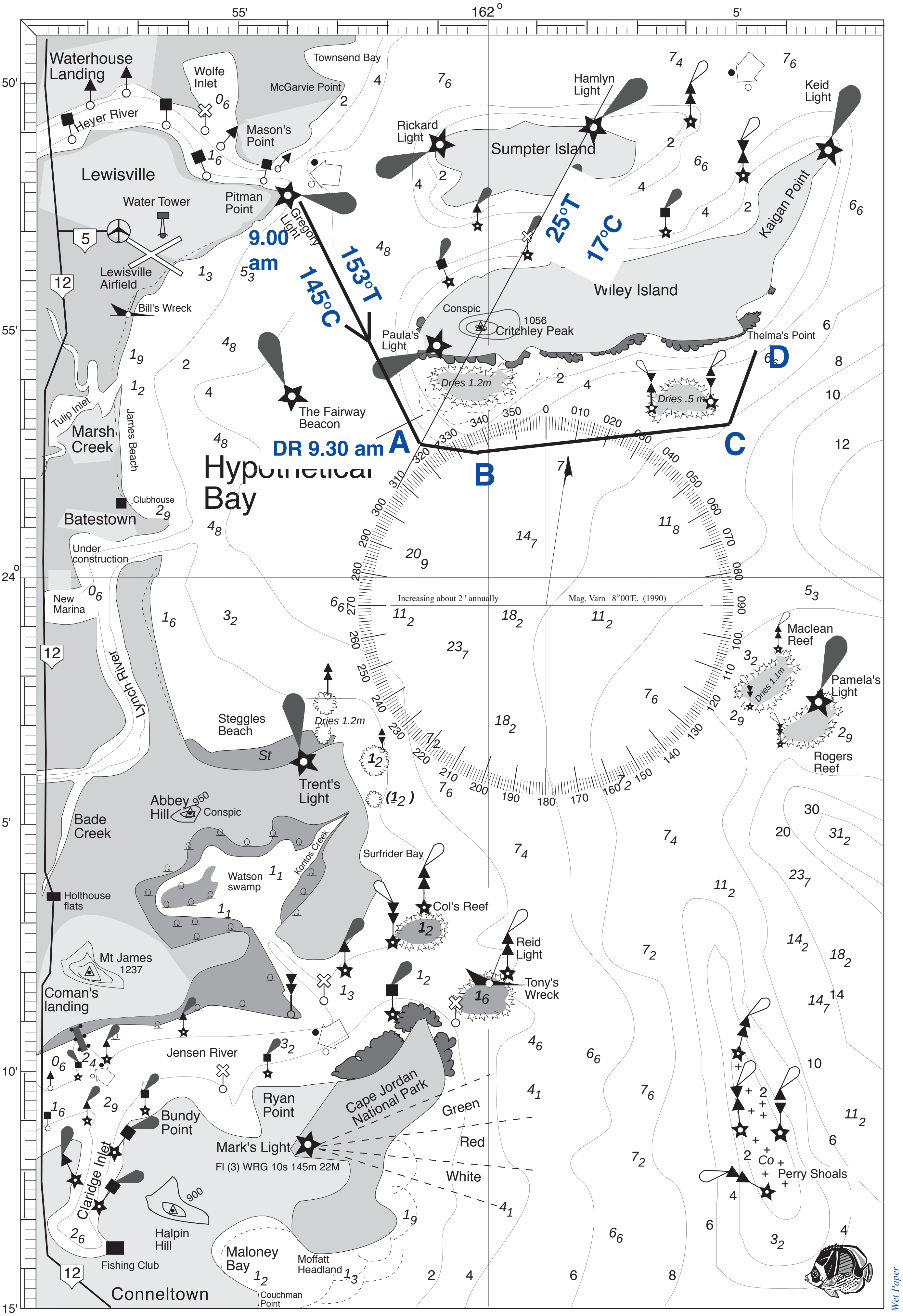
1. The day has come and you have your chart ready with the planned course marked in. You pass Gregory Light at 9 a.m. and so immediately mark it on the chart.
2. At 9.30 you are not sure of what you are looking at on your port beam, so calculate your DR position on the chart.

   Since your boat is travelling at 10 knots and it is 30 minutes since you passed Gregory Light, you should be 5 miles along your track.

   You mark this in as your 9.30 DR position, which gives you a better idea of what you should be able to see.
3. As you should have only about a mile to go to point A, you get your hand-bearing compass ready, and take a bearing on Critchley Peak. The reading is 22°C, so you are not yet up to point A.
   - Over the next few minutes, the compass bearing of Critchley Peak will decrease, and when it gets to 17°C· you know you are at point A and can alter course to point B.

Questions

1. Lay off a course from position A to position D as outlined in the figure opposite.
   a. How far is it from A to B, B to C and C to D ?
   b. What are the true bearings from B to Critchley Peak and Paula's Light?
   c. When you are supposed to be at position C, what compass bearings should you get on Critchley Peak and Keid Light?
   d. What compass course should you steer from A to B? You propose to make 10 knots, what is your ETA at position B?
   e. What is your compass course from B to C?
   f. What is your compass course from C to D?
2. A fishing trip is planned to Rogers Reef from the Fishing Club at Connelltown. Lay off a compass course from midway between the two reefs at the entrance to Jensen River to Rogers Reef. You plan to leave at 0800 hrs.
   a. You can make 12 knots. Estimate your ETA at Rogers Reef.
   b. The fishing is lousy and you stay for only one hour. Avoiding all water below 4 m, plot the shortest course to the marina in Lynch River.
   c. When you pass Maclean Reef Light, what compass course do you steer?
   d. You make 6 knots, what is your ETA at the marina?
   e. You left the fishing club in the morning. How far have you travelled during the day?


55'
162°
5'
50'
55'
24°
5'
10'
15'
Waterhouse Landing
Wolfe Inlet
Townsend Bay
McGarvie Point
Heyer River
Mason's Point
Lewisville
Water Tower
Pitman Point
Gregory Light
Lewisville Airfield
Bill's Wreck
9.00 am
153°T
145°C
Rickard Light
Hamlyn Light
Sumpter Island
Keid Light
Kaigan Point
25°T
17°C
Wiley Island
Conspic
1056
Critchley Peak
Paula's Light
Thelma's Point
D
Dries 1.2m
Dries .5 m
The Fairway Beacon
DR 9.30 am
A
B
C
Tulip Inlet
Marsh Creek
James Beach
Hypothetical Bay
Clubhouse
Batestown
Under construction
New Marina
Increasing about 2 ' annually
Mag. Varn 8°00'E. (1990)
Lynch River
Maclean Reef
Pamela's Light
Dries 1.1m
Rogers Reef
Steggles Beach
Dries 1.2m
St
Trent's Light
Abbey Hill
Conspic
Bade Creek
Kontos Creek
Watson swamp
Surfrider Bay
Col's Reef
Holthouse flats
Reid Light
Tony's Wreck
Mt James
1237
Coman's landing
Jensen River
Ryan Point
Bundy Point
Cape Jordan National Park
Green
Red
White
Mark's Light
Fl (3) WRG 10s 145m 22M
Perry Shoals
Claridge Inlet
Halpin Hill
Fishing Club
Maloney Bay
Moffatt Headland
Couchman Point
Conneltown
Wet Paper

Exercise 98
Buoyage
Systems

Method

Based on an exercise devised by the Marine Studies teachers and Don Reid of Gympie High School

1. Study the photo in Figure 98.1 and with the assistance of your industrial arts department, construct a series of models that represent lateral and cardinal marks.

   The models could be used as follows:

   - As a small ship simulator — any harbour or shipping channel in Australia can be modelled from a chart and students steer a model boat through the course. Adverse conditions could be simulated by spraying salt water around the room or using a large fan for a bit of fun.
   - before going on camp, Don uses the models to show students the navigation channels and types they will encounter. The class then discusses out of bounds areas, fishing or bait gathering spots.
   - Don's classes use the models to set up a model harbour.

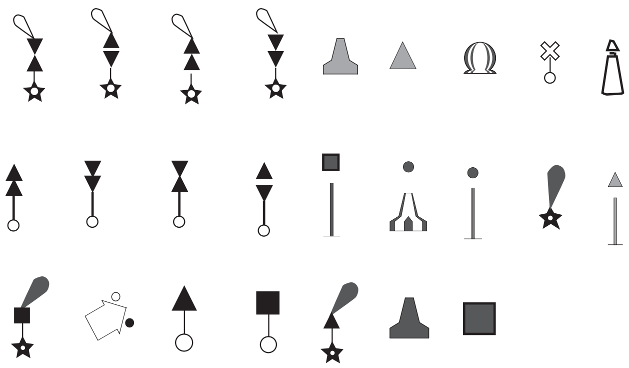
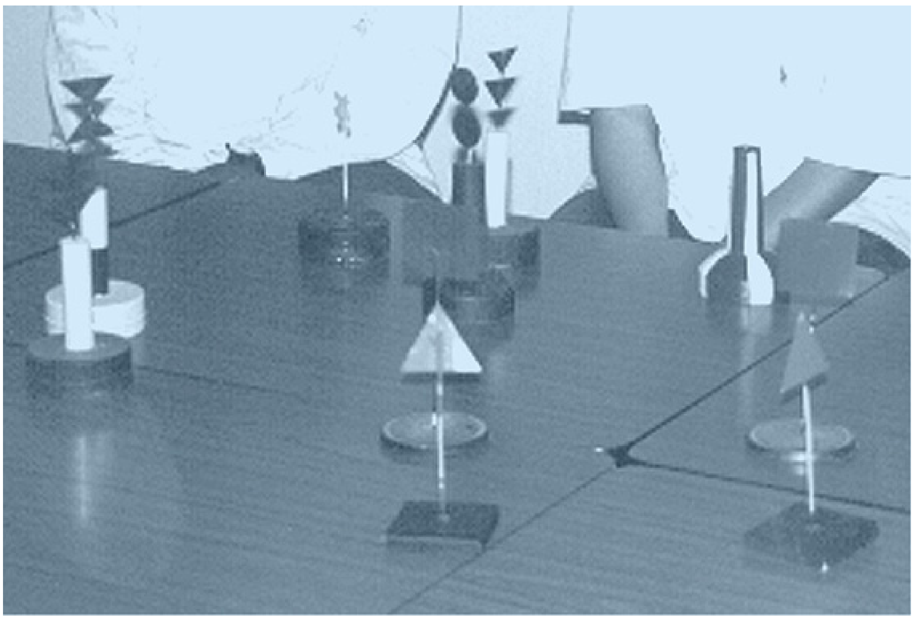


Figure 98.2 Chart symbols that could be used in this exercise

Research assignment

Time passes in Hypothetical Bay and as the population of Holthouse Flats and Batestown increases, the community decides on a new ecotourism project. Lynch River, Bade Creek and Watson Swamp are dredged and land adjacent filled for future developments as shown in Figure 98.3. Soundings are taken and you have the job of erecting a buoyage system.

1. Make a copy of Figure 98.3 and use the chart symbols in Figure 98.2, as well as any others you may feel appropriate, to plan a buoyage system for the new marina, airport and harbour town development.
2. Use a pencil first to plan the exercise and then ink and colour in your markers.
3. Decide where lights would be appropriate and where a lateral system would best serve the boating public.



Wet Paper

Figure 98.1 Model buoyage marks (Models courtesy Gympie State High School)

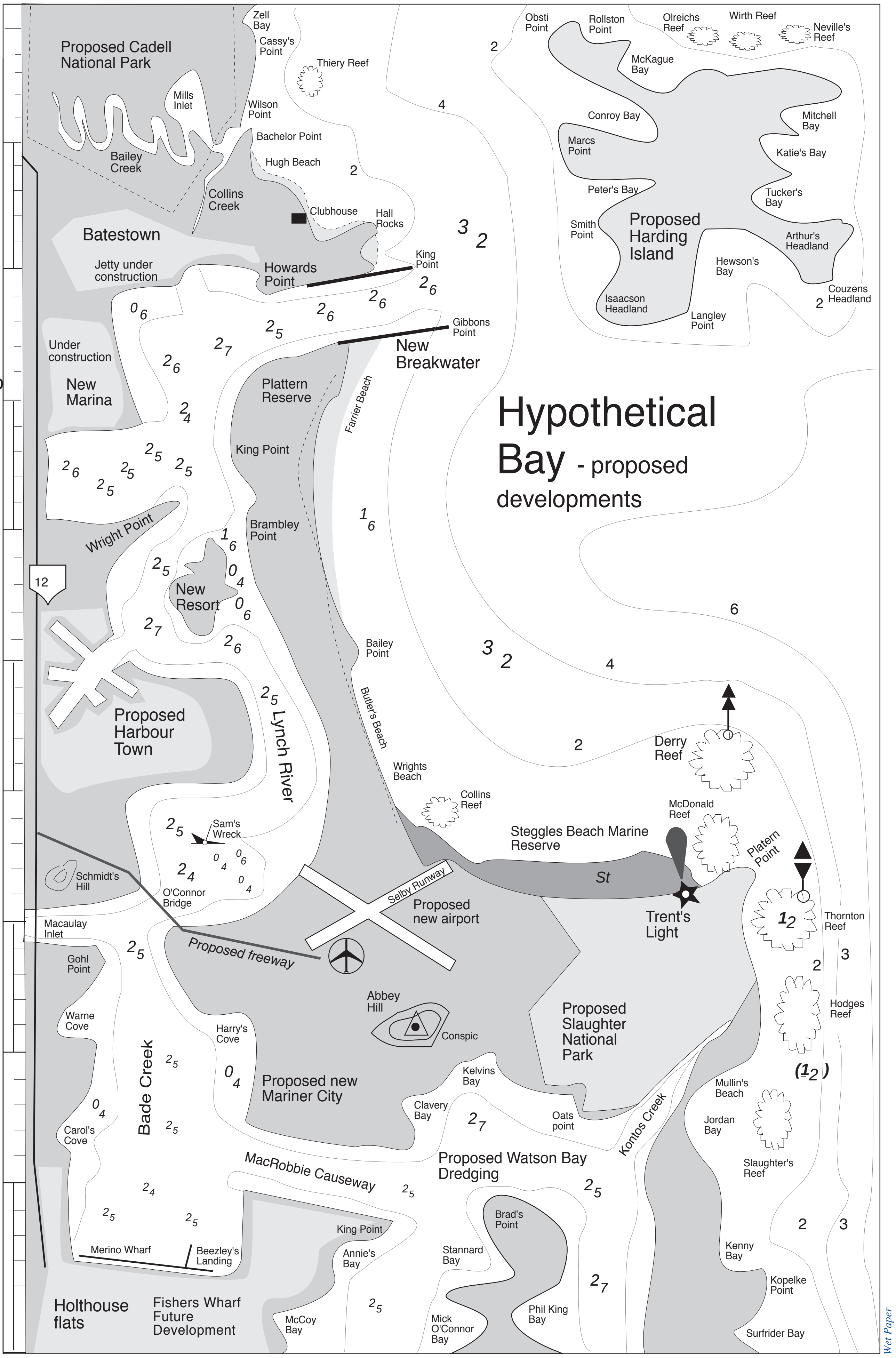


Figure 98.3 Hypothetical Bay proposed developments

EXERCISE 99
YOUR LOCAL CHART

When you look at charts for the very first time they look quite complicated. This activity seeks to introduce you to some chart features that don't occur on a map.

Later activities will help you use the chart.

METHOD

1. Look carefully at the map and then at the chart and write a list of 10 differences between the chart and the map.
2. Record these in your notebook, giving your reasons for the differences.

QUESTIONS

1. What is the deepest section of water on the chart?
2. What is the most northerly point on the chart?
3. Why does a chart need latitude and longitude?
4. What date was the chart prepared?
5. Is there a scale on the chart and if so what scale is used?
6. What are the main shipping lights nearest the local port?
7. What is the main degree of longitude and latitude?
8. Is the chart in fathoms or metres?
9. If you had to navigate a ship into port, why would you use a chart rather than a map?
10. Locate the photographs of the navigation marks in your textbook and make labelled drawings of the following.
    - Starboard lateral mark
    - Port lateral mark
    - Port hand floating can
    - Starboard mark on pole
    - Port mark on pole
    - North cardinal mark
    - South cardinal mark
    - East cardinal mark
    - West cardinal mark
11. Look at the chart on page 88 (*Marine Studies* first edition) and behind chapter cover in the second edition. Locate the compass rose and describe two important features.
12. Select a venue for an overnight stay on your chart, noting:
    a. What time should you leave to arrive three hours before sunset?
    b. Will tides affect your trip? If so, what times will affect the trip?
    c. How far are you going?
    d. What type of boat will you be in?
    e. What types of forecast will cancel your trip ?
    f. How many are you taking?
    g. How much fuel will you need?
    h. What will be your first compass course?
    i. How many course changes will you be making?
    j. What type of buoyage system (if any) is shown on your chart?

MATERIALS AND EQUIPMENT (PER GROUP)

Equipment required

- chart of the local area
- map of the local area
- copy of book *Marine Studies*

Exercise 100
Chart your school oval

Based on an original exercise by Bob Critchley, Bowen SHS (reproduced with permission).

Materials and equipment (per group)

Equipment required

- assistant to record bearings
- good hand bearing compass
- 100 m tape
- drawing board, T square, A3 paper
- copy of compass rose, glue, scissors

Research project

This exercise allows you to practice you skills without getting wet.

1. Decide on five to eight easily identified objects to include on your chart. Don't clutter the chart up with unnecessary features.
2. Lay out 100 m of tape parallel to the line of the objects.

   Think of them as landmarks on a shoreline and include only one or two on the other side of the oval as islands.
3. From each end of the tape, record accurate bearings (to 0.5° precision), of each of the selected objects and the line of the tape measure.

   Convert all bearings to true using the variation on the compass rose you have selected to paste onto the chart.
4. If you are confident, prepare the following exercises:
   a. Plan a course distance, speed and time as accurately as you can to travel from the library, to the animal shed then the goal posts. Now walk the course with a trundle wheel to see how accurate you were.
   b. Place a peg in the ground with a Mars Bar and give the latitude and longitude for the class to find the bar.
   c. Plot a new object on the chart. You have just discovered a new fishing spot called cricket pitch. Use your instruments to plot the new location
5. On the drawing board, using a scale of 1 cm = 10 m, draw in lightly the base line.

   From each end, draw in the LOP of each object and plot the object.
6. Add the compass rose and position it as accurately as you can.
7. Add the artificial latitude and longitude scale using your local latitude and longitude.

   Make 1' of latitude 1 cm long.
8. Put a warning on the chart that the 1' = 10 m is artificial and would normally be 1 nautical mile.

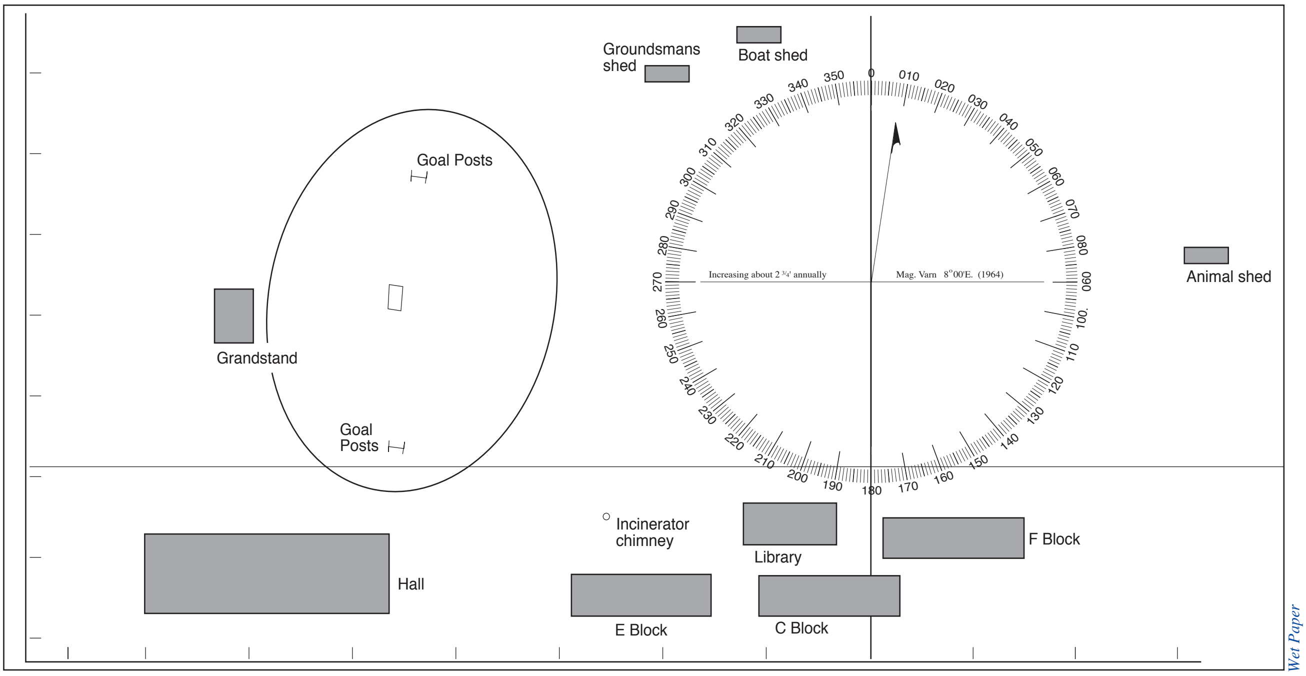


Figure 100.1 An example of a chart of a school oval

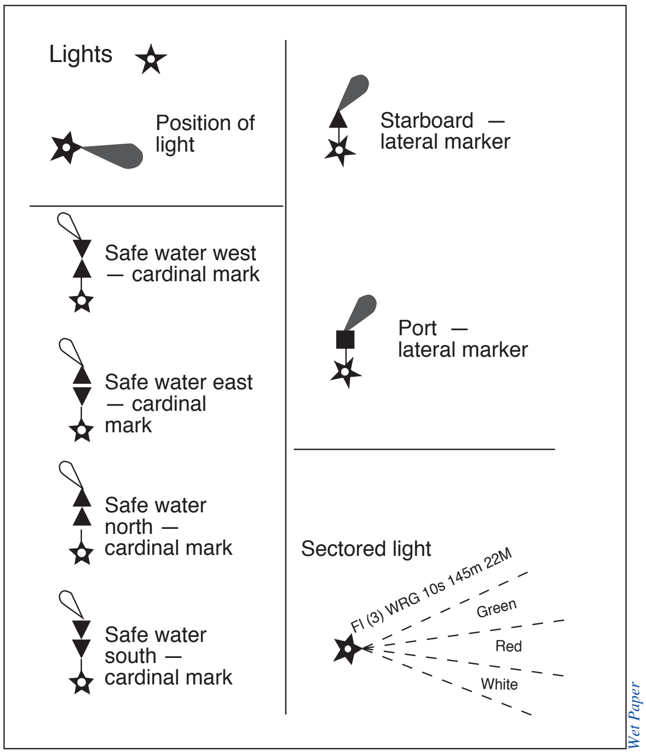
Exercise 101 Your own chart

Project

Make up a hypothetical bay of your own using the symbols on this page.

Additional references

Charts and chart symbols and maritime buoyage system, published by the Hydrographer of the Navy, 1982, Commonwealth of Australia.



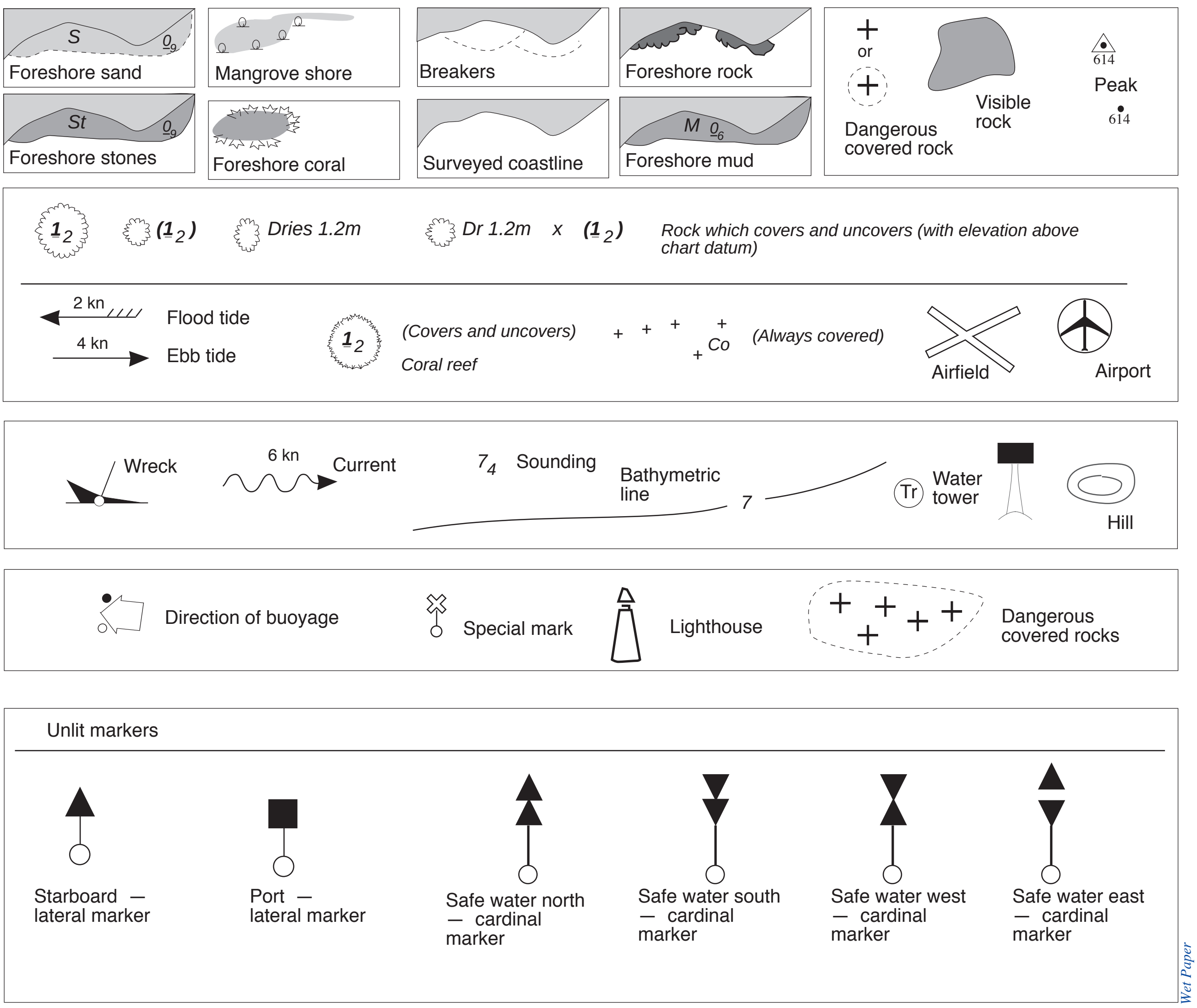


Fig 104.1 Common chart symbols

Exercise 102
A3 Chartwork

Cape Hillsborough Channel. Prepared by Bob Critchely, Bowen SHS. Reproduced with permission.

Notes

1. This exercise refers to the chart portion reproduced on pages 190 – 191.
2. Variation for 1993. No Deviation.
3. Work in soft lead pencil.
4. Leave all your working on the chart. Written answers to be done on a separate sheet and attached to chart.
5. All distance to within 0.1 mile, and all angles to 0.5°.
6. Your teacher may have prepared a chart and overlays with all the solutions is in the room so you can check your progressive working.

Questions

This exercise uses the A3 Version 5169 B on pages 192-193 and variation 1994 - nearest degree.

1. What are the latitude and longitude of the following points?
   a. Hempel Rock
   b. Coppersmith Rock Lighthouse
   c. Hill 670 Cockermouth Island.

2 You are at the anchorage at Maryport Bay, Brampton Island, in position 20°48' S 149°16' E. Mark this on your chart as position A and answer the following questions.

   a. What is your magnetic variation to the nearest whole degree?
   b. You want to go to Coffin Island. What compass course will you steer?
   c. How far is it from position A to Coffin Island?
   d. How long will it to take to arrive at Coffin Island if you travel at 6 knots?
   e. After you have been travelling for half an hour, what will be your DR position? Mark this on the chart as position B.
   f. You are worried about what you can see and decide to fix your position. You take the following bearings:

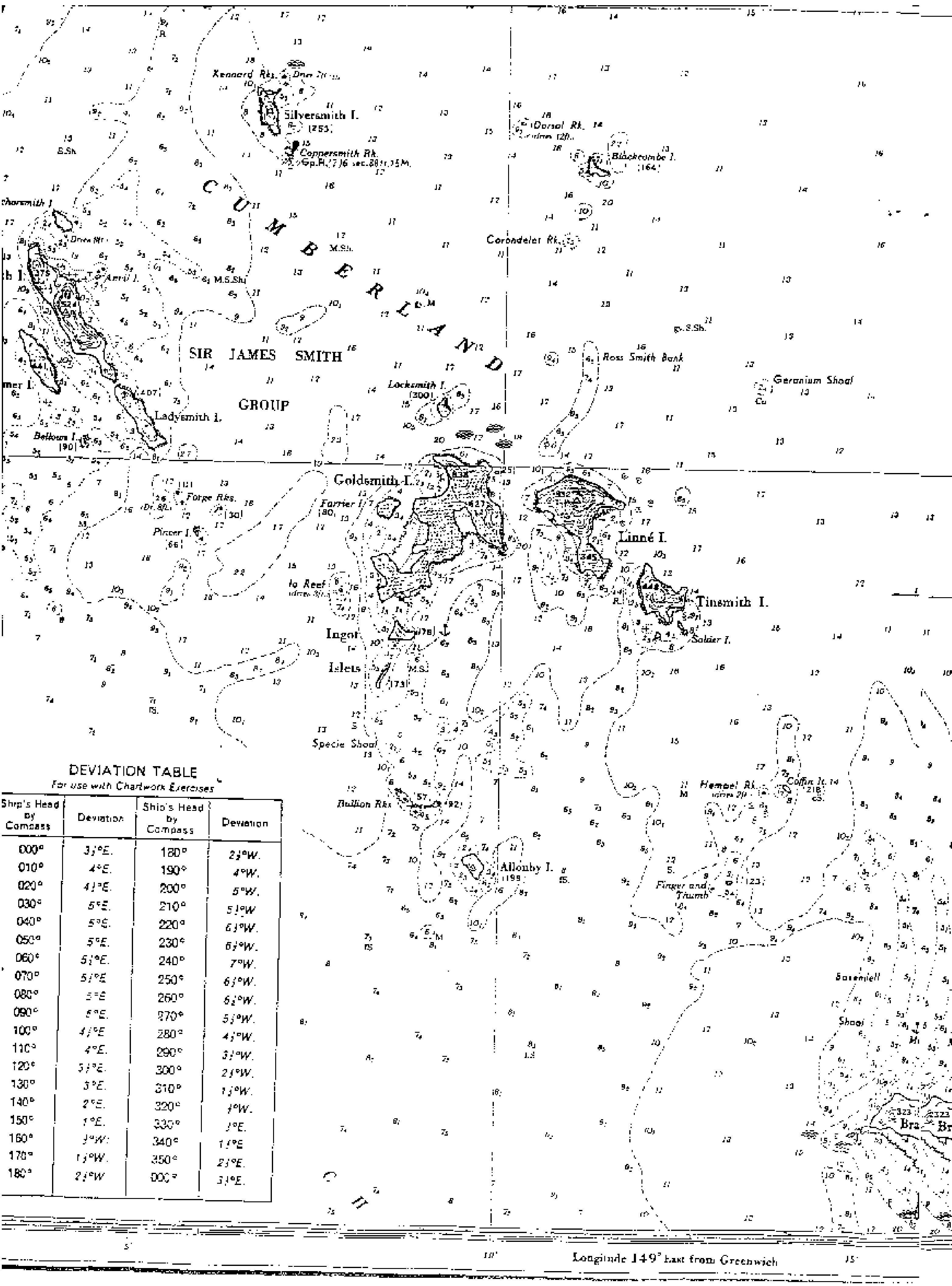
      Allonby Island Hill 198 273°
      Brampton Island Hill 323 131°
      Tinsmith Hill 448 340°

      Plot this position and mark it on the chart as position C.
   g. What are the rocks you can see in front of you?
   h. How do you account for the change in position from point B to point C?
   i. If the error in your position from B to C is caused only by current, how fast was the current flowing? Which direction was it flowing?

3. a. You are anchored near Geranium Shoal. Locksmith - S (southern tips of Locksmith Island) is in transit with Ladysmith - S. You also have Allonby Island Hill 198 in transit with Tinsmith Island - SE. Mark this position as position D.
   b. What is the latitude and longitude of point D?
   c. How far are you from Geranium Shoal?
   d. What course would you steer to arrive at the shoal?
   e. How long will it take you to get there at 6 knots?
   f. It is now a 3 m tide. What will your Metric Depth sounder read as you find the shoal?

Answers

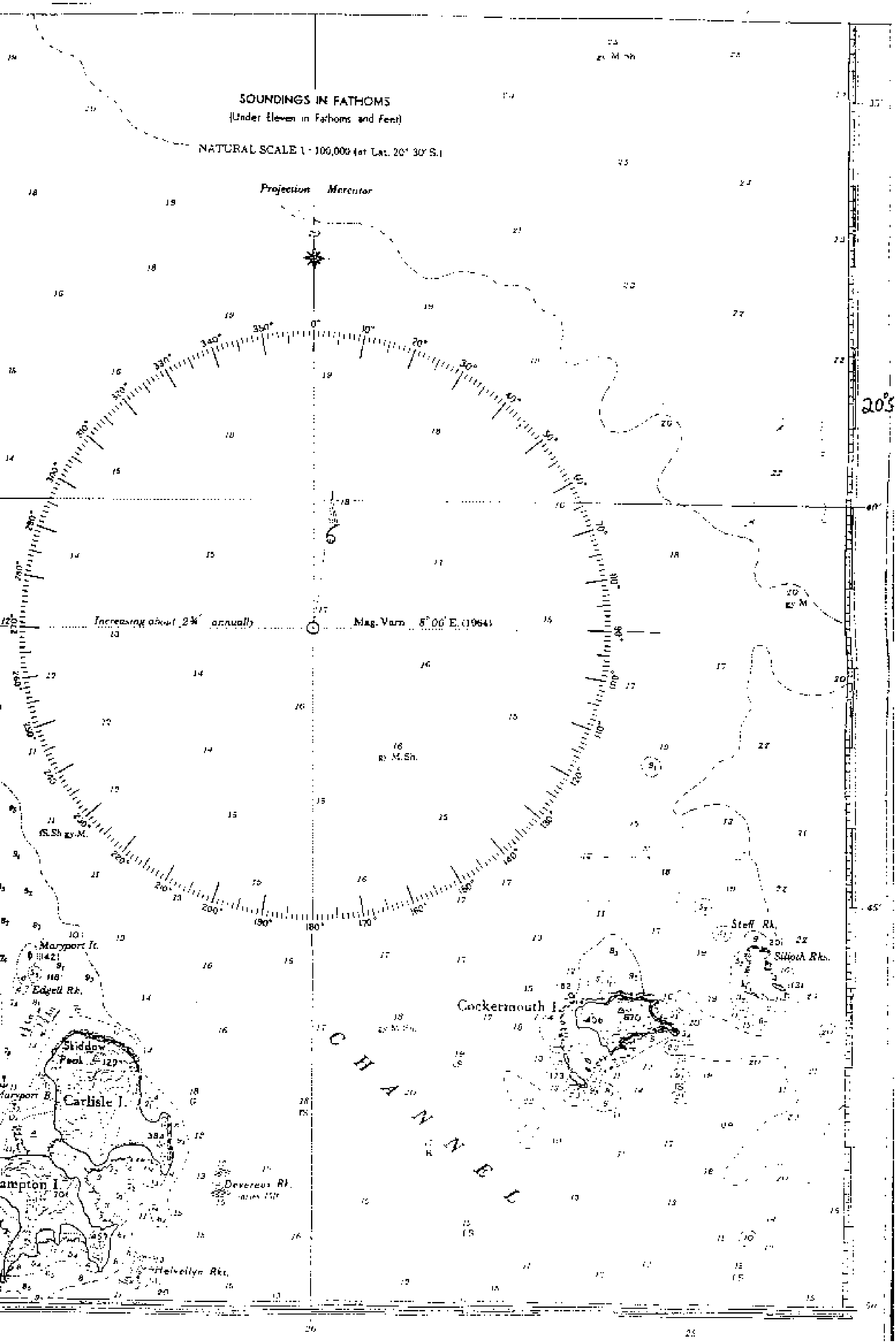
1. a. 20°44.2' S 149°13.7 E
   b. 20°36.0' S 149° 7.0' E
   c. 20°46.3' S 149°24.1' E
2. See answer chart.
   a. 9°22' ≈ 9° (to nearest whole degree).
   b. T.C. 335° C.C. 326°
   c. 4.2 miles.
   d. 42 minutes.
   e. See answer chart. (10 fathoms line).
   f. T.B. C.B. Allonby Island282° 273°
      Brampton Island. 140° 131°
      Tinsmith Hill 448. 349° 340°
   g. Finger and Thumb Rock.
   h. (i) Steered the wrong compass course. (ii) Steel interference. (iii) Current and tide.
   i. 3 knot current. (1.5 miles in .5 hour). SW direction.
3. a. See answer chart.
   b. 20°38.6' S 149°15.2' E
   c. 1.4 miles.
   d. C.C. 250° T.C. 259°
   e. 15 minutes.
   f. 8 m. 2 fathoms 4 feet = 5 m .5 tide (3 m).



DEVIATION TABLE

For use with Chartwork Exercises

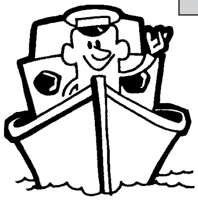
Ship's Head by Compass	Deviation	Ship's Head by Compass	Deviation
000°	3½°E.	180°	2½°W.
010°	4°E.	190°	4°W.
020°	4½°E.	200°	5°W.
030°	5°E.	210°	5½°W
040°	5°E.	220°	6½°W.
050°	5°E.	230°	6½°W.
060°	5½°E.	240°	7°W.
070°	5½°E	250°	6½°W.
080°	5°E	260°	6½°W.
090°	5°E.	270°	5½°W.
100°	4½°E	280°	4½°W.
110°	4°E.	290°	3½°W.
120°	3½°E.	300°	2½°W.
130°	3°E.	310°	1½°W.
140°	2°E.	320°	½°W.
150°	1°E.	330°	½°E.
160°	½°W.	340°	1½°E
170°	1½°W.	350°	2½°E.
180°	2½°W	000°	3½°E.


SOUNDINGS IN FATHOMS
(Under Eleven in Fathoms and Feet)
NATURAL SCALE 1 : 100,000 (at Lat. 20° 30' S.)
Projection Mercator
Increasing about 2¾' annually
Mag. Varn. 5° 00' E. (1964)
Maryport It.
Edgell Rk.
Skiddaw Peak
Carlisle I.
Maryport B.
Devereux Rf.
Helvellyn Rks.
Cockermouth I.
Steff Rk.
Silloth Rks.
CHANNEL
20°S

Exercise 103
Chart 5169 B

Cape Hillsborough Channel. Prepared by Bob Critchely, Bowen SHS. Reproduced with permission.

This exercise uses the full chart 5169 B. Copies may be purchased from local ship's chandlery.



Notes

1. This exercise uses the full chart 5169 B. Copies may be purchased from local ship's chandlery.
2 Variation for 1993. No Deviation .
3. Work in soft lead pencil.
4. Leave all your working on the chart. Written answers to be done on a separate sheet and attached to chart.
5. All distance to within 0.1 mile, and all angles to 0.5°.
6. Your teacher may have prepared a chart and overlays with all the solutions is in the room so you can check your progressive working.

Questions

1. At 0800 hr, you establish your position as position A at 20° 58.6'S 149° 10.3'E.

   a. What is your position relative to Green Island? Your compass course is 43.5°, and speed 6 knots. There is no wind or tidal effects.

   b. What is your DR position (lat. and long.) at 1000 hr? Mark this as B.

   c. According to the tide tables, the tide now is 3 m. What should your depth sounder be reading, in metres?

   d. Describe in words what you would expect to see around you to confirm your position. You should be able to describe at least three transit observations visible from B.

2. You continue on this course for a short time, until your depth alarm tells you (after tidal correction) that you have just crossed the 10 fathom line.

   a. What time should this occur? Mark the position as C on your chart.

   b. As soon as the depth reads 10 fathoms, you altered course to go to Geranium Shoal, approximately 3 mile NE of Linne Island. What compass course should you steer?

   c. You also increased your speed to 8 knots when you altered course. Mark in your DR position after another hour as position D.

   d. You decide to fix your position when Coffin Islet is in transit with the middle of Allonby Island on your port beam. This happens at 1130 hr, and at the same time you take hand-bearing compass readings of 178° on Skiddaw Peak, Carlisle Is, and 109° on Cockermouth Island hill 67°.

      Fix your position, and mark it as E on your chart, and show any working on your sheet.

   e. What course should you now steer to get to Geranium Shoal, and what is your ETA?

   f. Give at least three transits to confirm your position as over Geranium Shoal.

3. You fish on Geranium Shoal until dark, and all you can see is the Coppersmith Light.

   a. Describe what you would see.

   b. You up anchor and chase a school of fish chopping on the surface for a while, not keeping track of where you are going. Now you decide it's time to go to an anchorage for the night.

      To your horror, you discover the radar is not working, and the night is so dark you can't see anything except the Coppersmith Light.

      You decide to do a running fix on Coppersmith Light. You steer exactly to compass north, travelling at 6 knots. At 2100 hr, you take a hand-bearing compass reading of 274.5° on the light. At 2145 hr, the compass bearing of the light is now 240.5°. Fix your position as F.

      What is your latitude and longitude at F?

   c. Why did you choose to go North, seeing as you really want to go to the Shaw Is anchorage?

   d. You immediately turn at F, and head straight for the middle of the gap between Thomas Island and Kennard Rocks (even though you can't see it in the dark!).

      What course will you now steer? Speed is still 6 knots.

   e. At 2235 the bearing of the Coppersmith Light is 203° compass. Fix your position on the chart as G.

   f. What action will you now take to get safely through the gap in the dark?

g. You enter the obscured sector of the light. If you are on your intended course, how long will it be before you see the light again?

4. Once you can see the Coppersmith Light again, you intend turning NW, past St Helen Rock and Platypus Rock, until you can see the lights of your friend's boat anchored in the anchorage behind Burning Point. (You called them on the radio. They told you were a dill for not being safely anchored before sunset, but would leave plenty of lights on for you anyhow!)

   a. What course should you steer?

   b. What is your clearing bearing on Coppersmith Light behind you?

   c. Which way will you turn if your observed bearing of Coppersmith Light is increasing to greater than the clearing bearing?

   d. About how long will it take on this course before you see the lights of your friend's boat?

   e. Would you turn as soon as you saw their lights? Explain your answer fully.

5. On the way to Burning Point, your radar suddenly comes to life again (someone finally turned on the right switch). You take the following range readings: SW tip of Shaw Island 1.5 miles; Tip of Cape Conway 5.25 miles; and NW tip of Blacksmith Island 5.4 miles.

   a. Fix your position on the chart as H.

   b. What course would you now steer to clear Burning Pt by .5 mile before you make it safely to the anchorage on radar?

Answers

1. a. 1 mile ENE of Green Island NE, bearing 074.

   b. 20° 51.3'S 149° 20.5'E.

   c. Depth sounder 28.5 m.

   d. Starboard beam:- St. Bees Island Hills 938 and 1237 in line with NE tip of Keswick Island.

   Port bow:- Cockermouth Island, Island hill 173 and 670 in line.

   Port beam:-Gap between Brampton and Carlisle, see Finger and Thumb rock 123, and end of Goldsmith Island in background.

2. a. 1018 hr. (1.8 mile at 6 kn = 0.3 hr = 18 mins)

   b. 315.5° compass. (325 T less 9.5)

   e. 308° compass. (317.5 T less 9.5), 5.6 mile, 0.7 hr = 42 min, ETA 1212 hr.

   f. Linne S and Bullion; Linne N and Goldsmith 627; Locksmith S and Ladysmith S hill; Blackcombe E and Shaw peak.

3. b. 20° 33.4'S 149° 15.0'.

   c. It is a safe direction to keep you clear of Blackcombe Island in case you wandered in to the West when you were chasing fish, and gives enough distance to do a running fix.

   d 254° compass.

   f. Alter course to 277.5° C for 1 mile or 10 minutes, and then resume your original course of 254°.

   g. 7.5 mins (0.75 mile at 6 kn)

4. a. 304° C b. Less than 124° C c. Turn to port

   d. About 50 mins.

   e. Might be looking through the shallow gap between Burning Pt island and Shaw Island. Also, want to clear the tide race at Burning Pt.

5. b. 001° C

EXERCISE 104

PLANNING A TRIP

Cape Hillsborough Channel. Prepared by Bob Critchely, Bowen SHS. Reproduced with permission.

Notes

1. This exercise uses the full chart 5169 B. Copies may be purchased from local ship's chandlery
2 Variation for 1993. No Deviation
3. Work in soft lead pencil.
4. Leave all your working on the chart. Written answers to be done on a separate sheet and attached to chart.
5. All distance to within 0.1 mile, and all angles to 0.5°.
6. Your teacher may have prepared a chart and overlays with all the solutions is in the room so you can check your progressive working.
7. You need the table of extreme ranges at the end of this exercise
8. This exercise follows on from Exercise 103.

QUESTIONS

1. You are at position A from Exercise 103, about 1 mile NE of Green Island.
   a. Would you be able to see any of the Repulse Islands through good binoculars, if your height of eye is 3 m? Explain fully.
   b. Would you be able to see Tinsmith Island from A? Explain.
2. a. What is your position, as latitude and longitude, if Coppersmith Light is bearing 356° C, and you can see it standing up with an eye height of 3 m, but not sitting down with an eye height of 2 m?

   Mark your position on the chart as H.

   b. From H, what compass course would you steer to go to East Repulse Island? (Aim for the hill.)
   c. You can't make out the island because of distance and haze, so you steer a compass course. After one hour travelling at 5 knots on this course, you fix your position as I at 20° 45.8' S 149° 2.6' E. What is the set and rate of the current you are experiencing?
   d. What course would you now steer to go to East Repulse Island, so as to compensate for the current you are experiencing? The boat is still travelling at 5 knots.
   e. What will be your VMG on this new course?
3. On a rising spring tide the current between Cape Conway and Shaw Island runs South (T) at 2 knots.
   a. What compass course would you steer to go East (T) in a boat that can only travel at 5 knots? What will be your VMG?
   b. In the same boat and area, what course (C) and what VMG if you want to travel SE (T)?
   c. In the same boat again, what course (C) and what VMG if you wanted to travel NW (T)?
4. Plan a daylight trip from the anchorage at Keswick Island, to Maryport Bay at Carlisle Island, to Farrier Island, to the bay on the NW side of Thomas Island, to Genesta Bay on the mainland, and then to Rocky Point at Conway beach.
   a. Plan each leg, compass courses to waypoints, clearing lines where necessary, distances, times for a boat travelling at 8 knots, expected important transits and observations. You do not know the area, and visibility is only moderate due to intermittent rain, and winds about 20 knots making the seas dangerous in some areas.
   b. Show your intended course on the chart, and write up a table indicating all the information you would plan on using.
   c. When finished, exchange your chart and notes with another student, and study their planned trip. Make constructive criticisms of each others' planning and discuss your viewpoints. There is no correct answer to this, but some plans will be a lot smarter than others and demonstrate better navigation and seamanship.

   Both planning and criticising a planned trip are part of the navigation course.

Answers

1. a. No, as the Repulse Islands are 27.5 miles away, and for their height the geographic range is 20.8 miles. They will be over the horizon.
   b. Yes, just the top. Geographic range 28.8 miles, and island is only 17 miles away.
2. a. 20° 50.3' S 149°5.6' E, 14.4 mile range by interpolation.
   b. 311° C (only 9° variation on this side of chart)
   c. NE 32° T at 0.8 knot.
   d. 299° C. *
   e. 5.1 knots. *

   * note that the current is most likely mainly tidal, and will change during the course of this journey.
3. a. 57° C, VMG 4.6
   b. 110° C, VMG 6.2
   c. 322° C, VMG 3.4

TABLE 40
Geographic Range

Object height		Height of eye of observer in feet and meters										Object height	
Feet		7	10	13	16	20	23	26	30	33	36		Feet
	Meters	2	3	4	5	6	7	8	9	10	11	Meters	
		Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles		
0	0	3.1	3.7	4.2	4.7	5.2	5.6	6.0	6.4	6.7	7.0	0	0
3	1	5.1	5.7	6.2	6.7	7.3	7.6	8.0	8.4	8.7	9.0	1	3
7	2	6.2	6.8	7.3	7.8	8.3	8.7	9.1	9.5	9.8	10.1	2	7
10	3	6.8	7.4	7.9	8.4	8.9	9.3	9.7	10.1	10.4	10.7	3	10
13	4	7.3	7.9	8.4	8.9	9.5	9.8	10.2	10.6	10.9	11.2	4	13
16	5	7.8	8.4	8.9	9.4	9.9	10.3	10.6	11.1	11.4	11.7	5	16
20	6	8.3	8.9	9.5	9.9	10.5	10.8	11.2	11.6	12.0	12.3	6	20
23	7	8.7	9.3	9.8	10.3	10.8	11.2	11.6	12.0	12.3	12.6	7	23
26	8	9.1	9.7	10.2	10.6	11.2	11.6	11.9	12.4	12.7	13.0	8	26
30	9	9.5	10.1	10.6	11.1	11.6	12.0	12.4	12.8	13.1	13.4	9	30
33	10	9.8	10.4	10.9	11.4	12.0	12.3	12.7	13.1	13.4	13.7	10	33
36	11	10.1	10.7	11.2	11.7	12.3	12.6	13.0	13.4	13.7	14.0	11	36
39	12	10.4	11.0	11.5	12.0	12.5	12.9	13.3	13.7	14.0	14.3	12	39
43	13	10.8	11.4	11.9	12.4	12.9	13.3	13.6	14.1	14.4	14.7	13	43
46	14	11.0	11.6	12.2	12.6	13.2	13.5	13.9	14.3	14.7	15.0	14	46
49	15	11.3	11.9	12.4	12.9	13.4	13.8	14.2	14.6	14.9	15.2	15	49
52	16	11.5	12.1	12.7	13.1	13.7	14.0	14.4	14.8	15.2	15.5	16	52
56	17	11.9	12.5	13.0	13.4	14.0	14.4	14.7	15.2	15.5	15.8	17	56
59	18	12.1	12.7	13.2	13.7	14.2	14.6	15.0	15.4	15.7	16.0	18	59
62	19	12.3	12.9	13.4	13.9	14.4	14.8	15.2	15.6	15.9	16.2	19	62
66	20	12.6	13.2	13.7	14.2	14.7	15.1	15.5	15.9	16.2	16.5	20	66
72	22	13.0	13.6	14.1	14.6	15.2	15.5	15.9	16.3	16.6	16.9	22	72
79	24	13.5	14.1	14.6	15.1	15.6	16.0	16.4	16.8	17.1	17.4	24	79
85	26	13.9	14.5	15.0	15.5	16.0	16.4	16.8	17.2	17.5	17.8	26	85
92	28	14.3	14.9	15.4	15.9	16.5	16.8	17.2	17.6	17.9	18.2	28	92
98	30	14.7	15.3	15.8	16.3	16.8	17.2	17.5	18.0	18.3	18.6	30	98
115	35	15.6	16.2	16.8	17.2	17.8	18.2	18.5	19.0	19.3	19.6	35	115
131	40	16.5	17.1	17.6	18.1	18.6	19.0	19.4	19.8	20.1	20.4	40	131
148	45	17.3	17.9	18.5	18.9	19.5	19.8	20.2	20.6	21.0	21.3	45	148
164	50	18.1	18.7	19.2	19.7	20.2	20.6	20.9	21.4	21.7	22.0	50	164
180	55	18.8	19.4	19.9	20.4	20.9	21.3	21.7	22.1	22.4	22.7	55	180
197	60	19.5	20.1	20.6	21.1	21.7	22.0	22.4	22.8	23.1	23.4	60	197
213	65	20.2	20.8	21.3	21.8	22.3	22.7	23.0	23.5	23.8	24.1	65	213
230	70	20.8	21.4	22.0	22.4	23.0	23.4	23.7	24.2	24.5	24.8	70	230
246	75	21.4	22.1	22.6	23.0	23.6	24.0	24.3	24.8	25.1	25.4	75	246
262	80	22.0	22.6	23.2	23.6	24.2	24.5	24.9	25.3	25.7	26.0	80	262
279	85	22.6	23.2	23.8	24.2	24.8	25.2	25.5	26.0	26.3	26.6	85	279
295	90	23.2	23.8	24.3	24.8	25.3	25.7	26.1	26.5	26.8	27.1	90	295
312	95	23.8	24.4	24.9	25.3	25.9	26.3	26.6	27.1	27.4	27.7	95	312
328	100	24.3	24.9	25.4	25.9	26.4	26.8	27.2	27.6	27.9	28.2	100	328
361	110	25.3	25.9	26.4	26.9	27.5	27.8	28.2	28.6	29.0	29.3	110	361
394	120	26.3	26.9	27.4	27.9	28.5	28.8	29.2	29.6	29.9	30.2	120	394
427	130	27.3	27.9	28.4	28.9	29.4	29.8	30.1	30.6	30.9	31.2	130	427
459	140	28.2	28.8	29.3	29.7	30.3	30.7	31.0	31.5	31.8	32.1	140	459
492	150	29.0	29.7	30.2	30.6	31.2	31.6	31.9	32.4	32.7	33.0	150	492
525	160	29.9	30.5	31.0	31.5	32.0	32.4	32.8	33.2	33.5	33.8	160	525
558	170	30.7	31.3	31.9	32.3	32.9	33.2	33.6	34.0	34.4	34.7	170	558
591	180	31.5	32.1	32.7	33.1	33.7	34.1	34.4	34.9	35.2	35.5	180	591
623	190	32.3	32.9	33.4	33.9	34.4	34.8	35.2	35.6	35.9	36.2	190	623
656	200	33.1	33.7	34.2	34.6	35.2	35.6	35.9	36.4	36.7	37.0	200	656
722	220	34.5	35.1	35.7	36.1	36.7	37.0	37.4	37.8	38.2	38.5	220	722
787	240	35.9	36.5	37.0	37.5	38.1	38.4	38.8	39.2	39.5	39.8	240	787
853	260	37.3	37.9	38.4	38.9	39.4	39.8	40.1	40.6	40.9	41.2	260	853
919	280	38.6	39.2	39.7	40.1	40.7	41.1	41.4	41.9	42.2	42.5	280	919
984	300	39.8	40.4	40.9	41.4	41.9	42.3	42.7	43.1	43.4	43.7	300	984

Figure 104.1 Table Geographical range, source unknown

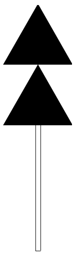
Exercise 105
Revision Test

Time 30 minutes

35 Marks

Knowledge and understanding

1. Cardinal marks are used in conjunction with a compass and indicate where navigable water exists in relation to that mark. The top of the cardinal mark has two triangles indicating the direction for safe water. The cardinal mark illustrated below is indicating that the safest water may be found in which direction from the mark?

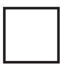


   a. West
   b. South
   c. East
   d. North

2. How many flashes will the mark in Question 1 display at night ?

   a. uninterrupted
   b. 3 in a group
   c. 6 in a group
   d. 9 in a group

3. The following colours apply to question 3.

Yellow  Black 

The colouring of the base that is associated with the top mark  is:

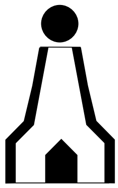
a.

b.

c.

d.

4. The red and white buoy pictured here indicates:



   a. danger
   b. safe water
   c. traffic ahead
   d. water ski area

5. Isolated danger marks are positioned over dangerous local areas. The isolated danger marks show:

   a. a white light, isophase, occulting or a single long flash every 10 seconds.
   b. a yellow light with any rhythm.
   c. a white flashing light showing a group of two flashes.
   d. a red flashing light.

6. The colour of an isolated danger mark is:

   a. red and white vertical stripes.
   b. black and red horizontal stripes.
   c. totally black.
   d. black and yellow horizontal stripes.

7. The 'lubber line' is:

   a. the mark on a compass indicating the ship's head.
   b. the approximate line of travel of a boat on the chart.
   c. the line taken by a vessel when navigating the lateral marks.
   d. when the two leading lights and markers are lined up.

8. When a mariner is leaving port, he/she should pass the lateral marker below

a. on the western side.

b. on his/her port side.

c. on his/her starboard side.

d. on the eastern side.

9. Magnetic variation is:

a. the effect on a compass due to metal objects in the boat.

b. caused by an error in ‘swinging’ the compass.

c. the number of degrees the earth’s magnetic field differs from geographic north.

d. an inbuilt error of a compass.

10. A bathymetric chart is:

a. a chart showing depths.

b. a chart using the metric system.

c. a chart made from satellite photographs.

d. the chart reading from an echo sounder

11. Secular motion is:

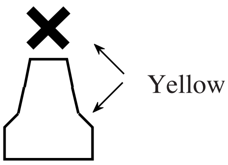
a. the motion of a boat that causes sea sickness.

b. the movement of the position of the north magnetic pole.

c. the variation due to magnetic effect.

d. the sum of deviation and variation.

12. a. What could special marks such as this indicate?



b. What type of light would or could the above mark have?

13. A boat travelled due north for 21° 24' S to a point 19° 15' S. What distance did it travel ?

(2 marks)

14. What is a transit line? Draw a line to show how a position may be calculated using this method.

(2 marks)

15. What is a reciprocal course? If a hand-bearing compass to a feature is 27° W, what is the reciprocal course?

(2 marks)

16. On mercator charts, the major distortion is at

a. the lines of longitude.

b. the equator.

c. the great circles.

d. the poles.

17. A nautical mile is equal to:

a. one degree of latitude.

b. one minute of latitude.

c. one degree of longitude.

d. 2.46 km over the water.

18. The position of a vessel on the ocean is given by its latitude and then its longitude. A latitude (0°) begins at:

a. the equator.

b. the Greenwich meridian.

c. the north pole.

d. the south pole.

19. The latitude of a position is

a. its distance from Greenwich.

b. the angular distance north or south of the equator.

c. its distance from the international date line.

d. its position on the great circle on the surface which passes through both poles.

20. The factors including wind, tide and poor steering, which push the boat off its course are known as:

a. deviation.

b. leeway.

c. set and drift.

d. repulse navigation.

21. Variation:

a. is an error in the functioning of a hand bearing compass.

b. depends on the direction the boat is heading.

c. is the angle between true north and magnetic north.

d. is the angle between magnetic north and compass north.

22. A vessel is positioned at 126°E longitude and is in radio contact with a vessel at 186°E longitude. If the time is 9 a.m. at 126°E, what will be the time on the second vessel?

    a. 1 p.m.

    b. 5 a.m.

    c. 9.16 a.m.

    d. 10 a.m.

23. The speed of a vessel is measured by a speed log. The speed of the vessel is measured in:

    a. nautical miles.

    b. km per hour.

    c. knots.

    d. log ratios.

24. One vessel gives it position as 24° 55'S and 153° 45'E. Another vessel gives its position as 26° 00'S and 153° 40'E. How far apart are they in nautical miles?

Information processing and reasoning

1. The following deviation chart was drawn up for a vessel. The skipper required you to draw a deviation curve on graph paper. All easterly deviations are to be on the right of a centre line and all westerly to the left. The magnetic bearing is 278°.

Ships head by compass	Compass bearing
N	280°
NE	282°
E	281°
SE	279°
S	276°
SW	274°
W	275°
NW	278°

(8 marks)

2. A hand-held compass shows a bearing of 128° to a lighthouse. What is the true bearing to the lighthouse if the variation is 9°E ?

(2 marks)

Answers	5. b	10. a	19. b
1. d	6. b	11. b	20. c
2. a	7. a	12-15 see text	21. c
3. a	8. c	16. d	22. a
4. b	9. c	17. b	23. c
		18. a	

SECTION 6

CHART 5169B

EXERCISE 106 LATITUDE, LONGITUDE AND BEARINGS

This section contains exercises for the extension section of the Queensland Marine Studies Syllabus and uses the full chart 5169B

All exercises in this section are by Bob Critchely Bowen State High School.

QUESTIONS

The order of accuracy that is required with all of these exercises is 0.5 degree and 0.1 minutes of latitude or longitude.

1. What is the latitude and longitude of each of the following:
   a. Hill 441 Hammer Island
   b. Spitfire Rock, Kennedy Sound
   c. Io Reef, West of Goldsmith
   d. Rocky Point, NW corner of chart
   e. Anchorage between Keswick and Saint Bees
2. What is the exact meaning of the chart symbols found at the following positions?
   a. 20° 30.65'S 149°02.40'E
   b. 20° 48.40'S 148° 50.04'E
   c. 20° 45.95'S 149°02.15'E
   d. 20° 54.25'S 149° 26.95'E
   e. 20° 53.45'S 149° 25.50'E
   f. 20° 40.45'S 149° 12.05'E
   g. 20° 36.00'S 149° 19.30'E
   h. 20° 45.35'S 149° 10.25'E
   i. 20° 44.10'S 148° 58.10'E
   j. 20° 47.85'S 148° 57.60'E
3. What are all of the characteristics of the light on Coppersmith Rock?
4. What is the scale of the chart?
5. a. To what date is the chart corrected?
   b. When was the chart printed?
6. What is the magnetic variation of the region for 1990, correct to the nearest 0.5°?
7. How far is it from:
   a. Cape Conway to Platypus Rock
   b. Hammer Island South East to Allonby Island North West
   c. East Repulse Island South East to Green Island North West
8. What is the bearing of:-
   a. South Repulse Island Hill 217 from Bennett Rock.(20° 39.5'S)
   b. Blacksmith Island Hill 524 from Bennett Rock. (20° 39.5'S)
   c. Stewart Pen. Hill 417 from Bennett Rock. (20° 39.5'S)
   d. Shaw Island Hill 365 from Platypus Rock.
   e. Burning Point from Platypus Rock.
   f. Coppersmith Light from Dorsal Rock.
   g. Thomas Island Hill 598 from Dorsal Rock.
   h. Blackcombe Island North from Dorsal Rock.

Answers

1. a. 20°38.85'S149°03.50'E

   b. 20°28.65'S149°01.75'E

   c. 20°41.65'S149°07.80'E

   d. 20°28.75'S148°45.85'E

   e. 20°54.15'S149°25.35'E

2. a. Rock, bommie or obstruction, always covered by water, which is less than 2 m at chart datum (zero tide), and a limiting danger line around it.

   b. Dries 2 ft on a zero tide, i.e. it will have 3 ft of water over it on a 5 ft tide.

   c. Depth of 8 fathoms and 3 ft (52 ft) on zero tide, i.e. it will have 60 ft of water on a 9 ft tide.

   d. Wreck, part of which is visible at chart datum or zero tide. May be covered at high tide.

   e. Overfall or tidal rip. May be hazardous to small craft when there is wind against the tide conditions. Usually quite safe in light winds, or wind with tide. Also more severe on spring tides than neap. Local knowledge required.

   f. Eddies or whirlpools. May cause confused seas during fresh to strong wind, and so be hazardous to small craft.

   g. 20 fathom line, at chart datum or zero tide.

   h. Peak height 198 ft Allonby Is. This is above MHWS (mean high water spring). Vertical sextant angle reading may require tidal adjustment.

   i. Flood tide rate of 3/4 knot to SE. This is the flow at mid tide rising, on a spring tide.

   j. Bottom is fine sand.

3. Group flashing 2, every 6 seconds. Height of 88 ft above MHWS. Range of 15 miles. Since the chart is pre-1971, this is the lesser of geographical range based on eye height of 15 ft and the luminous range for clear weather. Charts corrected after 1971 have only the luminous range. You calculate your own geographical range for your height of eye.

4. 1:100,000 at 20°30'S

5. a. 1963

   b. 1978

6. 9° E. Using east rose, 26 years x 2.75 per year = 71.5' = 1°11.5' which is added to the 8° in 1964 to give 9°11.5' which is 9° to the nearest 0.5°

7. a. 6.1

   b. 8.0

   c. 27.1 Nm

8. a. 307°T

   b. 76.5°T

   c. 224.5°T

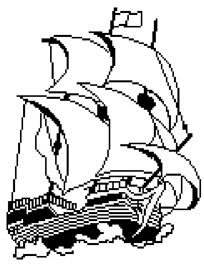
   d. 91.5°T

   e. 353°T

   f. 261°T

   g. 309.5°T

   h. 115.5°T



Exercise 107
Compass error

Method

This is simply the error between ship's head (true) and the ship's head (compass). It is the mistake in the compass due to the magnetic effect of the earth and the ship.

Variation and deviation

These are the two components of compass error as shown in Figures 107.1 and 107.2.

Variation

This is the component of the error due to earth's magnetic field.

It is found on the chart within the compass rose.

A calculation is required to bring the figure for magnetic variation up to date for the year.

Look at the compass rose for the practice chart AUS 5169B. Calculation Variation for 1990 is:

1990 - 1964 = 26 years at 2'.45 = 1° 11'.30 added to 8° 00'E = 9° 11' in 1990.

Deviation

This portion of the error is due to the effect of each ship's individual magnetic field. It is found from a *deviation card* that is peculiar and individual to the ship.

Variation and deviation together give the compass error (sometimes called the Total Error or just Error).

Note

Error only alters when the course being steered ship's head is changed. When a ship is steering a steady course, all compass bearings taken - as well as ship's head - will have the same compass error.

Remember

Error East - Compass Least, Error West - Compass Best

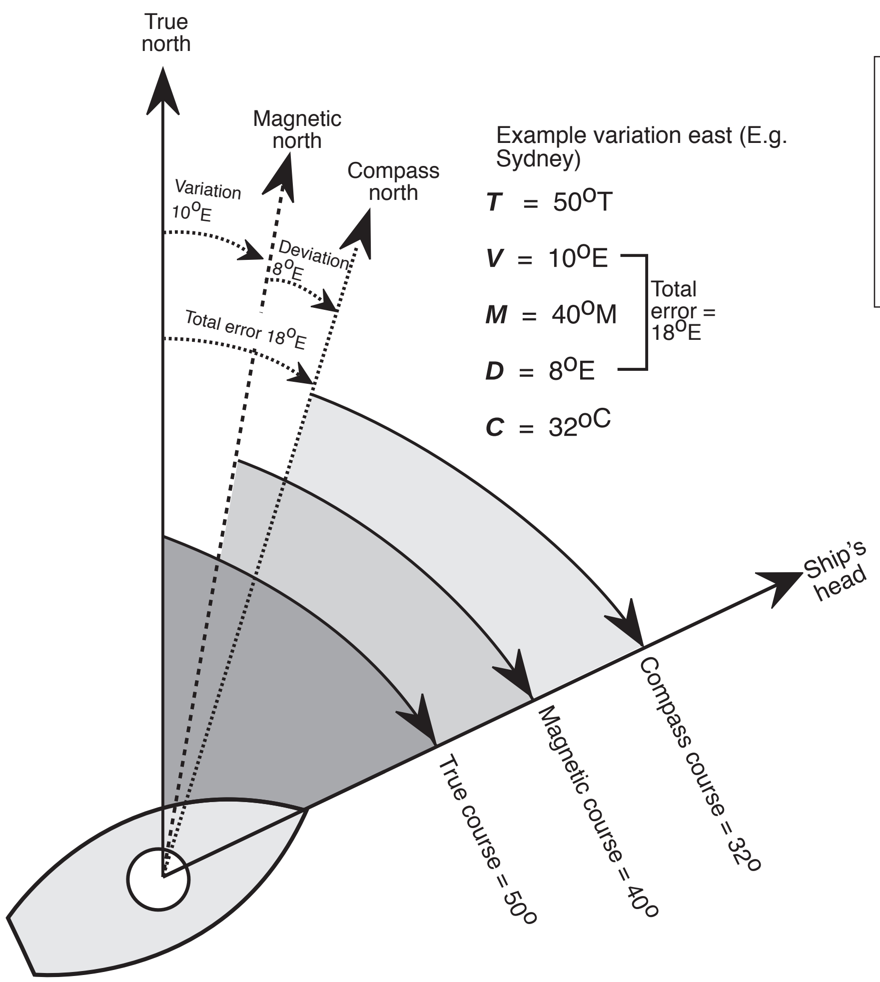


Figure 107.1 Variation east

Wet Paper

A handy mnemonic

The order of working for these example can be remembered by the phrase <u>T</u>ele <u>V</u>ision <u>m</u>akes <u>d</u>ull <u>c</u>hildren

Questions

1. Apply the following compass errors to complete the following statement:
   a. 132° (C), 16° W = _____ ° T
   b. 357° (T), 7° W =______ ° C
   c. 004° (C), 11° E =______ ° T
   d. 097° (C), 5° E =______ ° T
   e. 196° (T), 7° E =______ ° C
   f. 274° (T), 8° W =______ ° C
   g. 324° (C), 7° W =______ ° T
   h. 339° (T), 6° W =______ ° C
   i. 157° (C), 8^0 E =______ ° T
2. Given the magnetic variation = 5° E, find the compass error and deviation from the following sets of transit bearings. [TRUE , COMPASS]
   a. 042° T , 036° C E __ D __
   b. 358° T , 010° C E __ D __
   c. 176° T , 192° C E __ D __
   d. 246° T , 245° C E __ D __
   e. 263° T , 291° C E __ D __
   f. 148° T ,142° C E __ D __
   g. 083° T , 077° C E __ D __
   h. 039° T , 048° C E __ D __
   i. 306° T , 291° C E __ D __
3. Set A Variation, Deviation - find error
   a. 8.5° E, 3° E
   b. 9° E, 4.5° E
   c. 10.5° E, 1° E
   d. 11° E, 5.5° E
   e. 9° E, 1° E
   f. 8.5° E, 2.5° E
   g. 11° E, 3° E
   h. 10.5° E, 6.5° E

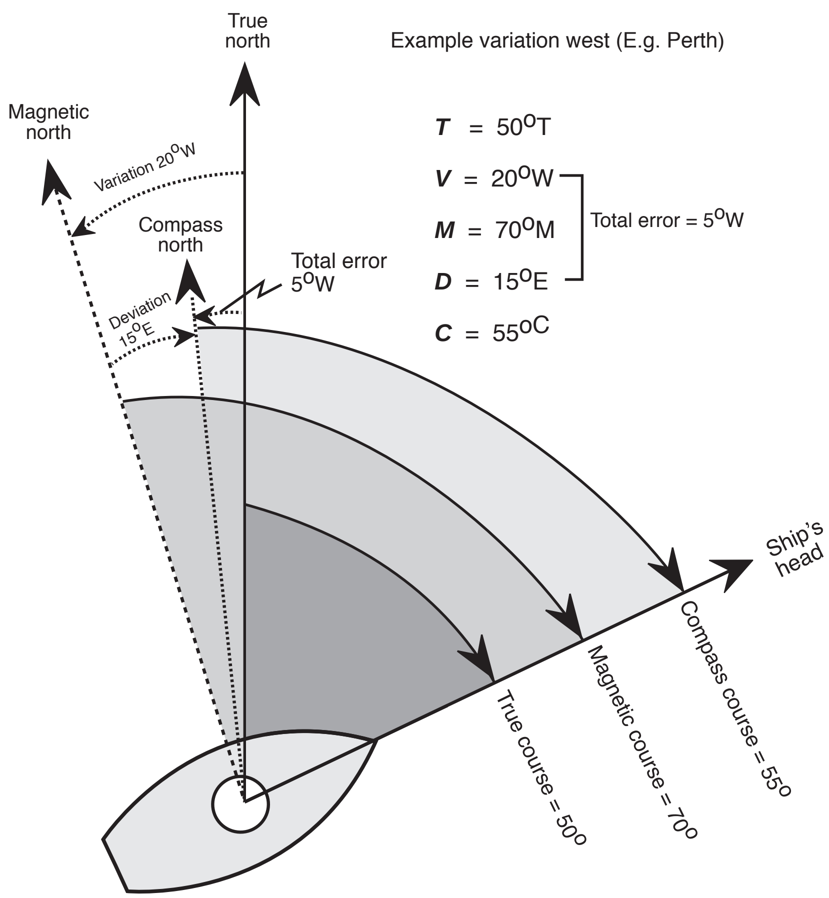


Figure 107.2 Variation west
Wet Paper

i. 11° E, 7° W

j. 8.5° E, 1.5° W

k. 10.5° E, 3° W

l. 9° E, 6° W

m. 8.5° E, 8.5° W

n. 11° E, 4° W

o. 9° E, 1° W

p. 10.5° E, 2.5° W

4. Set B Variation, Error - find deviation

a. 11° E, 17.5° E

b. 8.5° E, 1.5° E

c. 10.5° E, 13° E

d. 9° E, 15.5° E

e. 8.5° E, 8.5° E

f. 11° E, 9° E

g. 10.5° E, 16° E

h. 9° E, 5.5° E

5. Deviation, Error - find Variation

a. 3° E, 12.5° E

b. 6.5° W, 2° E

c. 4° E, 14.5° E

d. 5.5° E, 13.5° E

e. 1.5° W, 9° E

f. 3° W, 8° E

g. 0.5° E, 10.5° E

h. 2.5° W, 6° E

Answers

1. a. 116° (T)

b. 004° (C)

c. 115° (T)

d. 102° (T)

e. 189° (C)

f. 282° (C)

g. 317° (T)

h. 345° (C)

i. 165° (T)

2. a. Error = 6° (E), Deviation = 1° (E),

b. Error = 12° (W), Deviation = 17° (W),

c. Error = 16° (W), Deviation = 21° (W),

d. Error = 1° (E), Deviation = 4° (W),

e. Error = 28° (W), Deviation = 33° (W),

f. Error = 6° (E), Deviation = 1° (E),

g. Error = 6° (E), Deviation = 1° (E),

h. Error = 9° (W), Deviation = 14° (W),

i. Error = 15° (E), Deviation = 10° (E)

3. Set A. Variation,deviation, calculate the error

a. 11.5°E

b. 13.5°E

c. 11.5°E

d. 16.5°E

e. 10°E

f. 11°E

g. 14°E

h. 17°E

i. 4°E

j. 7°E

k. 7.5°E

l. 3°E

m. zero

n. 7°E

o. 8°E

p. 8°E

4. Set B. Variation, error, calculate the deviation

a. 6.5°E

b. 7°W

c. 2.5°E

d. 6.5°E

e. zero

f. 2°W

g. 5.5°E

h. 3.5°W

5. Find variation

a. 9.5°E

b. 8.5°E

c. 10.5°E

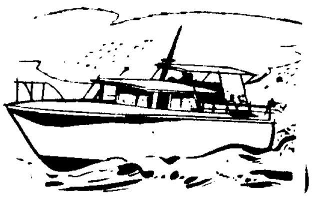
d. 8°E

e. 10.5°E

f. 11°E

g. 10°E

h. 8.5°E



Exercise 108
Position

Chart. AUS 5169B Hillsborough Channel. Variations and Deviations to 0.5 degree. Deviation from the card on the chart. Variation for 1990.

Questions

Position fixes

1. What is your position, in latitude and longitude (to 0.1') for each of the following fixes.? In each case, the ship's head by compass is given.

   a. Course 20° C

   Hill 441 Hammer Island 57° C

   Hill 530 Cape Conway 319° C

   Hill 217 South Repulse Island 280° C

   b. Course 238° C

   Shaw Peak Hill 1339 279° C

   Linne Island Hill 932 230° C

   Cockermouth Island 670 355.5° C

   c. Course 063° C

   Cape Hillsborough — Hill 851 234.5° C

   Green Island — Hill 204 172° C

   Keswick Island — Hill 943 87° C

   d. Course 118° C

   Coppersmith Rock 357.5° C

   Gap Ladysmith — Blacksmith 231.5° C

   Lockersmith North 101° C

   e. Course 042° C

   Coppersmith Light 217° C

   Water depth 20 m on a 2 m tide height.

   f. Course 280° C

   Coppersmith 356° C

   Extreme range of 14 miles

Transit and deviation exercise

2. Hill 417 (Stewart Peninsula) and Cave Island (N) are in line on a bearing of 261° (C). What is your deviation?

3. You alter course and the same features come into line on a compass bearing of 259°. What is your deviation?

4. Your are steering 340° by compass when Ladysmith Island (S) and Goldsmith Island (N) come into line, bearing 077° (C). What is your new deviation?

   What is the error in deviation (from the card)?

5. You are steaming approximately north when two southern points of Brampton Island come into line on a compass bearing of 275°.

   What is the deviation for the course that you are steering?

6. Round Head and Cape Conway give a transit bearing of 341°. What is your deviation?

7. The same transit, after an alteration of course, gives a compass bearing of 350°. What is your new deviation?

8. Silversmith Island (NE) and Blackcombe Island (N) are in line when steering a course of 330.5° by compass. The transit bearing of the two islands is 285° by compass.

   What is your new deviation for the course and what correction has to be made to the previous deviation?

Answers

1. a. 20° 40' S, 149° 00' E

   b. 20° 31.6' S, 149° 23.2' E

   c. 20° 51.9' S, 149° 10' E

   d. 20° 38.1' S, 149° 06.6' E

   e. Approx 20° 31.4' S, 149° 13' E

   f. Approx 20° 50' S, 149° 06.7' E

2. 5° East

3. 7° East

4. 4° East, 2.5° East

5. 21° West

6. 9° West

7. 18° West

8. 12.5° West, 13° East

   5° East

Exercise 109 Coastal navigation

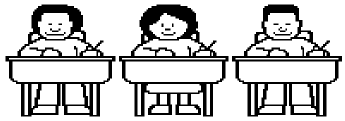


Chart AUS 5169B Hillsborough Channel. Variation for 1990. Deviation from the card on the chart.

Questions

Coastal navigation

1. Your starting position A, is 2 Nm north of Green Island. (N). Your true course is 333° and your speed is knots.
    a. What is your DR position after one hour?
    b. What is the latitude and longitude of position A?
    c. What is the range and true bearing of Cape Hillsborough from this DR position?
2. You now alter course to 310° (C). You immediately fix and find position B with Cape Hillsborough bearing 219° (C) and Rabbit Island (N) bearing 274.5° (C).
    a. What was your DR position after a further 2 hours steaming?
    b. What is the latitude and longitude of position B?
    c. On this course, how close would you pass to Outer Newry Island?
3. You now fix by radar VRM and you find that your new position C is 5.8 Nm from Cave Island, and 6.0 Nm from Rabbit Island.
    a. What is the latitude and longitude of position C?
    b. What is the compass bearing of Hill 417 from position C?
    c. What is the bearing (C) of Allonby Island from position C?
4. Adverse weather sets in and you wish to anchor at the anchorage just west of Shaw Island in approximate latitude 20° 27.5'S. You depart position C at 1500 and your speed is increased to 7 knots.
    a. Plot a course to this anchorage keeping at least 1 Nm from Burning Point.
    b. What true and compass courses will you steer?
    c. What is your earliest ETA at the anchorage?

Compass course to steer

5. You are steering a compass course of 304°, speed 8 knots. At 1230 you fix in position 20° 56.0'S. 149° 07.6'E. What will be your DR position at 13˚0?
6. You fix your position at 1330 with Andrews Point bearing 208°C and Redcliff Island N bearing 271^0 C. What is your fixed position at this time?
7. Your speed at this time is increased to 12 knots.

    What will be your DR position at 1415?
8. Your position is now fixed with Hill 417 bearing 267° by compass and Outer Newry Island (SE) bearing 195° (C).

    What is your fixed position at 1415?

Answers

1. a. 20° 52.3' S, 149° 06.7' E
    b. 20° 56.8' S, 149° 09' E
    c. 4 Nm, 239°T
2. a. 20° 44.7' S, 148° 58.4' E
    b. 20° 52.0' S, 149° 05.7' E
    c. 5.7 Nm
3. a. 20° 44.3' S, 148° 56.9' E
    b. 243° C
    c. 087° C
4. a. 015° T, 002.5° C and 052° T
    b. 038° C
    c. 1741
5. 20° 53.4' S, 149° 04.4' E
6. 20° 53.0' S, 149° 5.8' E
7. 20° 47.1' S, 148° 58.5' E
8. 20° 47.5' S, 148° 57.8' E

Exercise 110
Set and drift

Questions

Chart. AUS 5169B Hillsborough Channel. Variations and Deviations to 0.5 degree. Deviation from the card on the chart. Variation for 1990.

1. You are in a fixed position 2 Nm North of Cave Island, steering 310° (C) at 6 knots. An hour later you fix in position 20° 40.3' S 148° 49.4' E.

   What set and drift have you experienced?

2. At 0615 you depart the anchorage west of Carlisle Island, steering a compass course of 261° at 5 knots. At 0703, Allonby Island bears 334.5° (C) and Skiddaw Peak (129) bears 069.5° (C).

   a. What is your fixed position at 0703?

   b. What set and drift have you experienced since departing the anchorage?

3. You depart the anchorage north-east of Keswick Island at 0920, speed 7.5 knots. You are expecting to set to the north-east at 1.2 knots.

   a. What compass course will you steer to leave Cockersmith Island (and rocks) 1.0 Nm to starboard?

   b. What will be the speed made good?

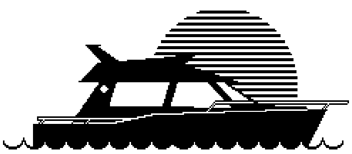
4. From a position of 2.5 Nm north of Green Island (N) you steer a compass course of 332° at 7 knots for 1.5 hours. At this time you fix with Allonby Island bearing 061.5° (C) and Hammer Island [441] bearing 347.5° (C).

   a. What is your fixed position at this time?

   b. What set and drift have you experienced?

5. From your most recent fixed position (Question 4) you wish to steer a compass course leaving Hammer Island 2 Nm to starboard. Your speed is 6 knots and you experience the ebb tide shown on the chart.

   Find your compass course to steer.



Answers

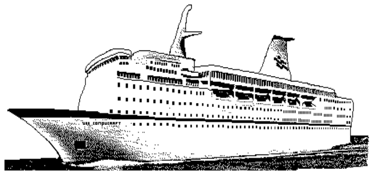
1. 082°, 2.2 kn, 2.2 Nm
2. a. 20° 48.6' S, 149° 11.2' E,

   b. 205° at 1.4 knots, 1.1 Nm
3. a. 209.5° C

   b. 7.9 knots
4. a. 20° 47.2' S, 149° 03.9' E

   b. 241° at 1.1 knots, 1.6 mile
5. 329.5° C

Exercise 111
Running fix including set and drift



Questions

The order of accuracy that is required with all of these exercises is 0.5 degree and 0.1 minutes of latitude and longitude. Deviation off the card on the chart.

1. While steering a compass course of 300° and maintaining a speed of 6.5 knots, Hill 701 on Brampton Island was at 348° compass at 0700.

   At 0800 the same Hill had a bearing of 58° compass. What is your latitude and longitude at 0800?

2. Coppersmith Light was observed at 0000 on a compass bearing of 357°. A compass course of 50° was steered at 6 knots until 0100 when the light was now observed at 273.5° compass.

   What is your 0100 position?

3. At 0830, the Hill on Green Island had a compass bearing of 172°.

   At 1030 the same hill bore 255.5°. The boat maintained a speed of 4 knots on a compass course of 123°. During this time, the effect of the tide and a strong north-east wind caused a set to the south-west at .75 knots.

   What is the 1030 position?

4. While maintaining a speed of 5 knots on a compass course of 32.5°, Hill 217 on South Repulse Island is observed by compass at 342° and one hour later at 248°.

   There is a strong south-east wind causing leeway of .75 knots, and an ebb tide of 1 knot in the direction shown on the chart.

   What is your position after the second sighting?

5. A boat is making 4 knots on a compass course of 70°. At 1000, Skiddaw Peak on Carlisle Island is observed by compass 137.5° Visibility is lost until 1200 when Hill 670 on Cockersmith Island is observed at 167.5°.

   You anticipate that the strong south-east wind is causing you .75 knot leeway and the local current is setting north-east at 1 knot.

   What is your noon position?

Answers

1. 20° 50.9' S, 149° 11.6' E, 306.5°, 354.5°, 64.5°, True courses and bearings
2. 20° 37.4' S, 149° 11.8' E, 64°, 11°, 287.5°
3. 20° 58.9' S, 149° 14.5' E, 135.5°, 148.5°, 268°
4. 20° 36.3' S, 148° 56.3' E, 46.5°, 356°, 262°
5. 20° 40.6' S, 149° 24.3' E, 84.5°, 152°, 182°

EXERCISE 112 COMBINED EXERCISE

Chart AUS 5169B Hillsborough Channel. Use deviation card on the chart. Use correct variation for 1981.

Part A

1. You are trawling heading 99° by compass, ship's speed 4.8 knots. At 0435, Stewart Peninsula triangulation point (417') bore 159° by compass, later at 05.23 Cave Island bore 241° by compass.

   What is the latitude and longitude of your ship at the time of the second bearing?

2. You continue trawling on this course at the same speed. At 0817 you obtain the following Radar VRM distances:

   Green Island distant 6.4 miles

   Wedge Island distant 6.2 miles

   Brampton Island 6.7 miles

   Calculate the set and rate of the current between 0523 and 0817.

3. You now cease trawling and head for position latitude 20° 34.1'S longitude 149° 22.5'E setting a speed by engine revs of 8.2 knots.

   What compass course must you steer to counteract the current previously found in Question 2?

4. What is your ETA at the position required in Question 3?

5. From the position found in Question 3, what compass course would you set to head for Fairlight Rock?

6. While heading for Fairlight Rock, you observe the following compass bearings:

   Blackcombe Island 149° by compass

   Coppersmith Rock Light House 217° by compass

   Shaw Peak 315.5° by compass

   Fix the ship's position at the time of these bearings and advise the compass bearing and distance of Fairlight Rock.

7. From the fix found in Question 6, steer 244° by compass. What distance will you pass off Silversmith Island?

8. Continue on this course till the western ends of Blacksmith and Hammer Islands bear 184.5° by compass. What information does this give you?

9. List 10 chart abbreviations with their meanings as found on this chart (try and pick 10 that you haven't used before).

Part B

1. Plot position 'A' in latitude 20° 33.8'S longitude 149° 25.4'E. Find the compass course to steer and the distance to sail to reach position B which is found by radar ranges of Finger Island 1.8 miles, Hempel Rock 1.5 miles and Solder Island 1.75 miles. What is the total error found on this course?

2. From position B steer 216° True, distance 10.8 Nm to reach position C. What are the compass bearings of Red Cliff Island (centre) and Wedge Island (centre) from position C?

3. From position C, find the compass course and distance and the latitude and longitude of position D. Position D is found by true bearings of Coppersmith Rock Light House 092° , St. Helen Rock 51° and Platypus Rock 001° .

4. While on passage from position C to position D you observe the highest point of Linne Island in transit with *lo reef* bearing 058.5° by compass. What is the total error of your compass as found by this transit and what information does this give you?

5. From position D (Question 3) find the compass course to steer to reach a ship in distress on latitude 20° 41.0'S longitude 149° 26.0'E, to counteract a current setting 151° at 1.5 knots. Ship's speed is 8 knots through the water. What is the actual ship's speed over ground?

6. On another day, you are heading 310° by compass, ship's speed is 5.5 knots. At 0837, you observe the highest point of Rabbit Island bearing 212° by compass, later at 0907 it bore 175° by compass. If a current is setting you 315° at 0.5 knots throughout this time, what is the latitude and longitude of your ship at 0907?

7. Your vessel is about 7 Nm south of Cape Conway. You wish to sail a true track of 225°. What compass course would you steer allowing 10° leeway caused by a south wind?

Answers Part A

1\.

Variation 1964	7°55 ' E	Compass Course	099°
Correction 2 3/4' x 16	+ 44 '	Deviation	4.5 ° E
Variation 1980	8°39 ' E	Magnetic	103.5°
		Variation	8.5 ° E
Call it 8.5°E	True Course	112°	
		Total Error	13°

	Stew Pen.	Cave Is.		
Comp. Brg.	159°	241°	Time 2nd Brg.	05.23
T.E.	13°E	13°E	Time 1st Brg.	04.35
				0.48
True Brg.	172°	254°	Interval	hrs/mins
			=	0.8 hrs

Distance = Speed x Interval
= 4.8 x 0.8 = 3.8 miles

Answer = Latitude 20° 46.8'S Longitude 148° 52.7'E

2\.

D.R. Time	08.17	Dist. = Speed x Interval
Time Dep.	05.23	= 4.8 x 2.9
	2.54	= 13.29 Miles
	hrs/mins	
		Rate = Drift - Interval
	= 2.9 hours	2.9 - 2.9 = 1 knot

Answer = Set 097° Rate 1 knot

3\.

True Course	027°		
Variation	8.5°E		
Magnetic	018.5°	018.5°	018.5°
Deviation	4° E	4.5° E	4° E
Compass Course	014.5°	014°	014.5°

Answer = Steer 014.5°

4\.

Interval = distance - speed
= 22 - 8.6
= 2.56 hours
2 hours 34 minutes

56 x 60 = 33.6 mins
100
Call it 34 mins

Departure time	08.17
Interval	2.34
ETA	10.51 hrs/mins

Answer = 10 hours 51 mins.

5\.

True Course	094.5°	
Variation	9° E	
Magnetic	085.5°	085.5°
Deviation	5° E	5° E
Compass Course	080.5°	080.5°

Actual Speed = 8.85 knots

6\.

Compass Course	310°	
Deviation	1.5° W	
Magnetic Course	308.5°	
Variation	8.5° E	
True Course	317°	Total Error 7° E

	0837	0907
Compass Bearing	212°	175°
Total Error	7° E	7° E
True Bearing	219°	182°

Distance = Speed x time
= 5.5 x 0.5
= 2.75 Miles

Latitude 20° 46.35'S Longitude 148° 54.85'E

7\.

True Track	225	
Leeway	10° -	Allow into wind from S.
True Course	215°	
Variation	8.5° E	
Magnetic Course	206.5	206.5
Deviation	5.5 W	5.5 W
Compass Course	212°	212

Answers Part B

1.

		Compass Rose A		Compass Rose B
Magnetic Variation 1964		8° 00 ' E		7° 55 ' E
Correction 17 x 2 3/4'	+	47 '	+	47 '
Magnetic Variation 1980		8° 47 ' E		8° 42 ' E
Call it		9° E		8.5° E

True Course	231.5°
Variation	9° E
Magnetic Course	222.5°
Deviation	6.5° W
Compass Course	229°

Distance 15.9 Miles

2.

True Course	216°	
Variation	9° E	
Magnetic Course	207°	207°
Deviation	5.5° W	5.5° W
Compass Course	212.5°	212.5°
		Total Error 3.5° E

	Redcliffe Island	Wedge Island
True Bearing	274°	208°
Total Error	3.5° E	3.5° E
Compass Course	270.5°	204.5°

3.

True Course	347°	
Variation	8.5°E	
Magnetic	338.5°	338.5°
Deviation	1° E	1.5° E
Compass Course	337.5°	337°
		Total Error 9.5° E

Distance 17.2 Miles — Latitude 20° 35.85'S Longitude 149° 01.4'E

4.

True Transit	068°
Compass Transit	058.5°
Total Error	9.5° E

5.

True Course	274.5°			
Variation	8.5° E			
Magnetic	266°	266°	266°	
Deviation	5.5° W	6° W	5.5° W	
Compass Course	271.5°	272°	272.5°	Total Error 3° E

Answer = 271.5°

6.

	Blackcombe	Coppersmith	Shaw
Compass Brg.	149°	217°	315.5°
Total Error	3° E	3° E	3° E
True Brg.	152°	220°	318.5°

Answer = 271.5° — Distances 1.45 Miles

7.

Compass Course	244°	
Deviation	7° W	
Magnetic	237°	
Variation	8.5° E	
True Course	245.5°	Total Error 1.5° E

Answer = Distance off = 0.65 Miles

8.

True Transit Bearing	186°
Compass Bearing	184.5°
Total Error	1.5° E

Answer = The error found by transit confirms that the deviation card is correct

9. Try and pick ten abbreviations that you haven't seen before. One mark for each correct answer.

SECTION 8
SKINDIVING

EXERCISE 129
RISK ASSESSMENT

Acknowledgement is made of information supplied by the draft Department of Education Safety Document section on Snorkelling.

CLASS DISCUSSION

Form a group or discuss as a class the following questions.

1. Make a list of places that you want to go skindiving and write them down. Include a pool in your list.
2. What effect could each of the following have on the safety of the skindiving party from the list you have just made?

   a. tides
   b. currents
   c. visibility
   d. waves
   e. sharks
   f. marine stingers
   g. coral

3. Are there any other local environmental or biological hazards that could affect the group's safety not mentioned in Question 2?
4. In class, discuss the following problems and propose a counter-disaster action plan for people who:

   a. cannot swim or have a fear of water or submerging
   b. suffer from epilepsy
   c. suffer from any fears e.g. sharks, sea snakes, etc.
   d. get seasick in small boats
   e. any other characteristic or disability which a class member may possess which the class needs to know in order to work cohesively as a group.

5. Are there any modifications to a normal lesson that may need to be made to account for these characteristics or disabilities? If so, discuss them.
6. What hygiene practices need to be established when people in the class share equipment?
7. Make a decision about the suitability of the following pieces of rescue equipment in your skindiving program. Make up a table showing where you would use each item and in what situation.

   - float
   - lifebuoy
   - pole with looped rope or inflated tube
   - safety boat
   - float rope

8. As part of workplace health and safety regulations, your leader has to take a roll call as students in the class enter and leave the water. You are on your annual marine studies camp and want to go skindiving on the reef crest some 400 m from shore. It is high tide and boats are going to be used. There will be four students per boat and four boats.

   Swimmers' names must be listed as they enter and leave the water. Discuss the best way to do this, who will be in charge and what special equipment will required to record names.

   Discuss who will be safety officers and how safety sheets will be designed.

9. Why would it be unwise to touch marine creatures unless instructed to do so?
10. Discuss the methods your class will adopt to ensure a quick and easy recall if weather conditions deteriorate or an emergency occurs in the water.
11. Discuss the most appropriate equipment e.g. digital mobile phones, VHF radio or 27 MHz radio, you should use at the snorkelling areas you intend visiting.
12. Discuss your counter-disaster plans of how quickly you could get a student who had been stung by a stonefish to the nearest hospital using careflight helicopters, etc.

Exercise 130
Safety

Questions

Read the safety hints on pages 247 and 248, the section on *EAR* in your textbook and answer the questions below.

1. What do the terms ABC, EAR and ECC stand for?
2. Why should skindivers fly a special flag in the area that they are skindiving in?
3. You are about to skindive with your buddy in an unfamiliar place.

   You chose your friend, but how do you know that this is a good buddy for you to dive with? List at least five skindiving compatibilities you should have with your friend.
4. Use your textbook to identify the safety signals shown in Figure 130.1.
5. You are going open water snorkelling and have been asked to put on a buoyancy vest. What is this piece of equipment and why have you been asked to wear it?
6. What is a snorkelling or skindiving plan and why is it important?
7. What is fatigue? Give a skindiving example.
8. How can sunstroke or sunburn be prevented while skindiving?
9. Your buddy suffers from epilepsy. What precautions should you take while skindiving?
10. After skindiving for five minutes, your buddy develops a severe cramp. It's a beautiful day with clear seas and warm water. Should you continue skindiving? Give reasons for your answer.
11. Why could lack of physical fitness cause a safety problem?
12. Why do you start equalising as you start to dive? Why not wait till you are in deeper water?

Safety

Your teacher has to assess the risk of each activity as part of work place health and safety regulations. The *Draft Queensland Department of Education Marine Studies Safety Module* suggests that teachers should:

a. determine each class members' capabilities in terms of physical attributes, maturity and motor and cognitive development

b. examine the severity or consequence of an injury that could be sustained in going skindiving

c. evaluate the educational outcomes of skindiving and identify the hazards and inherent dangers of engaging in skindiving activities

13. You are going skindiving on a reef off the main highway. Your buddy has a mobile phone. What dangers exist in relying on a mobile phone to make an emergency call?
14. Why should you avoid skindiving at dawn and dusk?
15. Why should you avoid a reef area where fishers are cleaning fish?
16. Why should you never turn your back to waves when entering a surf location?
17. What covering on rocks make them slippery when wet?
18. Why does the body loose heat faster in water compared to air and by how much?

19 What does the one up, one down method refer to?

20. What are some of the symptoms of:

    a. a heart attack

    b. an epileptic fit

    c. shock

    d. sea sickness

    e. fear

Safety hints list

1. Know emergency first aid — especially ABC, EAR, and ECC.
2. Fly the divers down flag to warn boaties that divers are underwater.
3. Always buddy snorkel — know the limitations of your buddy and yourself and of each others' equipment. Avoid groups of three as it is too hard to keep track of two other people.
4. At all times keep your buddy in sight. If eye contact is lost, surface immediately and look around.
5. Know your hand signals and stay in contact with each other while in the water.
6. Ensure that whoever you snorkel with is also a qualified skindiver. Don't lend your equipment to unqualified people.
7. Use correct, complete, well-maintained snorkelling equipment which is checked before each trip.
8. Control your buoyancy to make snorkelling as easy as possible. Be prepared to ditch your weights, clear your mask and snorkel or take other emergency action if needed.
9. Use a boat safety line or float as a surface support station whenever you go out. This will increase the safety and enjoyment of the snorkel.
10. Slowly surface close to the float and flag, watching and listening for possible hazards.
11. If you are cold, tired, injured or not feeling well, get out of the water. Remember that water draws away heat 25 per cent faster in water than in air.
12. Have the snorkel planned before entering the water, allowing a margin of safety in order to be prepared for emergencies. Set moderate limits for depth and time in the water. Know the snorkelling location.
13. If you are in a skindiving party, make sure you do a head count on the return journey.
14. Identify problems that can occur such as
    - Fatigue: don't snorkel after a sleepless night or long journey.
    - Sunstroke: long sleeved shirts, barrier creams and hats are advisable if some time is taken to reach the snorkelling area.
    - Seasickness: this will not pass off underwater. Remedies may cause drowsiness which would be fatal. Lie down in the boat until you reach shore.
    - Physical complications: be wary of colds, infected sinuses, ears or any other ear troubles, any weakness of the heart, coronary vessels or cardiovascular system, or if there is a past history of tuberculosis.

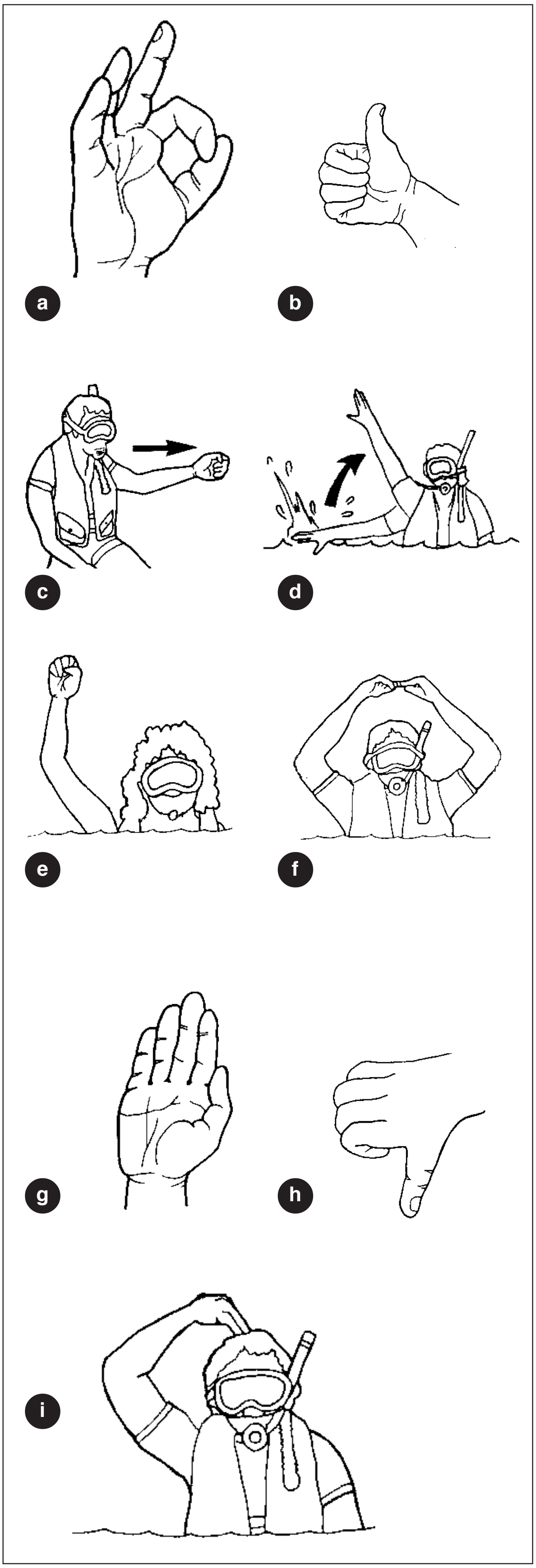


Figure 130.1 Skindiving safety signals, courtesy NAUI Australia
Wet Paper

- Don't snorkel if you have asthma, sinusitis, emphysema, epilepsy, diabetes (danger of coma) or if you recently have had hepatitis, nephritis or cystitis, unreduced hernia, or any operation. Snorkelling should not be resumed until completely recovered.
- Lack of physical fitness: many skindivers are injured because they lack the fitness to withstand cold and exhaustion. Don't use alcohol or dangerous drugs before snorkelling. Have a regular medical examination.
- Good sense and moderation is required when eating before a snorkel. Avoid heavy meals, in favour of frequent cups of tea, soup and light snacks.
- Psychological problems: fear of water or submerging, inability to meet crises or being given to panic all make snorkelling inadvisable.
- Be sure to equalise early and often both during descent and ascent (if diving deeply).

15. Avoid climbing down ladders while wearing fins.
16. Avoid diving head first with skindiving gear on.
17. Avoid skindiving in heavy surf.
18. Avoid skindiving around areas where fishers are cleaning fish because sharks are attracted to the waste.
19. Avoid skindiving at dawn and dusk as sharks are more active feeding at this time.
20. Avoid skindiving at night (unless in a qualified and organised night dive party)
21. Plan ahead. It's a long way to the telephone to get assistance if you buddy is stung by a stonefish. If at all possible skindive with a party that has a marine radio, that is capable of making contact with a rescue helicopter service. Mobile phones have limited range.
22. Avoid turning your back to waves on a rocky platform.
23. When entering from a rock shore platform, keep low and use both hands to balance. Avoid stepping from rock to rock.
24. A common mistake is to see a dry algae-covered rock and slip on it with a wet foot. Be aware that dry rocks can become slippery with wet feet.
25. In open water adopt the up one down safety method.
26. According to the National Heart Foundation, warning signs of a heart attack are:
    - a heavy pressure, squeezing sensation in the centre of the chest, sometimes with a discomfort or burning
    - pain may spread to the shoulder, arm, neck or jaw and may come and go
    - pallor, sweating

    If these symptoms occur:

    - call an ambulance at once
    - if one is not available immediately, drive the patient to the nearest hospital.

Every minute is vital in cases of suspected heart attack. If the patient loses consciousness, apply danger, response, breathing and circulation, (DRABAC) action.

Exercise 131
Snorkelling
video

Method

1. Obtain a copy of the video *Snorkelling for Kids of All Ages*.
2. Fast forward the track to the section that the presenter introduces as *Basic skills to snorkel safely*.
3. Run the tape ignoring references to page numbers as these correspond to a younger persons workbook and are covered in the next five activities.
4. Note the following skills demonstrated in the video:
   - how to fit a mask
   - pool entries
   - diving methods
   - clearing the snorkel
   - finning techniques
   - clearing a mask
   - equalising ear pressures
   - buoyancy

Optional

Rewind the video and watch the start remembering that this video has been made for a younger age group.

Materials and equipment (per class)

Equipment required

- copy of Snorkelling for *Kids of All Ages*

Available from:

NAUI Australia
PO Box 183
Capalaba 4157
Phone (07) 390 3233
Fax (07) 390 3159

AUSTRALIA

Additional resource

Obtain a copy of school snorkelling program

Available from:

Australian Underwater Federation
PO Box 1006
Civic Square, Canberra ACT 2608

You will have to search U tube for this one

Exercise 132 Equipment

Skindiving equipment needs to be chosen carefully. It must be suitable for the situation and be looked after to ensure you get value for money.

Questions

1. Use your textbook index to find the section on *snorkelling equipment* and complete Figure 132.2.
2. Select a mask, place it on your face without fitting the strap and breathe in through your nose.

   If the mask stays on then it probably will be the one for you.

   Adjust the snorkel to the left side of the head.

   How can you tell if your mask is an incorrect size?
3. Select a pair of fins that feel comfortable when placed over your feet.

   If the fins are to tight you will possibly get a cramp. If they are too loose you will loose them when you use them in the water.

   How can you tell if your fins is an incorrect size?
4. Why should people with a small lung capacity choose a snorkel with a small bore?

Safety

1. Goggles should never be worn when skindiving as there is no way of equalising pressure around the eyes or clearing water from inside during a dive
2. Younger children or people with small lung capacities require a snorkel with a small bore.

   Try to avoid snorkels with valve devices or table tennis balls on top as they can create dangerous situations.
3. If sharing equipment discuss hygiene standards and use an antibacterial solution when necessary. Always allow equipment to air dry and store in subdued light.
4. When you want to take the mask off your face, don't put it on your head or it could get knocked off by a wave. Place it around your neck so that you cannot lose it.

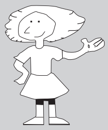


Figure 132.1 Putting on your fins
Wet Paper

Snorkelling piece	Materials used in construction	How the equipment helps you skindive	How to look after it and store it
Mask			
Snorkel			
Fins			
Wetsuits			
Stinger suits			
Weight belts			
Buoyancy vests			
Additional equipment: knives, spear guns, gloves			

Figure 132.2 Equipment use and care checklist. Students may make one copy of this page so that they can attach their answers before handing in for marking.

Exercise 133 Getting into and out of the water

Questions

Watch the snorkelling video as described in Exercise 131, to locate the four ways to enter a pool as shown in figure 133.1.

Find '*Safety with Skindiving*' in your textbook index to locate the text block on learning how to skindive. Answer the following questions.

1. Where should your first skindiving lesson be held?
2. There are three attitudes discussed in the text. Rewrite these in your own words.
3. What should you wear and what should you bring to your first skindiving lesson?
4. There are two simple tests to do before you go snorkelling. What are these and why are they important?
5. What is one technique you can use to become comfortable with your gear?
6. Look at Figure 113.2 A and list three ways you could enter the water. For each way describe one safety hint.
7. Figure 113.2 B shows a skindiver floating. Why is this such a useful exercise when learning how to snorkel?
8. Look at Figure 113.2 C.
   - Name three types of boats you think would be suitable for snorkelling. For each, describe from where you would enter and leave the boat and what type of method of entry and exit you would use.
   - What precautions should be taken when exiting from a rock pool?
   - When exiting from a swimming pool:
     - Should the fins be removed first and why?
     - Should the mask and snorkel be left on and why?
     - There are other people sitting beside the skindiver. What precautions should be taken not to injure them?
     - If the skindiver is wearing a weight belt, should this be taken off before exiting? Give reasons for your answer.

Safety

1. Be careful at the pool side as tiles can be slippery.
2. Avoid walking in fins as they may trip you. If you have to walk, walk backwards.
3. Put your mask on before you get into the pool to keep your hands free.
4. If you sit at the side of the pool and launch yourself in from a sitting position, make sure you don't injure your back.
5. Be careful of slippery edges when leaving the water.
6. If you snorkel in a reef, river, creek or bay be careful of broken glass or sharp edges that will cut your hands. Gloves are a handy piece of safety equipment
7. Make sure you can swim at least 200 m non-stop any stroke and tread water for 10 minutes.

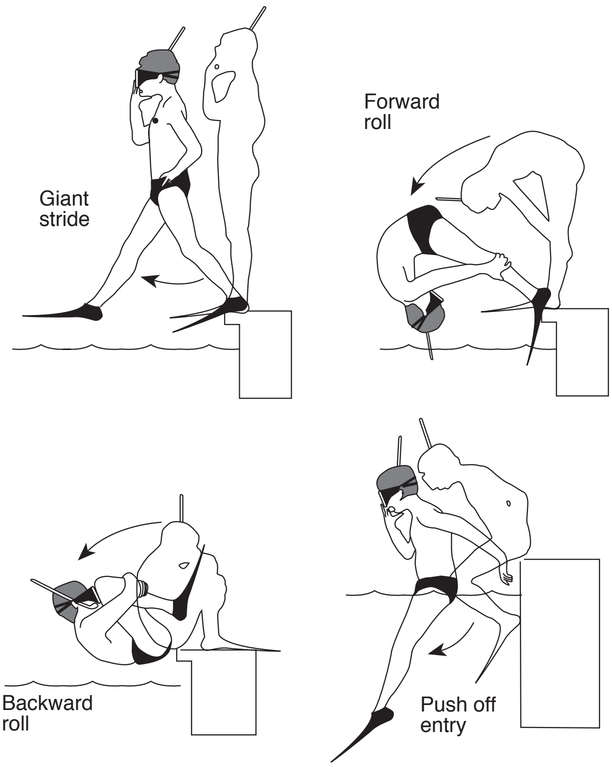


Figure 133.1 Four types of pool entry as shown in NAUI video (Adapted from British Sub aqua Snorkelling Manual)
Wet Paper

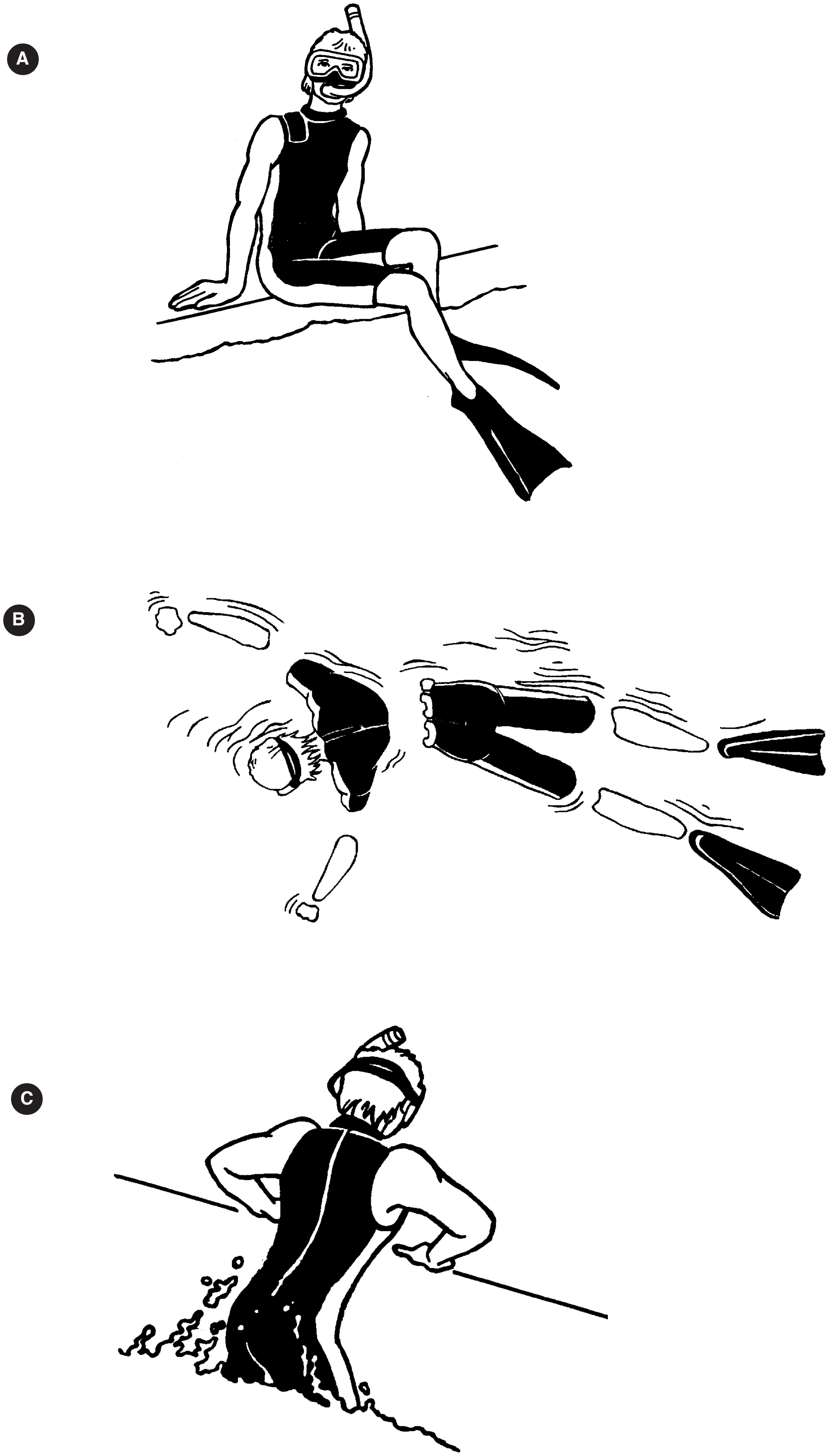


Figure 133.2 Snorkelling situations
Wet Paper

Exercise 134
Pool entries

Skills

There are many ways to enter the water. If you are in a boat, the backward roll method is preferred by some skindivers while others tend to use the safety jump.

- The safety jump or giant stride. Press your mask against your face and jump into the water with a scissor kick. The idea of the kick is to minimise going too far underwater.
- The submerging entry. Put all your gear on and climb down the ladder of the boat. Now put your head underwater and gently submerge.
- The backward roll. Hold the mask with your hand pressing against the face. Now roll backwards so that your legs do not strike the gunwales (sides of the boat). If you are in a small boat, have others move to balance the craft.
- The push off entry as shown in Figure 134.1. Position yourself right on the edge of the pool with your fins touching the pool wall. Hold your facemask with one hand and push off with the other.

Watch the NAUI video as described in Exercise 131, to refresh your memory.

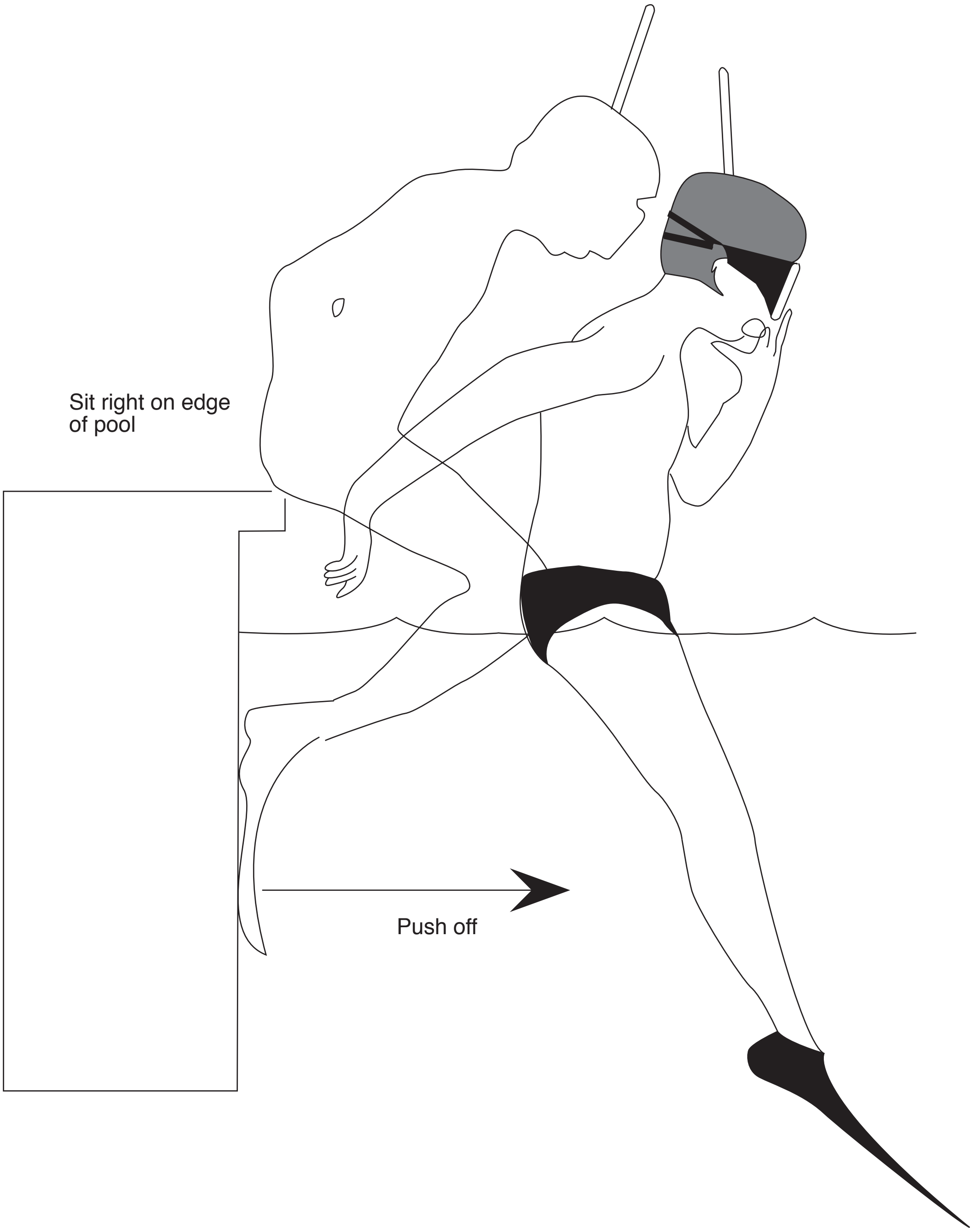


Figure 134.1 The push off entry (Adapted from British Sub aqua Snorkelling Manual)
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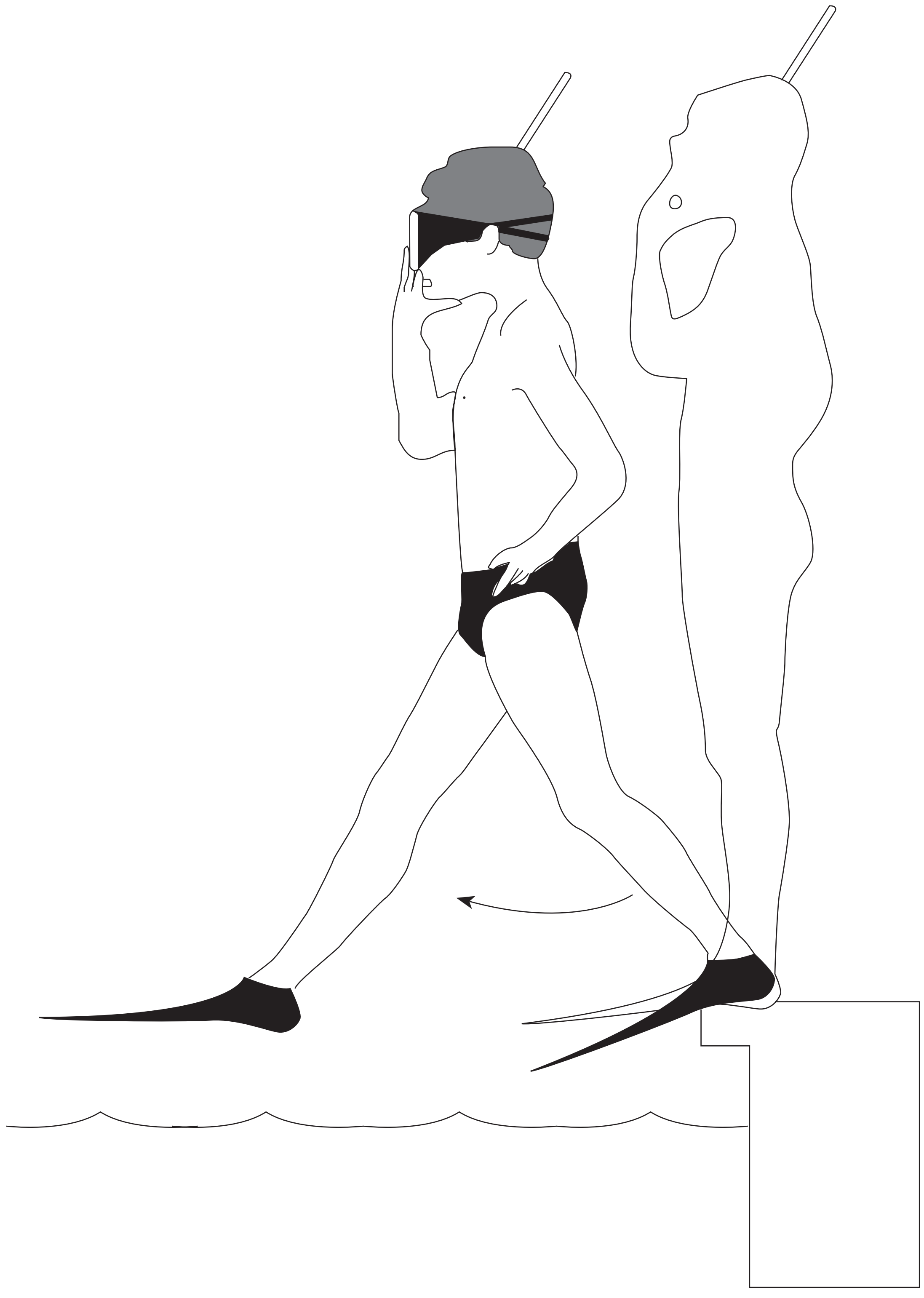


Figure 134.2 The giant stride or safety entry (Adapted from British Sub aqua Snorkelling Manual)

Wet Paper

Exercise 135 Clearing your snorkel

Skills

The NAUI video as described in Exercise 131, shows two ways to clear your snorkel:

Blast method

In shallow water, the preferred method is to blast the water out while on the surface.

- Kneel in shallow water, put your face in the water, and breathe in and out through the snorkel.
- Now inhale, hold your breath and place your tongue in the mouthpiece of the snorkel.
- Duck your head under the water until the snorkel fills.
- Now raise your head until your ears are level with the surface, take your tongue out of the mouthpiece and blow the air out. Don't inhale too deeply next as there may be some water in the snorkel.

  Don't dive too deep to start with. Learn to clear your mask in shallow water first.

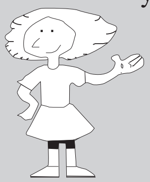
The displacement method

In this method a small amount of air is trapped in the snorkel prior to the dive. The idea is to trap air in the snorkel so that as you resurface that air displaces the water that fills in the snorkel.

- Stand in chest deep water, inhale and plug your mouthpiece as before. Submerge and swim along the bottom of the pool.
- Surface at an angle, remove your tongue and blow a small amount of air into the snorkel.
- Keep surfacing with your head tilted back and the snorkel pointing towards the bottom. As you break the surface, the air will displace the water and any further air can be blown out. The key to getting the water out is to keep the tip of the snorkel pointing towards the bottom.
- If some water enters the snorkel tube, blow it out with the air that is still in your lungs. If you can't do this then stop, take out the snorkel and get a fresh breath of air. Then head down again and keep skindiving.
- Congratulations, you have made a good start!

Safety

1. Surface with your hand up so that if you come up under a boat you won't bang your head.
2. Don't hyperventilate (taking many very deep breaths) before diving in the hope you will be able to stay under longer.



Questions

1. Look at Figure 135.1.
   a. What method is this for clearing a snorkel?
   b. Make a description of what is happening at each of the points 1-5.
   c. What problems did you or your friends have when using this method?
2. Look at Figure 135.2.
   a. What method is this for clearing a snorkel?
   b. Make a description of what the skindiver should do or what is happening at each of the points 1-6
   c. What problems did you or your friends have when using this method?
   d. Explain how air is expelled from the snorkel.
3. What safety precautions should you adopt when surfacing?

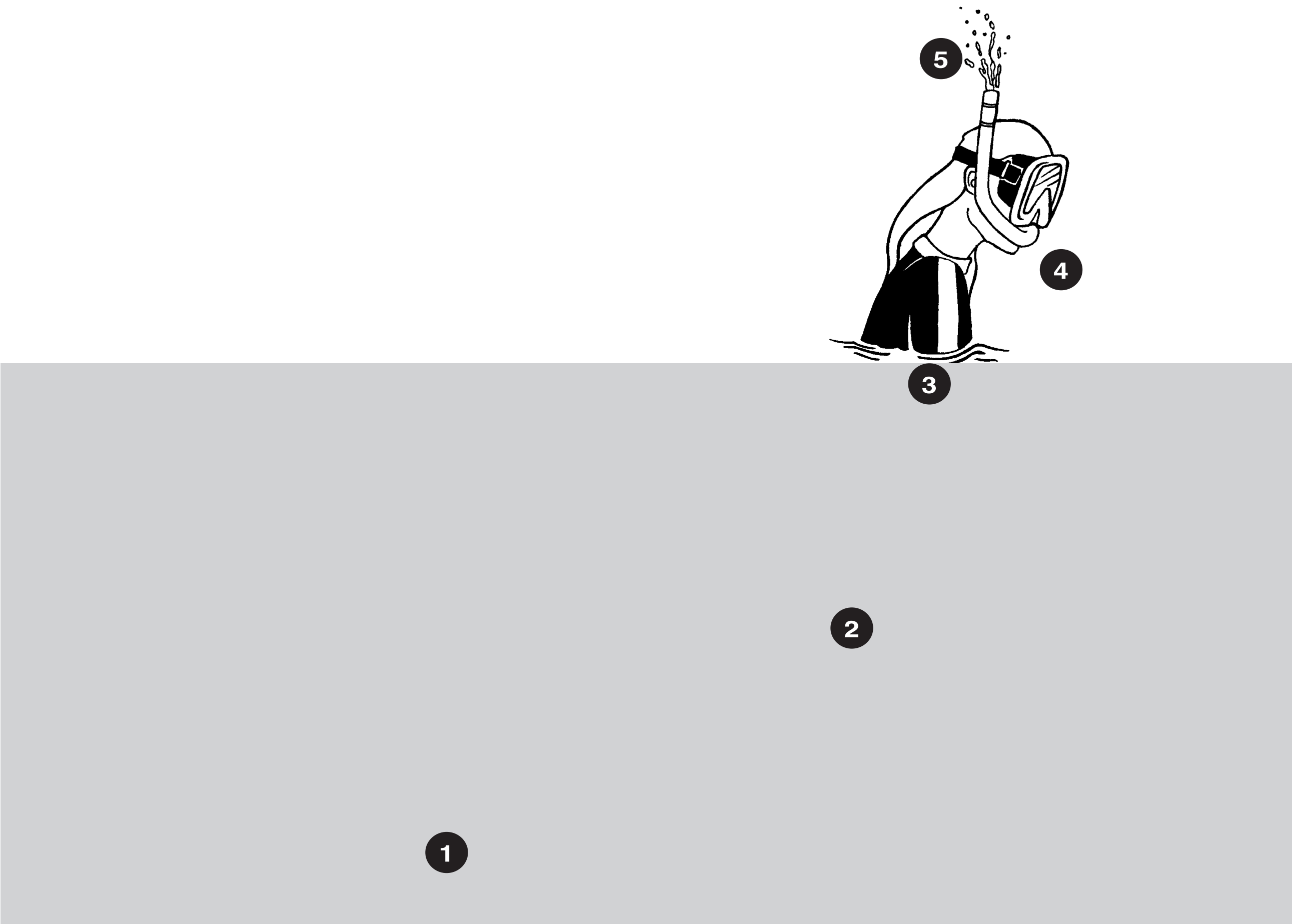


Figure 135.1 Blast method

Wet Paper

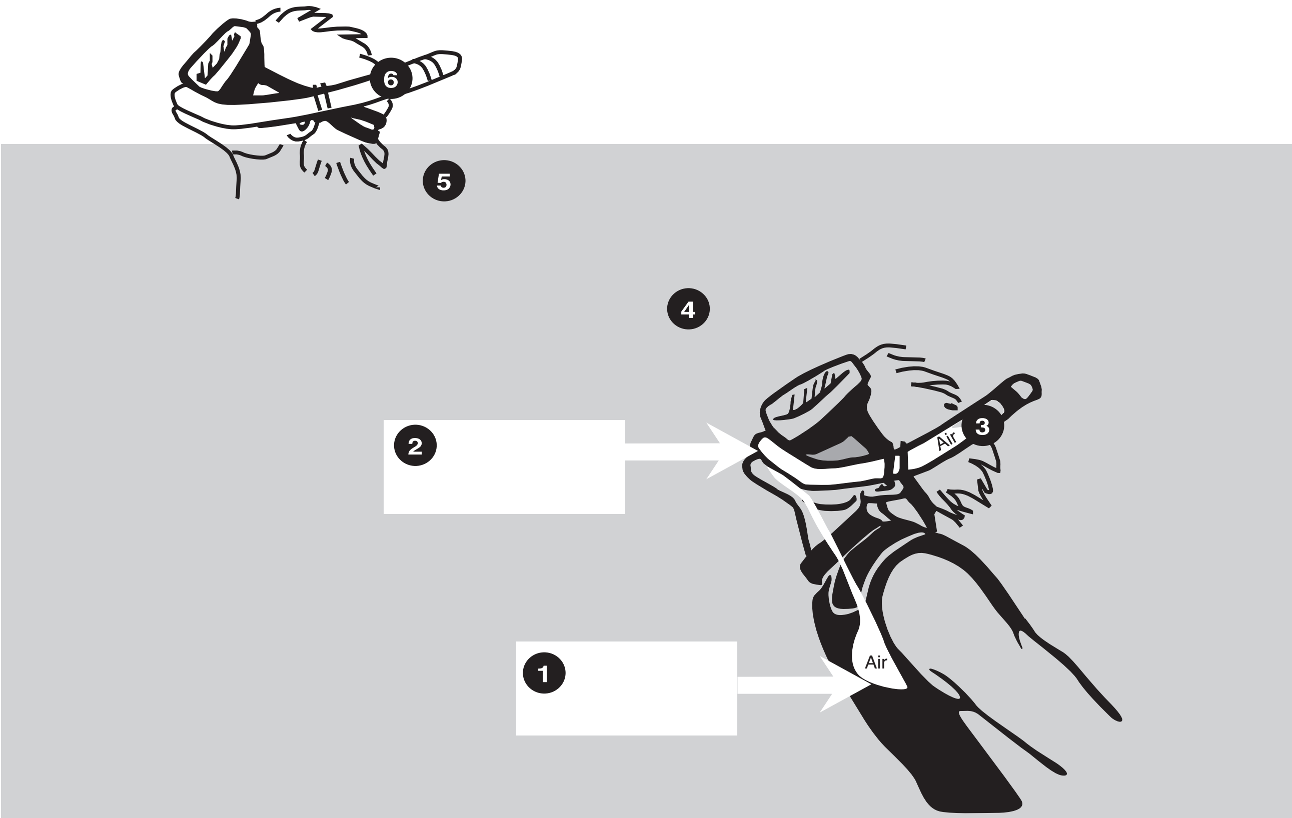


Figure 135.2 Displacement method

Wet Paper

Exercise 136
Duck diving and hyperventilating

Two possible dives are the duck dive and the safety or submerging dive.

Skills

The duck dive

The duck dive involves making a pike, swimming down, turning and swimming underwater and then surfacing.

Submerging or safety dive

In this dive the skindiver simply submerges and looks around before duck diving. Used whenever there is danger of underwater snags or obstacles close to the surface or where visibility is limited and the dive area is not known.

Hyperventilating

The length of time you can stay underwater depends on many factors: body temperature, water temperature and physical fitness are some.

The desire to breathe is caused by a carbon dioxide build up in the lungs. This desire can be reduced by taking deep breaths in quick succession. This lessens the amount of carbon dioxide and is called *hyperventilation*. It's a dangerous thing to do. If you don't breathe in when your body wants more oxygen, it can cause you to blackout! This could kill you if it happened under water. Use your common sense and listen to your body telling you when to surface and take a breath.

Safety

1. Don't hyperventilate prior to skindiving.

   A good rule is to extend your inhalations as well as exhalations — slow and deep is best. Remember, you need to purge that additional carbon dioxide from the snorkel tube that tends to build up while skindiving on the surface.

2. When ascending to the surface, always look up, point and turn in a slow 360^0 movement — this is done to prevent any head collisions with boats or schools of sea jellies.

Questions

1. Look at the diagram in Figure 136.1 and answer these questions.
   a. What type of dive is it?
   b. How else could you get to position 5 to see the racoon butterfly fish?
   c. Describe each of the steps 1 - 7 in your own words.
   d. What problems did you or your friends have when you first attempted this dive?
2. You are ascending at point 6 and notice a school of box jellyfish. What should you do?
3. At point 4 you see a stingray. What should you do?
4. Upon surfacing you cannot clear your snorkel and your mask is full of water. What should you do?
5. At points 2 and 3 what should you be doing?
6. What is hyperventilation and why should it be avoided?

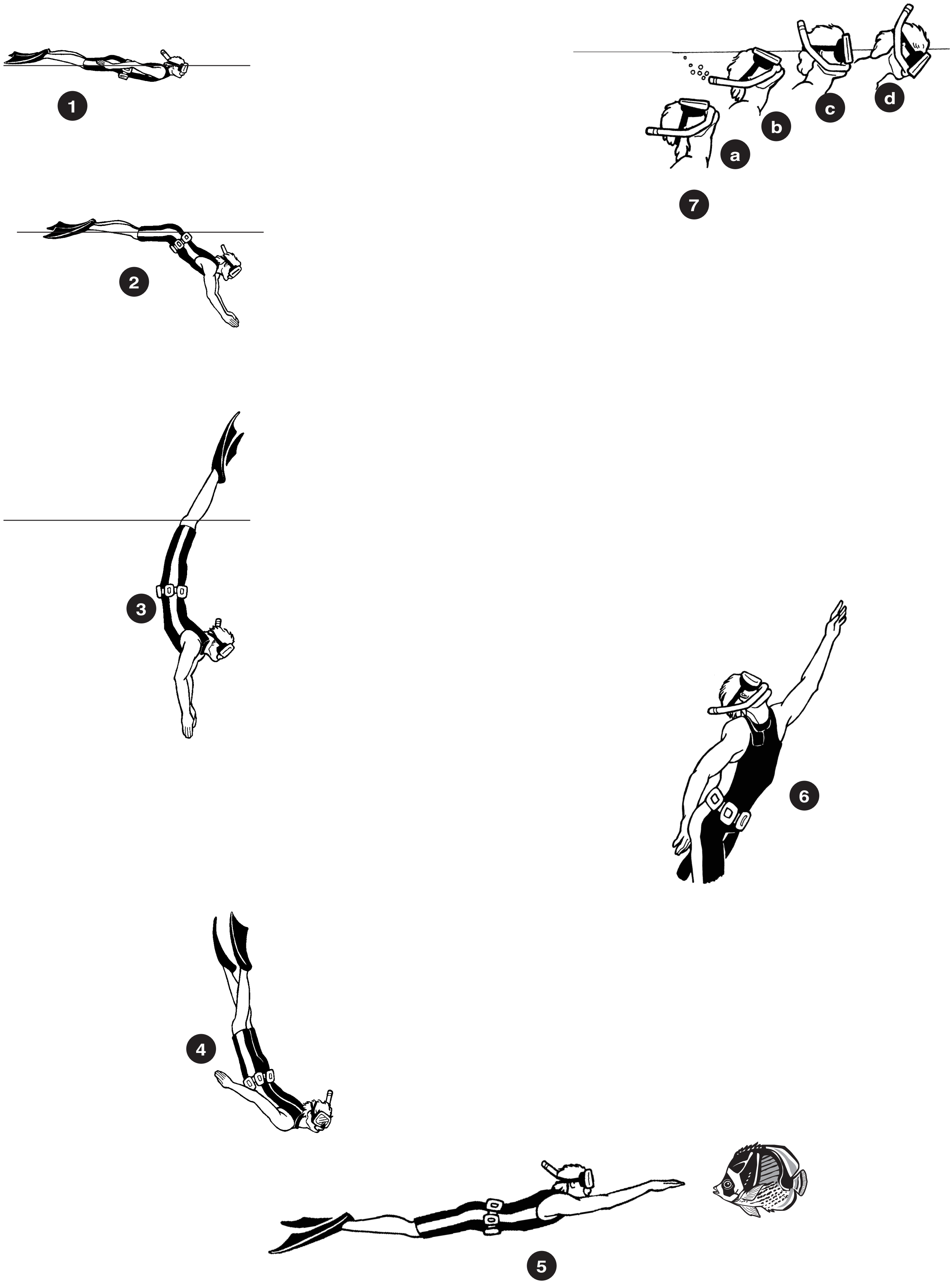


Figure 136.1 The duck dive

Wet Paper

Exercise 137 Clearing your mask

Skills

Watch the snorkelling video as described in Exercise 131, to learn how you can clear your mask.

Clearing your mask at the surface

While you are floating, a little water may enter your mask and the glass may fog up. Take the following steps:

1. Stand up and take your mask off, spit in it and rub saliva around inside.
2. Rinse the mask and put it back on.

Mask fills while under water

You will recall that the water inside your mask is displaced by air. The air rises to the top of the mask and water flows out from the bottom.

If your mask fills while underwater, it is easy to clear. NAUI Australia recommends clearing it using the following methods:

1. In a purge valve mask, the water flows out the one way in the nose of the mask, so the head is tilted forward during the clearing process.
2. With a non-purge valve mask, the mask is cleared as shown in Figure 137.1 and 137.2.
    a. Start by tilting your head forward, pushing the top of the mask against your head and blowing air gently out of your nose.
    b. Complete the operation by pulling the bottom of the mask away from your nose with your thumb, tilting your head back and exhaling through your nose until all the water in the mask has been displaced.

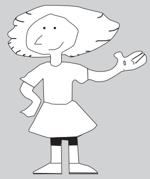
Notes

1. Remember, you must be exhaling before tilting your head back so water will not run up your nose.
2. A steady exhalation is more effective than short, strong bursts of air (which tend to escape instead of remaining inside the mask).
3. Water coming into a mask can be caused by hair in the top or bottom of the mask

    This can be fixed by making sure your hair is well back at the top and if you have a moustache, use vaseline to improve the seal on the face.

Safety

1. Don't dive too deep to start with.
2. Learn to clear your mask in shallow water first.



Questions

1. Why do you tilt your head up when you clear your mask?
2. As you breathe out through your nose, air displaces the water. Why?
3. What is a purge value?
4. What is different about clearing a mask with a purge valve?
5. Describe what is happening in Figure 137.1 and 137.2.
6. Based on your experiences and the experiences of others, list three problems students had in clearing their masks.

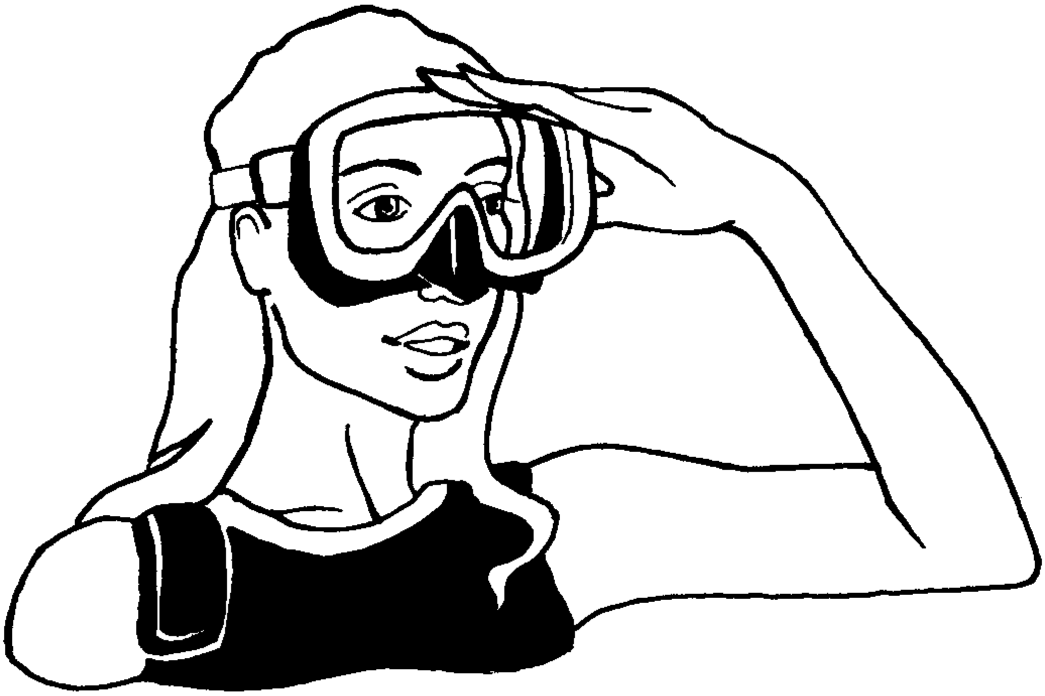


Figure 137.1 Start by tilting your head forward and displacing the water at the bottom of the mask first.
Wet Paper

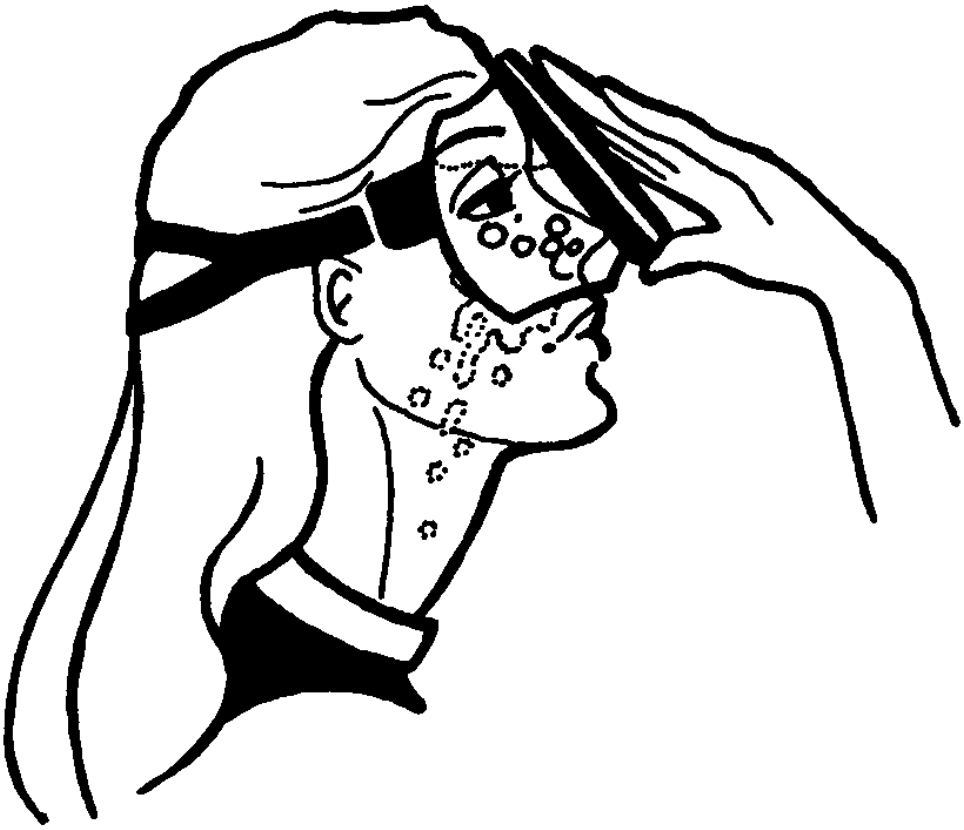


Figure 137.2 Displacing the water by allowing it to flow out the bottom of the mask from air blown out of your nose.
Wet Paper

Exercise 138 Equalising or clearing your ears

Safety

1. Don't blow too hard.
2. Don't dive if you cannot clear your ears.
3. Pinching the nose through the compensators under the mask, and blowing air from your lungs into your closed mouth and then up into the middle ear through the eustachian tube. Should be done gently in order to protect the eardrum.
4. Don't dive with a cold or flu.

Skills

As you go down under the water, the pressure increases on the eardrum. Air in the inner ear is trapped and can expand or contract with changing pressure. This air affects the eardrum which must be protected by clearing your ears or equalising the pressure. The air in your mouth or throat can be blown into the inner ear through the eustachian tube. This makes the pressure on the outside of the eardrum the same as the inside.

1. Practice equalising on the surface first by tilting your head to one side, pinching your nose and blowing gently.
2. Turning your head stretches the eustachian tube. If you chew gum before skindiving you will find this helps clear the eustachian tube.
3. If you do this underwater, you will equalise the pressure on both sides of the eardrum thus making diving underwater possible.

   If you cannot do this, then don't dive underwater. That doesn't mean you can't snorkel. Just don't dive or you will end up with very sore ears and a headache and will damage your eardrum.

   Either pinch and blow gently or swallow as you dive.

   Never wait till the pressure asks you to equalise, always start equalising your ears the moment you start to dive. Now submerge underwater without a mask and equalise.
4. Review the equalising section in the video as discussed in Exercise 131.

Questions

1. What is equalising?
2. Redraw Figure 138.1 in your note book and mark in the following features:
   - Outer ear
   - Inner ear
   - Ear drum
   - Eustachian tube
3. The tube labelled A in Figure 138.1, is connected to what part of the head?
4.. Look at Figure 138.2. The skindiver has just begun to dive.

   Describe what he should be doing about equalising.

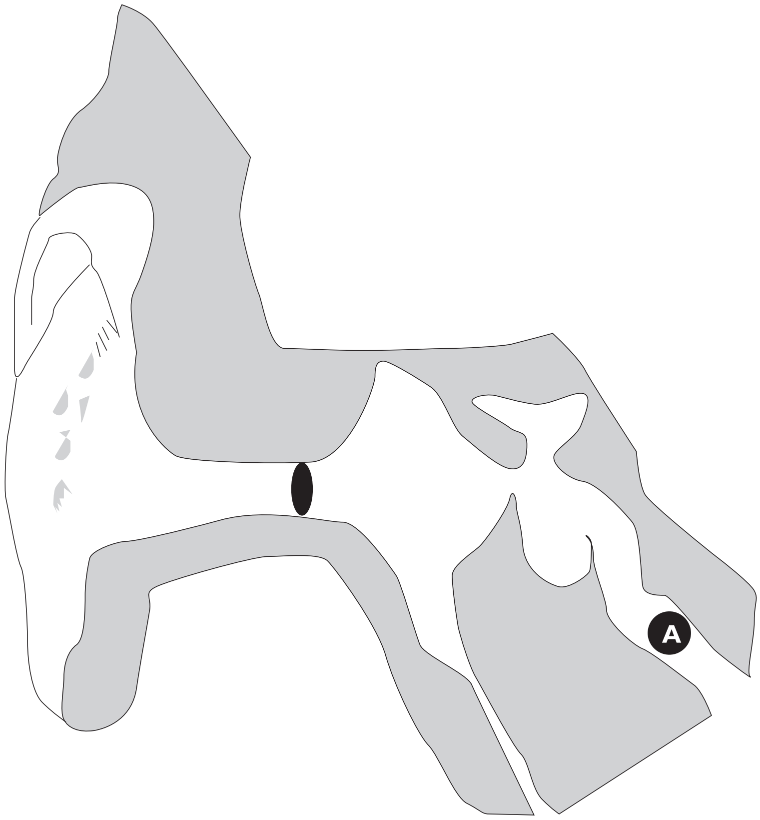


Figure 138.1 Anatomy of the ear
Wet Paper

Figure 138.2 Equalising
Wet Paper

Exercise 139 Finning and planning

Skills

To get the most power from your fins it is important to use the correct method. Without fins, a skindiver tends to kick from the knees down using the calf muscles to raise and lower the legs. These muscles are small compared with the muscles of your thigh so you should try to use these when using fins. Usually the hands are held by the side to conserve energy.

1. Keep your arms by your side and your legs straight.
2. Leg movement should be slow, steady, up and down movements originating from the hips.

   Remember to push down with your top foot and up with your bottom foot as shown in Figure 139.2.
3. Avoid bending your knees as shown in Figure 139.3 as this wastes effort.
4. Avoid excessive body roll by keeping your backside down in the water.

Questions

1. What type of leg action does the skindiver tend to use when swimming without fins?
2. If a skindiver cycled his/her legs as shown in Figure 139.3 while snorkelling, what effect would this have on the ability to skindive for a long time?
3. Figure 139.2 shows a skindiver finning.
   a. Why are the arms at the side?
   b. Why is a weight belt worn?
   c. What type of wetsuit is worn and what temperature water do you think the skindiver is snorkelling in?
4. Redraw Figure 139.1 and colour in the correct colours.
5. Figure 139.4 shows two skin diving situations. Four skindivers are diving near an inshore reef and two skindivers are diving off an offshore bommie.
   - Redraw the diagram and mark where the inshore group should place a safety float rope and divers flag.
   - Redraw the offshore situation and draw in where a boat with a diver's flag should be moored.
6. Skindiving is usually avoided in the 3rd and 4th hour between tides. Using your knowledge of the rule of twelfths, explain why this is so.

Safety

1. Always use a float rope to snorkel to when finning for long distances.
2. Avoid swimming with your hands as this uses up energy.
3. Wear a wetsuit to prevent loss of body heat thus avoiding cramps.
4. Stay with your buddy.
5. If you are cold or tired, get out of the water.
6. Have a snorkelling plan and make sure your buddy knows where you are skin diving to.

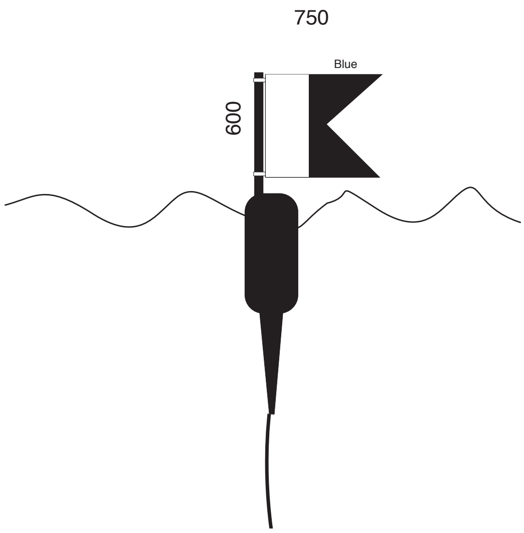


Figure 139.1 Dive flag
Wet Paper

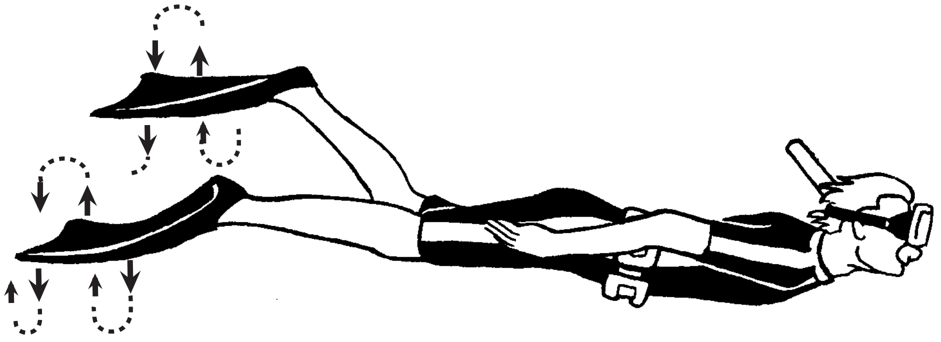


Figure 139.2 Correct finning method

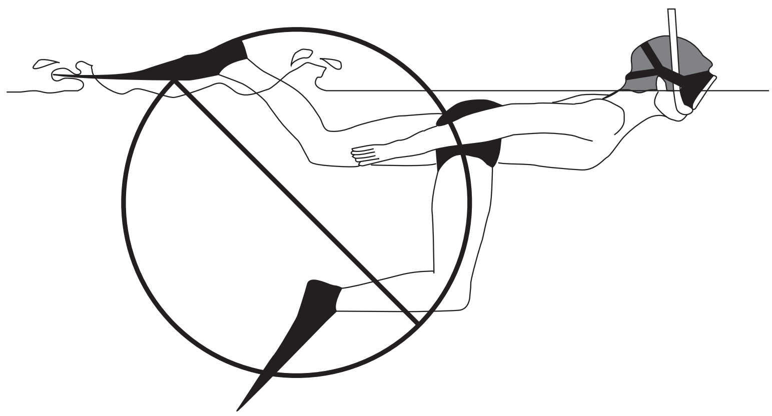


Figure 139.3 Incorrect finning method (Adapted from British Sub-aqua Snorkelling Manual)
Wet Paper

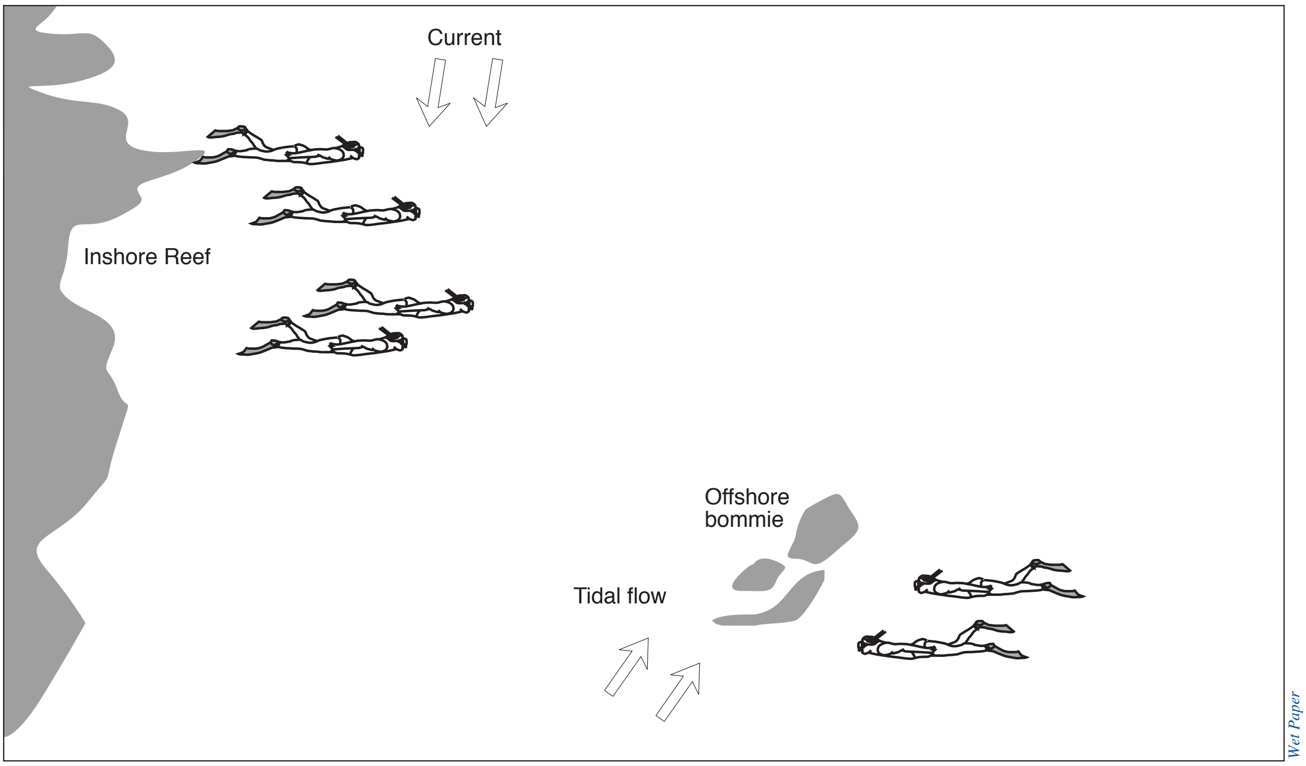


Figure 139.4 Skindive planning

Exercise 140
Rescue and first aid

Class discussion

1. Obtain a copy of the Royal Lifesaving Association's *Swimming and lifesaving manual*.
2. Discuss as a group the most appropriate method for rescue from a pool or reef situation as shown in Figure 140.1 considering such factors as individuals strength, confidence etc.

   Nominate one member in your group to do a Royal Lifesaving Association rescue certificate and become the safety officer for the group.
3. Write for a copy of the St. John Ambulance first aid manual and information about how to do a first aid course.

   Nominate one member in your group to do that course and become the first aid officer for the group.

Reach

Low risk for rescuer

Throw

Low risk for rescuer

Wade

Medium risk for rescuer

Row

Medium - high risk for rescuer

Swim

High risk for rescuer

Tow

Very high risk for rescuer

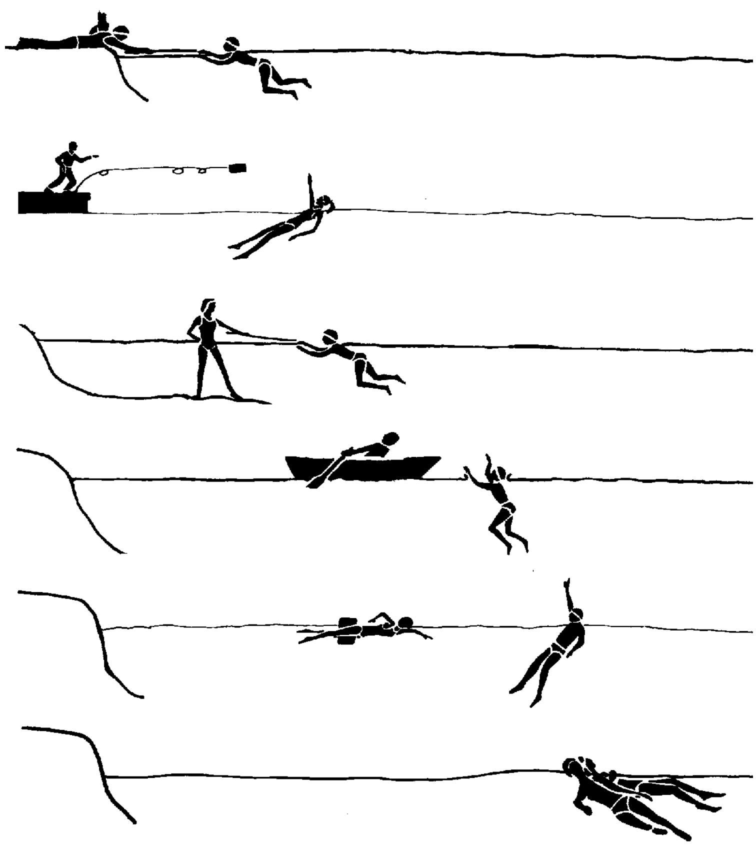


Figure 140.1 Suggested steps to rescue with associated risk, adapted from Royal Lifesaving Association manual

Exercise 141
The diving bell

Research assignment

Use your textbook to locate Figures 141.1 and 141.2. Now read the text on that page and answer the questions below.

1. Who invented the diving bell and in what date?
2. Before the diving bell, skindivers used a bag made of goatskin. What was the problem with this method?
3. What kept the diving bell down?
4. How was air brought to the bell? Redraw Figure 141.1 and write a paragraph explaining your answer.
5. How long could divers stay down using this method and what restrictions did it place on them?
6. In 1840, August Siebe invented an important extension of the diving bell. What was it and why was it significant?
7. Study Figure 141.2 and make a list of equipment the diver is wearing. Give a reason for wearing each piece of equipment shown.
8. Robert Boyle made an important discovery that affected all divers. What was it and what scientific principal was involved?
9. Jacques Cousteau and Emile Gagon invented an important piece of diving equipment almost 100 years later. What was it and what freedom did it give the divers?
10. Use your library to find records of other early diving methods noting the date historic events occurred and their significance.

Make a cartesian diver

1. You can make show the effects of pressure by making a cartesian diver as shown in Figure 141.3.

   Try to keep the test tube in the centre by adjusting the pressure.
2. Explain to the class how it works.

See the show

If you get the opportunity to go to Sea World in Queensland, visit the world of the sea theatre and see the dive show on the history of diving. Sea World also provides a series of projects dealing with the sea to help students understand and appreciate its wonders. For further information contact the Education Division, Sea World, PO Box 190, Surfers Paradise, Q 4217

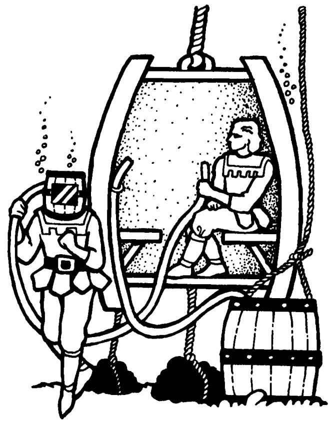


Figure 141.1 An early diving bell (Courtesy Sea World, reproduced with permission)

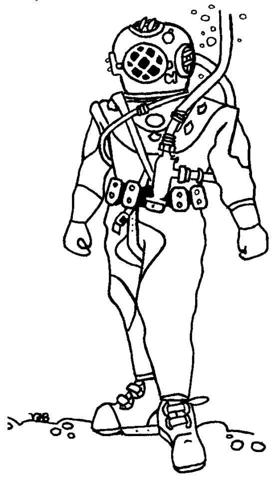


Figure 141.2 An early diving suit (Courtesy Sea World, reproduced with permission)

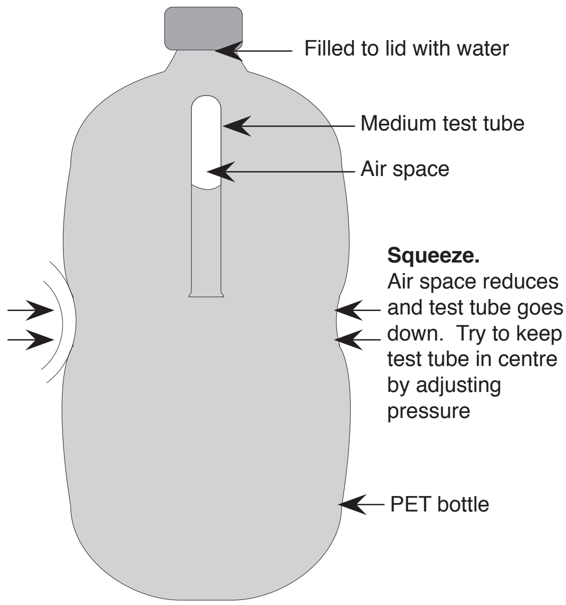


Figure 141.3 A cartesian diver experiment (After Tony Isaacson, Hallett Cove High School, SA)

Wet Paper

Exercise 142
Buoyancy

When objects are placed in water they will either float, sink or occasionally appear to hang in the water. When an object is placed in water so that it is partially or totally immersed, it will displace a volume of water equal to the volume of part of the object immersed.

The upthrust on an object is equal to the mass of the volume of water displaced by the object.

1. When the upthrust is greater than the mass of the object it will float and have positive buoyancy.
2. When equal to the mass of the object, it will just float on the surface and the skindiver is said to have neutral buoyancy.
3. When less than the weight of the object, the skindiver is said to have negative buoyancy

Questions

Study the information presented in the information box, Figure 142.1 and 142.2 and answer the questions below.

1. What does Archimedes Principle state?
2. Look up *displacement* in your textbook index and write out the sentence that uses it. Now rewrite the Archimedes Principle in your own words and give an example using a boat.
3. What is the formula for density?
4. If I put an 80 L skindiver in a tank that is completely full, how many litres of sea water will be displaced?
5. In the above example what is the upthrust?
6. When will an object float?
7. A diver has a mass of 75 kg when weighed in air. What will be the diver's apparent mass when placed in water and will the person float or sink?
8. You are floating in a pool and you breathe out. Predict what will happen? Give a reason for your answer.
9. You throw a barrel of water overboard with water in it. It has a volume of 100 litres and a mass of 250 kg, when weighed in air.
   a. What will the apparent mass of the object be when placed in water?
   b. Will it float?
10. What is the difference between positive and negative buoyancy?

Archimedes Principle

An object immersed in water will displace a volume of water whose mass is equal to the upthrust.

But will it float?

Worked example 1

An object has a volume of 75 L and a mass of 150 kg, when weighed in air.

a. What will the apparent mass of the object be when placed in water?

b. Will it float?

Answer:

a. Volume of object = 75 L

Mass of H_2O displaced = 75 L x 1 kg/L = 75 kg

Upthrust

Apparent mass = Mass in air – Upthrust = 150 kg – 75 kg = 75 kg

Therefore the object will appear to be half as heavy.

b. The object has a mass of 150 kg. The upthrust is equal to 75 kg. Therefore the object will sink.

If a skindiver puts on a wetsuit, the volume displaced will be greater and so will be the upthrust. The skindiver will be more buoyant.

If a skindiver puts on weights, which are small but have a high density, less water will be displaced, decreasing the upthrust and so the skindiver will sink

Worked example 2

A diver has a volume of 80 L and a mass of 75 kg, when weighed in air.

What will be the apparent mass when placed in water and will the person float or sink?

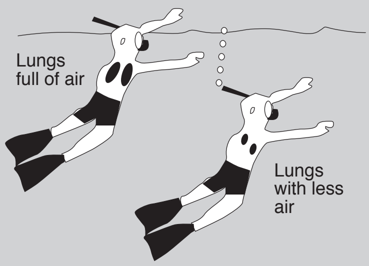
Density of water = 1 kg/L.

Volume of person= 80 L, Mass of water displaced = 80 L x 1 kg/L= 80 kg (upthrust)

Apparent mass of diver = 75 kg – 80 kg = – 5 kg .

The diver will float because he or she weighs less in water.

When the upthrust is greater than the mass of the object, the object will float.



When you breathe in you will rise and when you breathe out you will sink because the air in your lungs adds or subtracts from the upthrust by changing the volume of your body.

Review the section on buoyancy from the NAUI video in Exercise 131.

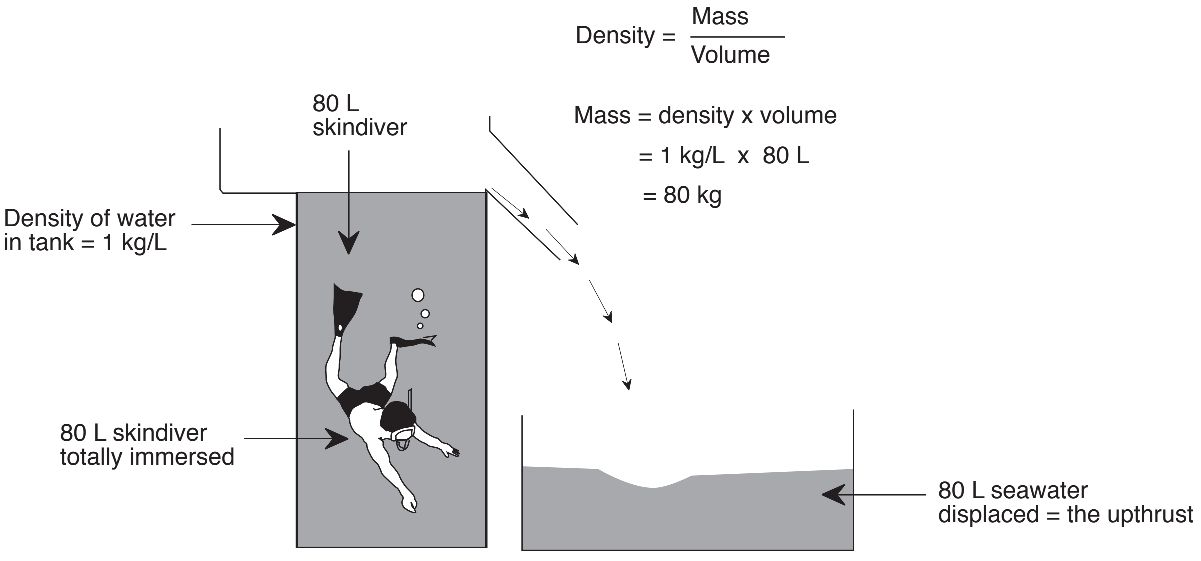


Figure 142.1 The upthrust on an object is equal to the mass of the volume of water displaced by the object.
Wet Paper

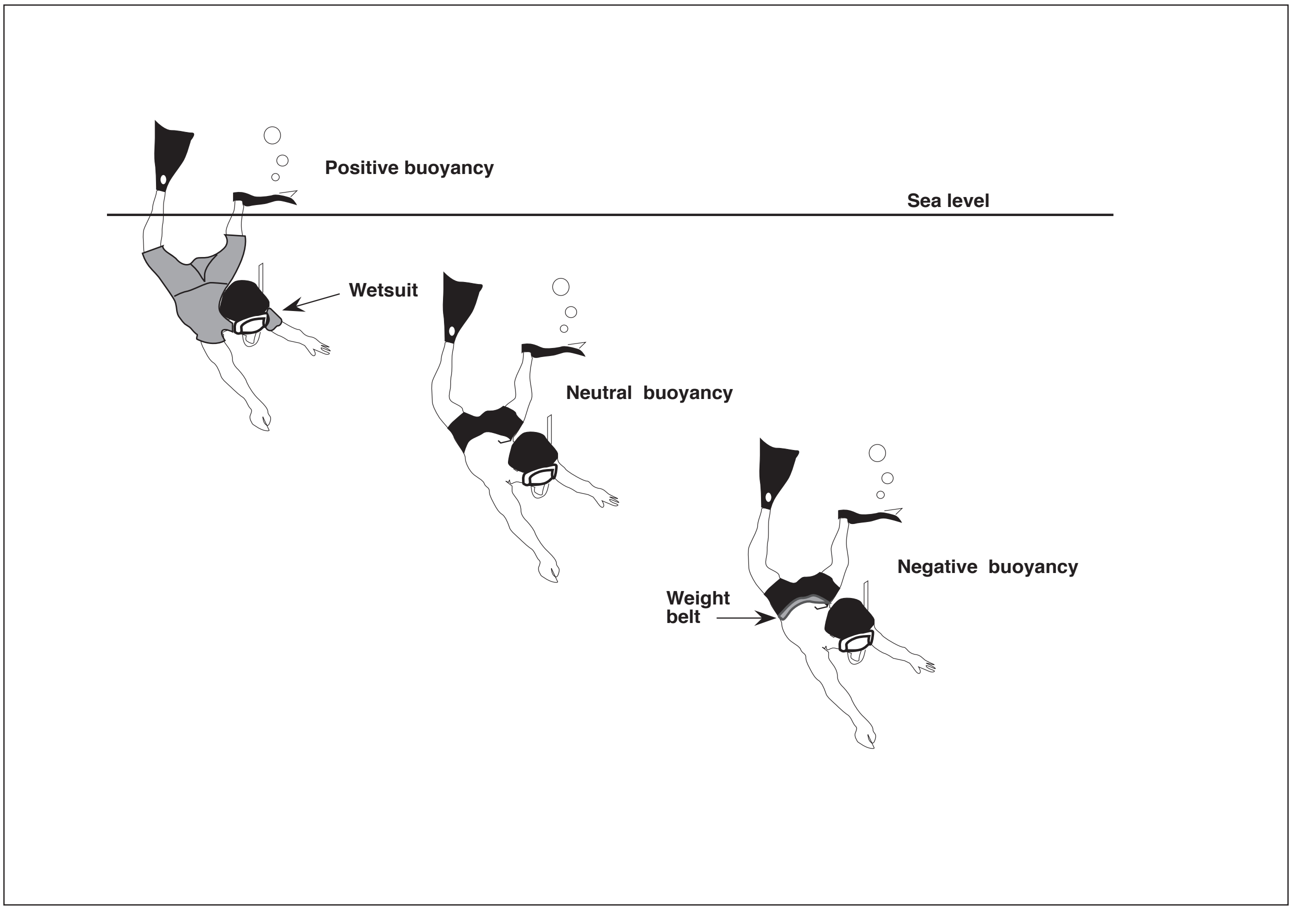


Figure 142.2 Positive buoyancy can be achieved by using a wet suit or BC, negative buoyancy can be achieved by using a weightbelt.
Wet Paper

Exercise 143 Light and sound

Most oceanographers these days use SCUBA. A knowledge of how changing conditions affect the human body is essential for survival.

The physiological differences which the diver must adapt to can be summarised thus; sound, sight, temperature, buoyancy and movement and pressure.

Questions

Use your textbook index to find the section on *Underwater sciences* and answer the questions below.

1. Use your textbook to indicate which of the arrows are red, orange, yellow, green and blue in Figure 143.1.

2. Label the following in Figure 143.2:
   - Sclera
   - Choroid
   - Aqueous humour
   - Ciliary muscles
   - Optic nerve
   - Aqueous and vitreous humours
   - Lens
   - Retina
   - Blind spot
   - Cornea

3. Use your textbook to help you draw arrows in Figure 143.3 to indicate how a mask improves vision underwater.

3. Locate the sight information box in your textbook that discussed *refraction* and answer the following questions.

   a. When wearing a mask underwater, do objects appear closer to or farther from you?

   b. What scientific term is used to explain this?

4. Find the sound box in your textbook and answer the following questions.

   a. Does sound travel any differently in water than it does in air? If so, how differently and what problems could it cause for skindivers?

   b. Is sound transmitted between air and water? If not, what is the effect for skindivers?

   c. What are the implications for a diver surfacing with respect to sound?

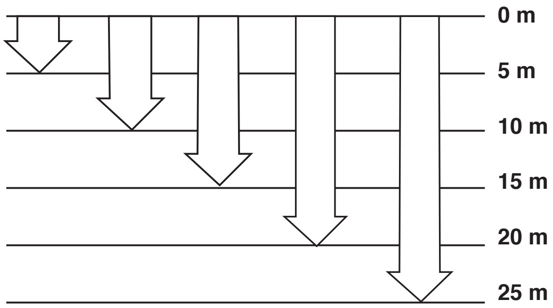


Figure 143.1 Colour penetration

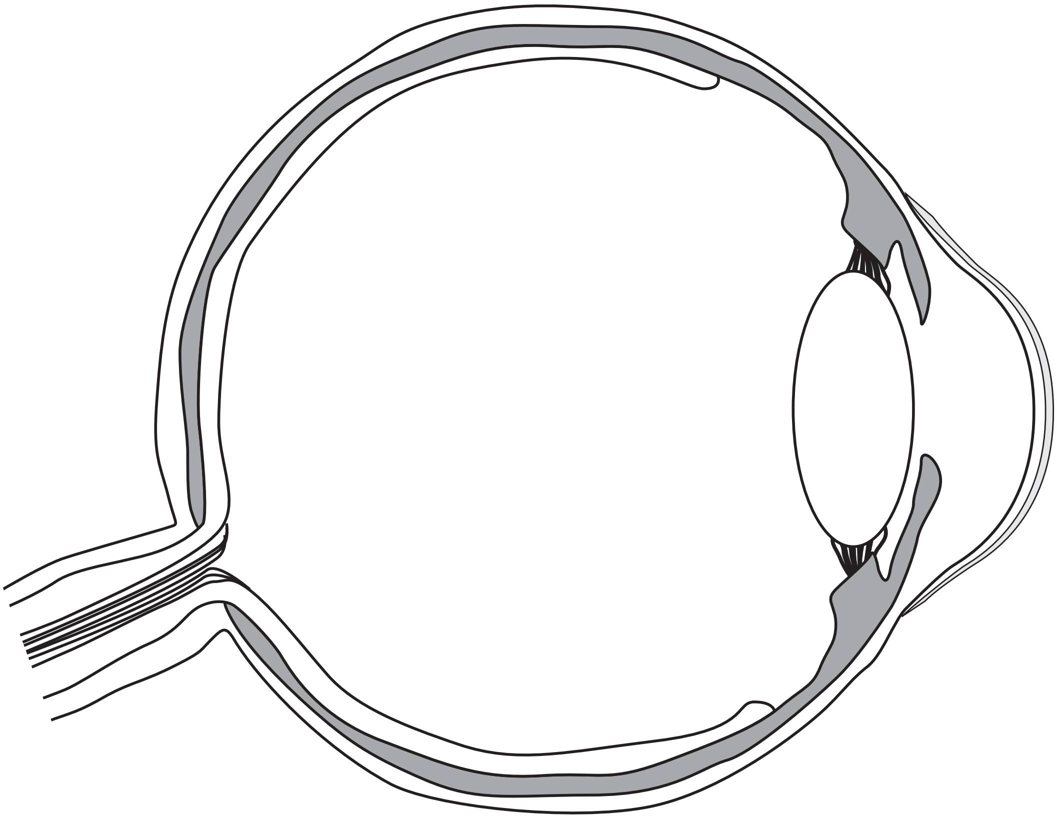


Figure 143.2 Anatomy of the eye

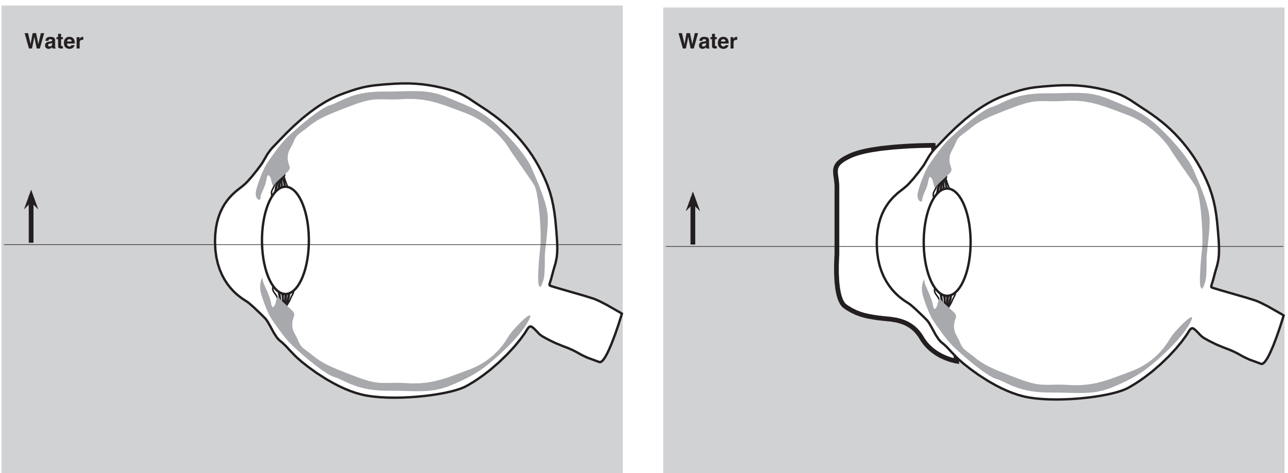


Figure 143.3 How a mask improves vision underwater

Students may make one copy of this page so that they can attach their answers before handing in for marking.

Wet Paper

Exercise 144
Snail research

Research project

1. Decide as a class to undertake a research project in conjunction with your State Management Environmental Authority.
2. An example project involved students and staff qualified in SCUBA, mapping an area of Ningaloo Reef in WA.

   A sample site was agreed upon with assistance from the Conservation and Land Management Agency (CALM).

   Students then ran transect lines over the reef counting the mollusc *Drupella cornus* and supplied results to CALM.
3. Write for a project sheet on this activity to :

   Wet Paper
   14 Milbong Tce Ashmore Q 4214
   Fax: (075) 39 4187

Alan Wolfe

Figure 144.1 Counting *Drupella cornus* infestations, Ningaloo Reef, July 1994. Photograph courtesy Alan Wolfe, South Fremantle State High School

Alan Wolfe

Figure 144.2 Students from South Fremantle High School return from skindiving quadrat surveys, Ningaloo Reef, July 1994. (Photograph courtesy Alan Wolfe)

Exercise 145
Reef projects

Research projects

1. Write for a copy of the publication Project Reef Ed.
2. Find the following projects from the table of contents and discuss each one in your group, talking about the possibility of undertaking a project while on your marine studies camp.
   - Worm watching
   - Clams big and beautiful
   - Following a friendly fish
   - Pursuing a parrot fish
   - Super spotter
   - Who's who in fish families
   - Colour patterns in reef fish
   - Map a bommie scuba project
   - Movement in fishes
   - Fish distribution
   - Fish territoriality
   - Schooling in fishes
   - Association between species
   - Goby and shrimp
   - Clownfish and anemone
   - Cleaner wrasse
3. Project Reef Ed is available from :

   Great Barrier Reef Marine Park Authority

   PO Box 1379 Townsville Q 4810

   Fax: (077) 72 6093

Exercise 146 Mapping a bommie

Acknowledgement to Phil King, Coffs Harbour High School

Project

A bommie is a large coral or rock outcrop, part of which is shown in Figure 146.1.

Bommies make an ideal site to study marine animals because you can view organisms from a standing position.

1. You need to do a recognised SCUBA course before you can undertake this project.
2. Often you will visit different places in your dive course and as you gain confidence you will become better at making underwater observations.
3. An example of this project comes from students of Coffs Harbour High School who undertake a SCUBA course as part of their Marine Studies program.

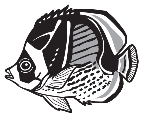
   They practice the skills necessary for writing and observing underwater during the course at Coffs Harbour.

   Each year they save up and go to Heron Island off the Queensland coast and map part of the famous Heron Island Bommie.
4. Write for a project sheet on this activity to:

   Wet Paper

   14 Milbong Tce Ashmore Q 4214

   Fax: (075) 39 4187



(Photo courtesy Phil King and students Annette Vandenberg and John Catsell).

Figure 146.1 Students from Coffs Harbour High School complete their mapping the bommie project as part of the school marine studies program

Exercise 147 School project clubs

Project ideas

Exmouth District High School, WA

1. In this school, the marine studies teacher completed a dive course with PADI and the Exmouth Dive Centre.
2. This involvement led to their teacher becoming a keen underwater photographer.

   A local dive instructor provided instruction for students, and their photographs were developed at school and at a local photo lab.
3. Motivated students completed their PADI dive course.
4. A project sheet is available from Wet Paper.

Toowoomba Grammar School, Qld

1. In this school, the teacher Ted Brambleby organised a SCUBA club for years 8 –12.
2. The year 12 students had worked their way through the NAUI certificate program and used their last year to train a group of years 8 – 9 students to gain their instructors certificate.

   The school club has many skindiving and SCUBA excursions each year.
3. Ted Brambleby has worked with Neville Coleman who publishes a magazine, *Underwater Geographic* which details ways underwater photographs were taken as well as a many other ideas.

   Some books by Neville Coleman which would be invaluable to your club members include:
   - *A field guide to Australian marine life*
   - *Discover underwater Australia*
   - *Discover underwater Australia*
   - *Nudibranchs*
   - *Australian fish behaviour*
   - *Encyclopedia of marine animals*
   - *Beginners guide to underwater marine biology*
   - *Australian marine fish*

   A workbook for underwater projects has been completed by Ted and Neville and is available from:

   Sea Australia Resource Centre
   PO Box 702, Springwood Q 4127
   Fax: (07) 341 8148

Kingscliff Enviroclub, NSW

1. This club is also based on the years 7 –12 vertical integrated approach.
2. The club meets once a week and explores ways members can continue their environmental work through the many environmental organisations. Some of their may activities have included participating in the following programs:
   - Landcare
   - Frogwatch
   - Streamwatch
   - Surfrider foundation storm water taskforce and Ocean Care Day
   - Sea World Junior Marine Biology program
   - MESA Seaweek
   - Landrap
   - Coastwatch
   - Whalewatch
   - Skywatch

Project sheet

You can write to Wet Paper for a project sheet called:

Marine Studies Club Ideas
14 Milbong Tce
Ashmore Q 4214
Fax (075) 39 4187

NEVILLE COLEMAN'S
UNDERWATER GEOGRAPHIC
P.O. BOX 702 SPRINGWOOD QLD 4127 PTY LTD ACN 002 043 076 PH: (07) 341 8931 FAX: (07) 341 8148

Figure 147.1 Why not write for back issues of this magazine?

Figure 144.2 Students from Exmouth District High School with teacher Peter Garwood and their first ever underwater photographs.
(Photograph courtesy Exmouth District High School).

Exercise 148 Underwater hockey/fishing

This activity is described by the Australian Underwater Federation in their School Snorkelling Program Publication.

It is based on the training handbook for the national snorkellers club publication, *Snorkelling Manual* , by the British Subaqua Club.

In this activity students form teams to play hockey underwater. The puck is called the squid and the goals are at either side of the pool.

The squid is pushed around by modified hockey sticks and the goals are a flat box at either side of the pool.

The rules are much the same as in ordinary hockey with offside, foul plays, etc. and the winner is determined by the number of goals scored after a set time.

You can write for copies of how to play the game as well as other useful information on snorkelling from:

AUF National Headquarters

PO Box 1006

Civic Square

Canberra ACT 2608

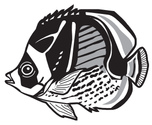
Telephone: (062) 47 5554

Australian Underwater Federation

Exercise 149
Revision Test

Time 30 minutes

35 Marks



Knowledge and understanding

1. During World War II, Jacques Cousteau and Emile Gagon invented a device which allowed divers to breathe compressed air. This device was:
   a. a regulator.
   b. a diving hat.
   c. a diving bell.
   d. the diving snorkel.
2. Snorkels enable you to breathe while you are swimming on top of the water. A snorkel with a small bore:
   a. decreases the volume of air trapped inside the snorkel and should be used by young children.
   b. decreases the volume of water trapped.
   c. has a smooth J-shape.
   d. increases the amount of stale air rebreathed and can cause snagging.
3. It is difficult to determine the direction of sound underwater because:
   a. sound travels slower under water.
   b. the sound waves have larger wave lengths in water.
   c. the propeller of the motor spins at high frequencies.
   d. sound travels faster under water.
4. Swimming goggles should not be used for snorkelling because:
   a. the diver can't equalise his/her ears.
   b. the diver can't equalise the pressure around the eyes.
   c. it is impossible to clear the bubbles around the eye.
   d. it distorts the colour of the objects, due to refraction.
5. Which of the following is not a feature of a good mask?
   a. A mask with a large volume is easier to clear and increases the diver's field of vision.
   b. The face plate must be made of safety glass to guard against breakage or scratching.
   c. The plate should be secured with a non-corrosive band.
   d. The mask should be watertight, preferably with a soft double seal.
6. Which of the following is not an advantage of using a wetsuit ?
   a. Reduced heat loss and therefore reduced chance of cramp and hypothermia
   b. Protection from cuts and abrasions
   c. Negative buoyancy
   d. Protection from stinging animals
7. As depth increases:
   a. the range of visibility and the intensity of colour decreases due to the diffusion and absorption of light.
   b. objects appear larger due to the refraction of light.
   c. objects appear to be reddish in colour as this frequency disappears first.
   d. the brightly coloured marine organisms appear yellow.
8. When viewing an object through a mask, the object will:
   a. appear smaller and further away due to absorption.
   b. appear larger and closer due to refraction.
   c. be sharply defined because of the pin cushion effect.
   d. appear to be brighter than usual because of the absorption of the glass.
9. Hyperventilation is caused by:
   a. excessive heavy breathing.
   b. extreme cold.
   c. surfacing too quickly.
   d. high pressure trauma.
10. Water draws heat away from the body faster than air. Water draws heat:
    a. 2 times faster than air.
    b. 5 times faster than air.
    c. 10 times faster than air.
    d. 25 times faster than air.
11. List four things you should do to care for skindiving equipment.

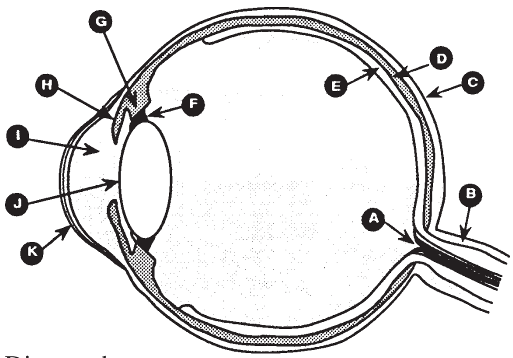
    (2 marks)
12. What are purge values and what are the advantages and disadvantages of each ?

    (1 mark)

13. State Archimedes' principle

(1mark)

14. Name the points a – k in the diagram below.



15. Discuss the statement:

'The greatest change in pressure on your body is in the first 10 metres'. Why is this so ?

What precaution must we make for this when diving?

(2 marks)

Information processing and reasoning

1. A plastic bag with a volume of 8 L was placed at the surface. This bag was then taken to a depth of 20 m. The pressure at the surface was 1 atmosphere and the pressure at 20 m was 3 atmospheres.

   a. Calculate the volume of the bag at 20 m.

   b. Why should you never hold your breath while ascending ?

(3 marks)

2. A 2 m piece of timber has the dimensions of 5 cm x 10 cm. If it has a weight of 75 kg when weighed in air, will the timber float? Show all working.

(3 marks)

3. A sound wave of frequency 2000 Hz has a wave length of 0.75 m in water.

   a. What is the period of the sound wave in water ?

   b. What is the speed of the sound wave in water ?

   Use the formula:

   $v = f\lambda$ $f=1/t$

   where:
   v = speed

   f = frequency

   λ = wavelength

   T = period

   Speed of sound in air = 340 m/sec

   c. If the water is 50 m deep, how long will it take this sound wave to travel from the surface to the bottom and back to the surface ?

(3 marks)

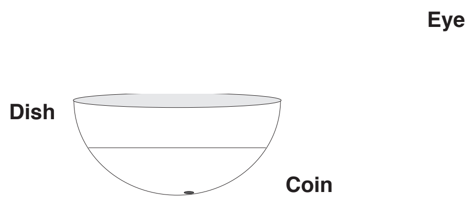
4 When light enters a medium in which it travels more slowly, it is refracted towards the normal.

When it enters a medium in which it travels more quickly, it is bent away from the normal.

Draw a diagram to illustrate this and show where an observed object appears and where it actually is positioned.

(2 marks)

5. A small coin is placed in a large dish that has opaque sides. From the position of the eye as shown, the coin is not visible. However when water is poured into the dish the coin becomes visible. Explain the physics of this observation.



(3 marks)

Answers

1.	a	6.	c
2.	b	7.	a
3.	d	8.	b
4.	b	9.	a
5.	a	10.	d

SECTION 9 BODY SURFING

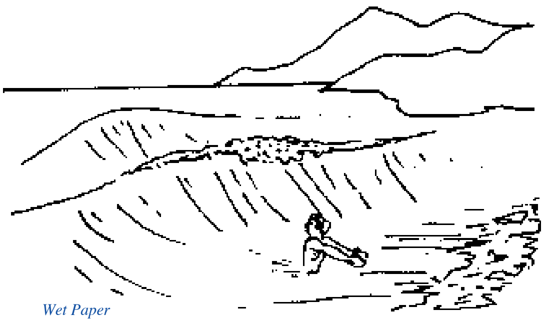
* Wet Paper wishes to acknowledge the work of Peter Chapman from the Gold Coast for his assistance in developing this chapter.

EXERCISE 150 THE BASICS*

QUESTIONS

Read the information box on the right and answer the questions that follow.

1. What are three important aspects of speed and manoeuvrability in water sports?
2. What is the ideal shape for a body surfer? Is this a disadvantage if you are short and round?
3. The author mentions the thrill of slotting yourself into 'a spinning vortex of crystal and foam'. What is he referring to?
4. Where can all waves can be caught from?
6. There are two places where the author suggests you learn to surf. Where are they?
5. What does the term *out the back* mean?
6. What depth will a 0.75 m wave break in?
7. In the last paragraph the author suggests that you don't go out too far. Why?



In water sports, speed and manoeuvrability of your craft depend on length, width and weight. A compromise is usually sought between length (which determines speed) and width (which determines manoeuvrability) depending on the desirable functions of the craft.
This may not necessarily be completely true with bodysurfing. If you view your body as a water craft, the longer and thinner you are, then the faster you should go. However if you are short and plump then don't feel disadvantaged, because excess of weight will increase your buoyancy and could actually help you catch a wave.
It is a good idea to wear a swimming costume that creates minimal drag. To date, for boys 'speedos' are not bad and for girls, a one-piece costume will work well.
Having been enlightened to the advantages and potential thrills of bodysurfing, you can hardly wait to slot your body into a spinning vortex of crystal and foam; but you'll need some help to feel confident at every stage of your adventures, so let's assume you've never seen a wave before and take it from there.

Basic bodysurfing

You do not have to be able to swim at this stage. All wave catching will be accomplished by standing in about waist - to chest-height water and springing off the bottom onto the wave as it approaches you. This will give you a sense of security so you can concentrate more on surfing the wave. When you have mastered this stage and can 'read' the waves, you will be ready to try some of more advanced techniques.

Is it safe to enter?

Until you gain enough confidence and ability to face the surf alone, confine your first attempts to a populated, patrolled beach where help is available if needed. If you can't find a patrolled beach, try to find a shorebreak with waves that are no bigger than 1 m at high tide. If the surf is small, go 'out the back' at low tide. When the surf is bigger than this, rips and sweeps may be present. Wait until you become more confident and have sufficient knowledge about what you're doing before you venture out into the bigger stuff.
So ideally you should start off learning in a shorebreak where the waves are breaking close to the beach. The waves should be, as mentioned above, less than 1 m high before the break. A 0.75 m wave generally breaks in about 1 m of water so you should be able to stand up quite easily.
Your aim at this stage will be to station yourself, standing at the bottom, where the average-sized waves are breaking. Don't go out too far as you will get out of your depth in the deeper water beyond the break.
Chapman 1994

Exercise 151
Beaches

Questions

Use your textbook index to find the section on *Sand banks, rip currents and wave patterns* and answer the questions below.

1. What are waves affected by as they approach the beach?
2. Name three types of wave and use drawings to illustrate your answer.
3. What is a rip? Use a drawing to illustrate your answer.
4. If you are caught in a rip, what should you do?
5. The photograph in Figure 151.3 is from Triggs Beach in WA. What is the sea floor like and what type of wave is breaking?
6. Beaches with a sand sea floor have a different wave breaking pattern than beaches with a reef or rock sea floor. Write a paragraph explaining why.
7. Why does the wave shape change with the tide?
8. What is an onshore wind and what type of surf does it create?
9. What is an offshore wind and how does it affect the wave breaking pattern?
10. Turn to a chart of Hypothetical Bay and answer the following questions.
    a. Maloney Bay is a famous beach for the locals from Conneltown. What would be the best prevailing winds for a body surf in the bay?
    b. Use the legend at the end of the navigation chapter to locate the sea floor symbols. What sea floor does Maloney Bay have?
    c. A 25 knot north-westerly is blowing with a 2 m south-easterly swell and you wanted to go for a surf. Is it worth the effort to drive down? Give reasons for your answer.
    d. Would it be possible to surf at Perry Shoals? If so, would it be wise?
    e. Surfrider Bay has a famous break. Is it rocks, reef or sand?
    f. Jensen Beach near Batestown is famous for its surf carnivals with the annual ironwoman and ironman races a feature event.

       What would be ideal surfing conditions for this beach and what type of surf conditions would force a cancellation of a surf carnival?

Safety

The Australian Surf Lifesaving Association have identified four types of rip

Permanent

Here the current remains in the same place for months, even years.

Fixed

Where a gutter or depression in beach sand keeps a rip in place for months.

Flash rips

Where a depression suddenly occurs in a beach profile.

Travelling

Where a rip moves up the coast.

Surf clubs should become familiar with the special contours of their particular beach and give practical advice to schools.

At time of publication, safety guidelines for surfing were not available to the publisher and schools are advised to consult the DOEM or State safety manuals when available.

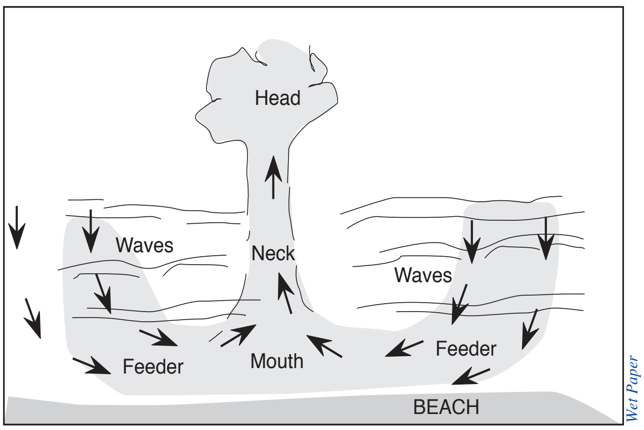


Figure 151.1 Rip current formation (After ASLA 1987)

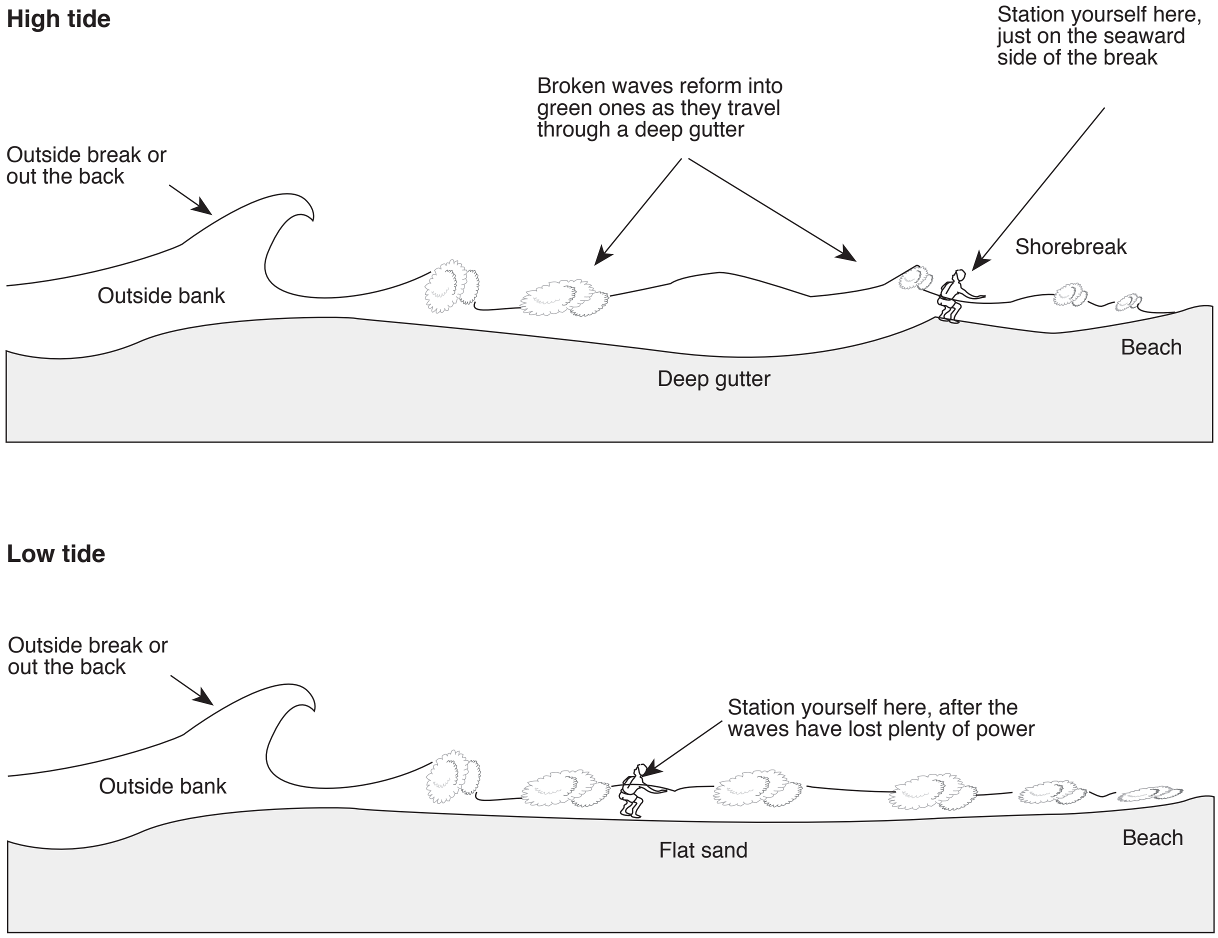


Figure 151.2 Cross section of typical bank/gutter formation comparing low and high tides showing learning points.
Wet Paper

Wet Paper

Figure 151.3 Triggs Beach WA.

Exercise 152
Getting out

Questions

Read the information box , look at the figures on these two pages and answer questions below.

1. What should you check for before you go out body surfing?
2. Why do you pick a best spot and how do you use it effectively to catch waves?
3. Why do you need to keep touching the bottom when you are learning to body surf?
4. You are confronted with a large wave. What do you do to get through it?
5. The author refers to a block start position. Draw a wave breaking and show the sea floor. Now draw a stick figure to show this position.
6. If two waves come at you in quick succession, what should you do?
7. What is a dumper and how do you get under one?
8. On your way out, the author suggests you reassess the situation. What are you supposed to reassess and why?
9. What does reading the waves mean?
10. How do you know which is the right wave to catch?
11. How does the author suggest you catch smaller waves?
12. How does he suggest you get larger waves?
13. If you are not getting any waves at all, what does he suggest you do?

Getting out there

Having checked for rips and sweeps, you decide it's OK to enter. Pick out the spot in the surf where you think the best waves are breaking and make this your objective. Line this spot up with a marker on the shore (e.g. umbrella, car or some other object as shown in Figure 152.2).

If you drift away from your reference point you will know that you are moving out of position.

If possible, when you get to the spot, line yourself up with some other stationary object at right angles to your shore marker. If you have these two reference markers you will know exactly where you should be and/or how far and fast you have drifted.

Remember that at this stage you should be able to touch bottom most of the time, so you won't need to swim out there. Go ahead if you want to, but you will expend much less energy if you just wade out and dive under the waves as they come at you.

If you are confronted by a large wave about to break on you, dive down to the bottom as far under the wave and out to sea as possible. Now grip the sand in your hands with your body in press-up position and push yourself seaward (see Figure 152.1 a – d), or for maximum thrust, after gripping the sand, bring your body into block start position with your feet on the bottom and spring off obliquely to the surface and seaward.

When you see two waves coming in quick succession don't try to come up between them or you could get a face full of foam. Dive under the first one and remain under until you hear the second one pass over — don't be fooled and come up too early.

Dumpers have a backward exploding effect that can actually shoot you out to sea if you position yourself correctly, but it takes a little experience. If you combine the press-up and spring technique with the backward exploding effect you will get a boost seaward.

On your way out be continually assessing the situation. Are you being carried out or along too quickly, or towards rocks? Are the waves a bit bigger than they appeared to be from the shore? Don't commit yourself to any fixed objective – remain flexible enough not to go past the point of no return.

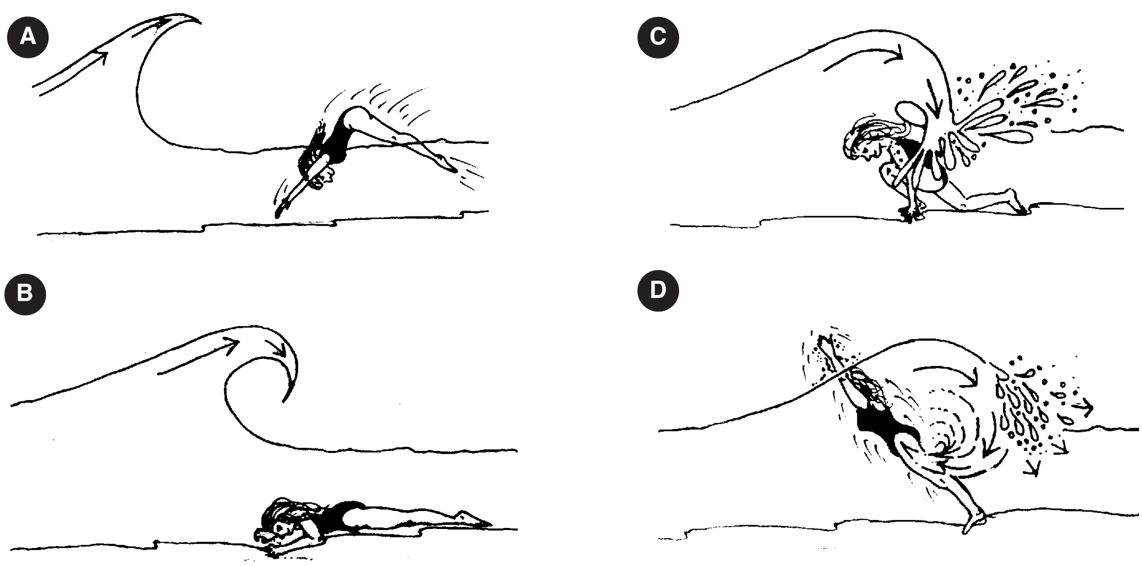


Figure 152.1 Getting through a dumper (After Chapman 1994)

Waiting and positioning yourself for the right wave

Once you have found the best spot, you are ready to think about catching waves. You will not be able to catch every wave that comes through. Waves break in different locations depending usually on how large the wave is, and how deep the water is.

Choosing the right wave to catch, and putting yourself in the best spot to catch it, will be the most crucial stage of learning for the novice. Being able to read the wave comes with experience. The right wave, (at this stage) is the wave that presents itself at the right time and place to be catchable by you.

You can assist greatly here by placing your body in the optimum position facing and in front of the wave just before the wave peaks up and reaches its greatest height. If a larger wave pops up, run out to meet it, and if a smaller wave comes through you will probably have to back pedal or run towards shore to put yourself in the best spot to catch it.

If you are having trouble getting to the waves, i.e. if you are losing the waves before they break, you might be too far out, so move towards the shore a bit.

Chapman 1994.

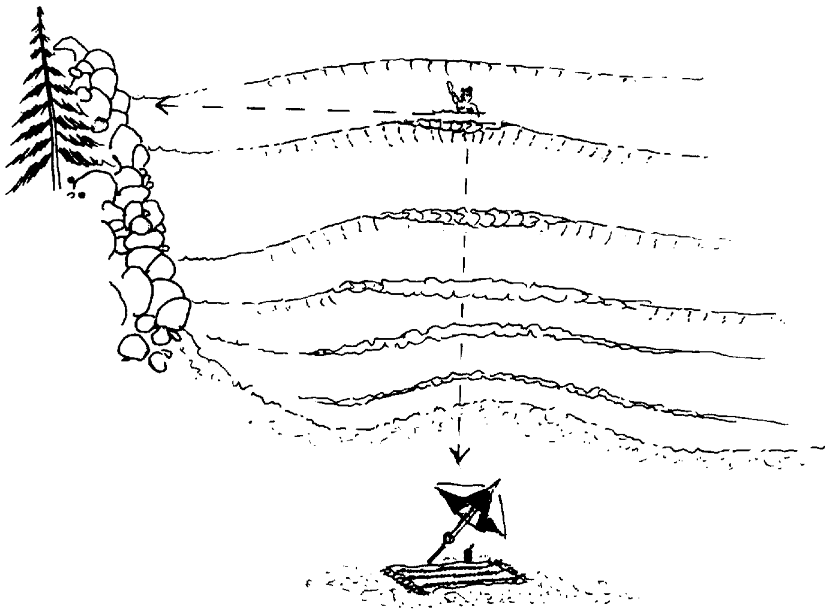


Figure 152.2 Lining up your position (After Chapman 1994)

Wet Paper

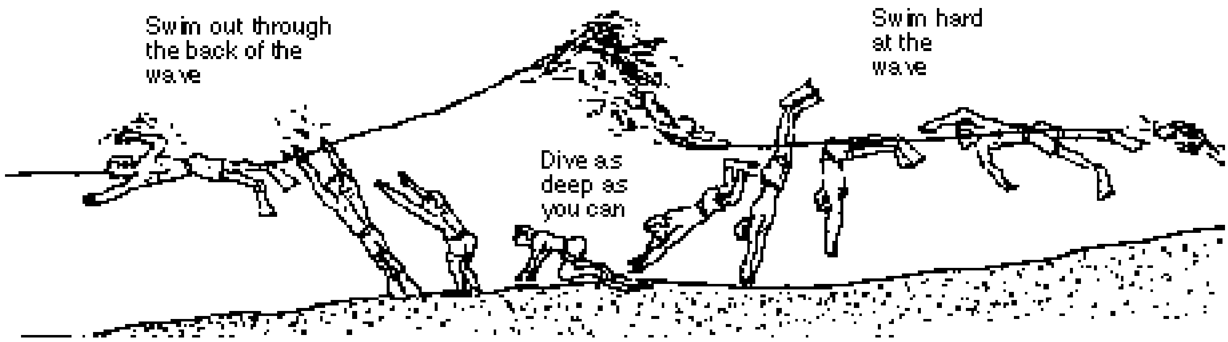


Figure 152.3 Getting out at high tide

Wet Paper

Exercise 153
Catching waves

Questions

Read the information boxes on this page and page 288, look at Figure 158.1 and answer the questions below.

1. The author describes the unbroken wave as a moving force in the shape of a curve. Using Figure 153. E2, draw a diagram to represent what you think he means.
2. Is swimming speed important in catching a wave?
3. What is important to catching the wave?
4. A wave approaches that you think you can catch. List the steps the author recommends that you use to catch the wave.
5. Now that you are on the wave, make a description of how you should ride it towards the shore.
6. Read the additional notes on page 288 and answer the following questions.
   a. The author draws a distinction between white water and a green wave. What is it?
   b. Once you have caught a wave, what should you do?
   c. What does the author recommend you do if you begin to lose the white water?
   d. Describe the difference between a sidekick start and a scissor kick start.
   e. The author recommends that you get onto the wave early. What happens if you get a late take-off?
   f. What techniques does the author recommend you use to get onto a wave early?

Catching the wave

The most important thing, in deep water, to remember here is that an unbroken green wave is a moving force in the shape of a curve.

So for you to lock into and ride this curve of energy you must present your body to it also in the shape of a curve, i.e. match these two curves together (see Figure 153.1.E2).

Most novices make the mistake that it is swimming speed which gets you onto a wave.

Some speed is necessary, but this locking together of the two curves will allow you to catch the wave with a minimum of effort once the technique is mastered.

Aspects of white water surfing

White water is a completely different force to a green wave. A green wave is a force only moving through the water which causes nil displacement of water particles and floating objects; but once a green wave has broken it changes into a wall of turbulent water which can pick up objects and carry them forward.

Once you have caught the wave you must:

1. Straighten your arms and place your hands firmly on your hips, keeping your shoulders down and your face under the water up to the line of your scalp. This will put your body in the most streamlined shape.
2. Eventually you will have to be able to surf with your head completely out of the water to go onto the advanced stage. So start lifting your head up and grabbing a gulp of air momentarily and then regaining your streamlined position once more.
3. When you have gained a bit of experience, you can reduce drag if you lift your lower legs out of the water by bending them at right angles at the knee.
4. If you begin to lose the white water:
   - Put your head down to streamline your body
   - Begin kicking your feet — short quick strokes
   - Shoot your left arm straight out, just on the surface of the water. This will make your body even more streamlined.
   - Now dart your right hand out making quick shallow strokes in the water ahead of you. Keep this up until you reach the beach, another break or lose the wave.

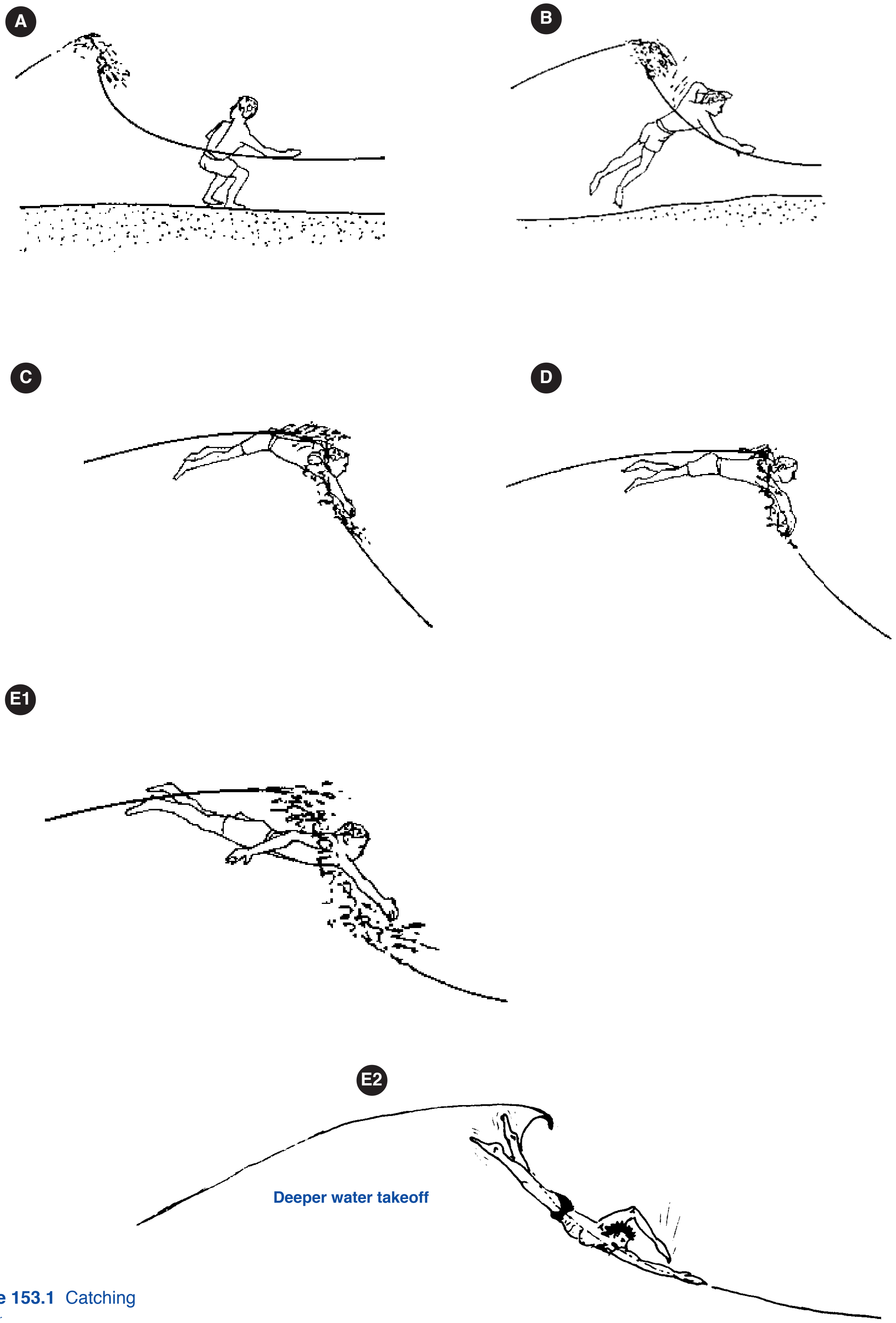


Figure 153.1 Catching
Wet Paper

ADDITIONAL NOTES

by Peter Chapman

The jumpstart

For small waves, about 0.5 m high.

1. Choose your wave.
2. Fix your eyes on the wave, observe it, assess the situation and place yourself in the best spot to catch it. Remember you should be standing on sand.
3. Take a deep breath for reserve (in case you get dumped) and for extra buoyancy.
4. Now quickly turn shoreward and spring energetically off the bottom and onto the wave.
5. At the same time, or just after, throw your hands as far forward as possible and make a long deep sweep under your body to give yourself a great surge forward. Then bring your hands up to hip level.

   You should slide down the face of the wave, like sliding down a slippery dip and be out in front of it when it breaks. Shortly, the foam of the broken wave will catch up to you and surge you forward.

Sidekick start

For medium-sized waves, about 1 m.

1. Choose your wave.
2. Face the wave and position yourself in the best place to catch it.
3. Turn and point the left side of your body towards the wave, keep your right foot anchored if possible to the same spot on the sand. Simultaneously raise your left your leg up the curve of the wave as far as possible.
4. Now at the perfect moment that only you can judge, spring off the bottom, up and into the lift of the curve of the wave, and give a strong kick with your left leg to give you forward momentum.
5. Bring your right leg up and your body should now lie in the curve of the wave.
6. Throw your hands forward and make a long, deep sweep under your body to give yourself a great surge forward, as in the jump start.

Scissor kick start

For medium-sized waves, about 1 m.

This method is used in deep water or when it isn't possible to spring directly off the sand and onto the wave.

1. Choose your wave and position yourself to catch it.
2. Turn sideways to the wave.
3. Place your legs up in the curve of the wave to give yourself lift.
4. Now do an extremely strong scissor kick. This should give you a great amount of initial thrust.
5. If possible, do a deep stroke with your arms.

Swimming onto a wave

For large waves, over 1 m.

Large waves can be difficult to catch, possibly due to the greater speed at which they travel just before they break. Remember, the aim is to pick the wave up at the crest and slide down the face of it.

If you don't get onto a big wave early when the slope of the wave surface is gentle, and you attempt to catch the wave when it is standing up, you stand a very good chance of being thrown out in front of the wave into mid-air and free-falling to the bottom.

If this happens you will land at the bottom of the wave with little or no forward momentum and the wave will come crashing down on top of you. So you must aim to get onto the wave early so as to slide down it, and be in front of the curl with as much forward speed as possible when the white-water hits you.

To avoid being injured do a slow somersault finishing off lying flat on your back on the sand if possible. This is the best way of cushioning your fall, by spreading your arms and legs and using your body as a parachute.

Also if you lie on the bottom spread-eagled, the wave is less likely to suck you towards the shore and into its turbulence.

To gain the necessary speed to get onto a large wave early, you really need flippers. Swimming onto a wave with flippers is not difficult, but if their use is overdone the novice will not fully appreciate the art of catching a wave. The steps involved are quite simple;

1. Choose your wave.
2. Position yourself in the best place to catch it.
3. Build up a smooth, strong kicking action with your flippers.
4. Place your left arm straight out in front of you and stroke quickly with the right .

SECTION 10

MANAGING ACCIDENTS

EXERCISE 154

HANDLING MARINE CREATURES

Acknowledgement is made of information supplied by the Queensland Department of Education Draft Safety Document section on Handling living marine organisms.

CLASS PROJECT*

1. During this exercise make up a wall chart and classify marine creatures into the following risk levels:

   - Low risk. Those marine organisms that are not regarded as dangerous to people e.g. dolphin, sea weed.
   - Medium risk. Those marine organisms that, if handled correctly, offer minimal danger e.g. sea cucumber, jelly fish, turtle.
   - Very high risk. Those marine organisms that cannot be handled without a high level of risk e.g. moray eel, blue-ringed octopus, cone shell.

2. Hazards not only include handling organisms, they can include cuts from scalpels in dissections, wounds to hands by fishing line, or infections caused by incorrect disposal of bacterial plates in water testing.

   Make a list of those activities that the class could participate in and appoint a safety officer for each group to note this in a class chart.

3. Because of workplace health and safety regulations, it may be necessary to classify people into those who are classified to handle certain marine organisms or not.

   Your class could discuss how this should be done based on prior learning. If your family comes from a fishing background, you prior learning should be recognised by the class.

   However your class will not know this unless you tell them. It may well be that you have more knowledge than your teacher and by discussion, you will be able to find this out.

   Make up a list of class members and their prior learning (skills or knowledge) in handling living marine organisms. Discuss how they can help the class on excursions, skindiving trips etc.

4. Seafood cooking is a popular activity and your class should discuss;

   - how hygiene will be maintained in camp situations
   - what types of fish species can be eaten
   - if the flesh of some fish species needs to be removed before cooking
   - any other safety precaution which need to be addressed before consuming seafood e.g. oysters, shellfish, octopus, squid, shark, etc.

   What type of symptoms may be apparent and discuss appropriate first aid for different situations.

5. Obtain a copy of *Hazardous sea creatures* by Neville Coleman with over 170 colour pictures. Available from Sea Australia Resource Centre, PO Box 702 Springwood Q 4127.

   Look for the animals that could be classified as low, medium and high risk.

* This project is an ideas project only and is an attempt to address the new ideas of risk assessment involved in workplace health and safety regulations. The ideas contained are neither inclusive or exclusive.

Exercise 155
Boating

Questions

Study Figure 155.1 showing two students in a power boat. The one sitting in the bow has her boat licence and is teaching the student driving the boat.

1. Is this boat on open water or inshore? Give reasons for your answer.
2. There is no one in sight and the day is calm. Assess the probability of an accident in this situation and rate it on a 1 – 10 scale with 10 the most probable and 1 the least probable.
3. A speedboat approaches from around the bend at high speed. What possible accidents could occur? Rate the chance of them happening.
4. The speedboat passes but the wash of the boat causes the student sitting in the bow to fall overboard. What accidents can occur now and what's their probability?
5. The trainee driver attempts to rescue the person in the water. Make a list of accidents that can occur and rate the situation.
6. In attempting to rescue the student in the water, the boat capsizes with the motor in gear and still going. What accidents can occur now? Rate their probability.
7. Select other photos or make up your own scenarios and discuss them in class.

Wet Paper

Figure 155.1 Assessing the danger in boating situations

Exercise 156 Weather and coastlines

Questions

Study the information in Figure 156.1 and answer the questions below.

1. What potential dangers would be associated with skindiving the reef described in situation 1?
2. Which of the forecasts given in situation 2 would be most favourable to surfing or skindiving and which would present the most dangerous situation?

   Are skindiving situations different to surfing conditions? Why?
3. What are the dangers associated with rock pools and surf tunnels under the rocks as described in situation 3?
4. For situation 4, make a list of safety equipment needed and suggest some of the reasons why it should be taken.
5. What dangers do you think would be associated with skindiving around boats and boat harbours as described in situation 5?
6. Study the weather map.

   Find out where each of the following places are in situations 6 – 12 and assess the weather's suitability for the activity described on the available information.

Situation 1 Meat works

An excellent skindiving or surfing reef has been found near the mouth of a creek where a meat works discharges its blood and offal.

Situation 2 Exposed rocky headland

A group of skindivers or surfers plan a trip to a rocky headland exposed to surf. The following forecasts are given

Wind speed (knots)	Wind direction	Sea condition	Height of seas
5 - 10	Onshore	choppy	1.0 m
5 - 10	Offshore	smooth	0.5 m
0 - 5	None	smooth	0.5 m
15 - 20	Onshore	rough	2.5 m
20 - 25	Onshore	very rough	3.0 m
0 - 5	Offshore	slight	0.5 m

Situation 3 Rock pool

A group of skindivers plan a trip to a rocky headland exposed to surf. On the headland they find a series of pools interconnected with each other by tunnels under the headland.

Situation 4 Reef pool

A reef trip is planned by a school group of a mixed ability students.

The reef is isolated with no phones, water, power or food. The students are very keen to snorkel off the reef slope.

Situation 5 Boat harbour

A boat harbour has a wealth of sunken treasure in the form of lost coins, wallets, outboard motors and fishing gear. A group of skindivers plan to see if they can recover this wealth and return it to their owners.

Situation 6 Shark Bay WA

A group of skindivers from Perth plans to go diving to study infestations of coral by a predatory snail.

Situation 7 Victor Harbour

You plan to go fishing.

Situation 8 Bells Beach

A group of surfers are planning a day at Bells Beach Victoria.

Situation 9 Perth

A group is preparing to go on a sea trek from Fremantle to Mandurah.

Situation 10 Coffs Harbour

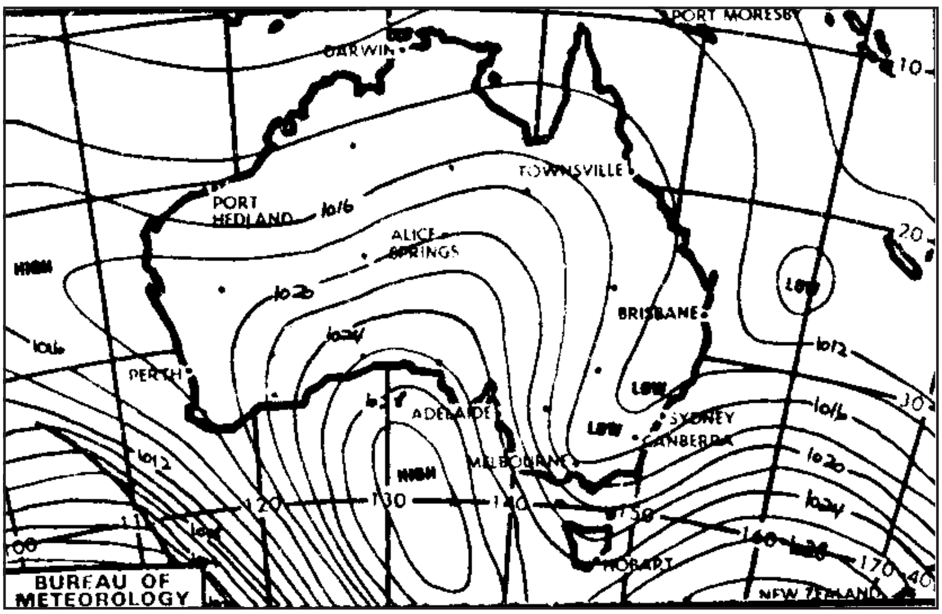
A trip to go whale watching is planned by Ballina and Orara High School.

Situation 11 Adelaide

A day's sailing from the expedition boat shed is planned.

Situation 12 Mackay

A day's skindiving with Greg McGarvie at Brampton Island.



Wet Paper

Figure 156.1 Situations for exercise

Exercise 157
Surfing

Study Figure 157.1: a girl paddling out, a boy dropping in; and his mate on the inside of the wave. Now answer the following questions.

The surfer on the inside

1. How big is the wave above his head?
2. What could be about to happen?
3. The wave breaks and the surfer is trapped under the wave. He is pushed down towards the bottom.

   List three things that good physical fitness could do to help him survive.
4. The bottom is coral and the break is notorious for causing accidents.

   What should the surfer be wearing?

The surfer dropping in

5. At this stage, is he aware of the girl paddling out? Give reasons for your answer.
6. List possible consequences for the girl paddling out if he continues to be unaware of her.

The surfer paddling out

7. What steps could she take to avoid being hurt?
8. What possible injuries could she sustain if she is hit by the surfboard?
9. Could this photo represent a perfectly safe scene? Give reasons for your answer.

Six rules for surfers

10. Read the six safety rules for surfers in the box above and answer the following questions.
    a. Why is rule 1 so important?
    b. What is the consequence of breaking rule 5?
    c. Why do local surfers get so much respect?

Rules

Six rules for surfers *(as outlined by Surfer Magazine)*

1. The surfer first to his or her feet in the best and most critical takeoff position has the wave.
2. Respect local surfers.
3. Respect surfers who respect you.
4. The surfer paddling out has the responsibility to stay clear of the riding area.
5. Never, ever, resort to physical violence.
6. Enjoy other people's surfing as well as your own.

Figure 157.1 Assessing the dangers in surfing situations (Photo courtesy Martin Tullemans)

EXERCISE 158
SUN SENSE

SUNBURN TREATMENT

- apply cold water where possible
- if you feel sick consult your doctor

QUESTIONS

Use your textbook index to locate the section on *tissues and glands*.

1. Label the following parts on Figures 158.2 and 158.3.
   - Hair
   - Epidermis
   - Layer of cells that burn and cause skin cancer
   - Blood vessel
   - Red blood cells
   - White blood cells
2. Indicate on the diagram what a skin cancer could look like.
3. Skin cancer cells spread to the rest of the body. Indicate on the diagram how this could occur.
4. Use the the information in Figure 158.5, on page 299, to answer the following questions.
   a. When is the foundation for skin cancer laid?
   b. What percentage of skin cancers can be cured and why?
   c. How should you acquire a tan?
   d. When is the worse time of the day to sunbake and why?
   e. List three simple sun protection measures to tell parents or care givers
5. Study Figure 158.1
   a. What sport is the boy engaged in?
   b. What protection has he taken to prevent getting cancer?
   c. He will spend a lot of time paddling.
   What care should he take of the back of his legs?
6. Study Figure 158.4 on page 298.
   a. What is the store selling?
   b. What is the material made of?
   c. What is this material used for and how does it protect the skin from cancer?
   d. Go and look at the product. What safety sticker should be on the label?

Figure 158.1 Dressing for sun protection

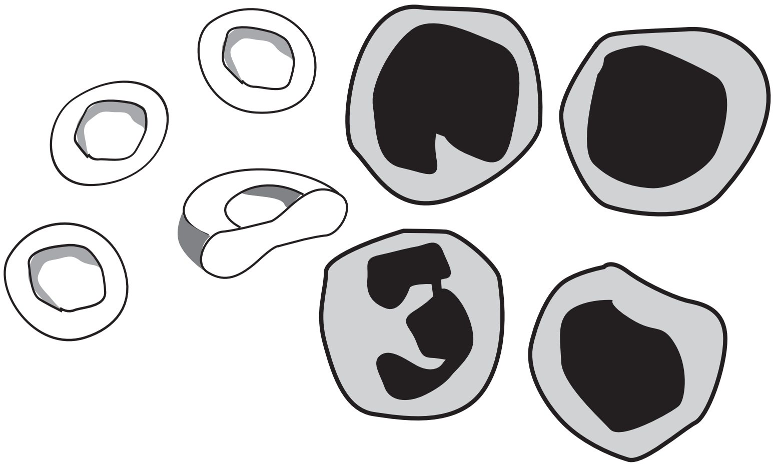


Figure 158.2 Blood cells

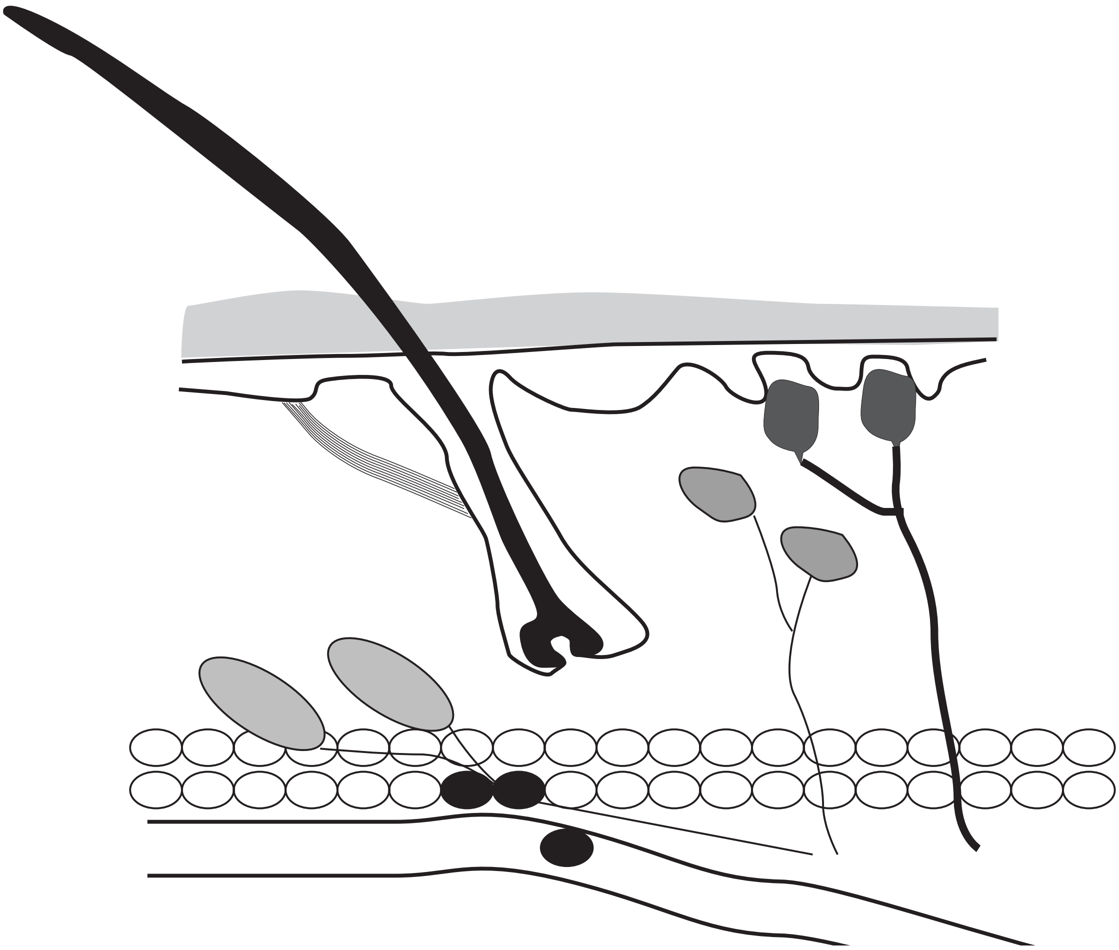


Figure 158.3 A cross-section of the skin

Figure 158.4 Sun protection clothing

ENJOY THE SUN BUT TAKE CARE

CANCER

By adopting a few simple sun protection measures not only can we save ourselves and our children from the pain of sunburn, but also prevent long-term damage to our skin which can result in premature ageing and the development of skin cancer.

Avoid even a single bad sunburn. Sunburn should be regarded as a severe injury to the skin and even one dose of sunburn could trigger the start of skin cancer. The foundation for skin cancer is all too often laid in childhood.

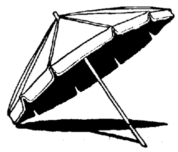
Although about 95 per cent of all skin cancers can be cured provided they are diagnosed early enough, it is better to prevent them, particularly as prevention is simply a measure of common sense.

SKIN AND THE SUN

Sunbathe, don't sunbake That is the key to preventing most skin cancer. Acquire a tan gradually by making your first exposure only about 10 minutes during the early morning or late afternoon when the sun's rays aren't so strong. Gradually increase this time a little each day. If you wait until your skin begins to turn red before coming out of the sun, it is too late – the damage has already occurred.

DON'T BE FOOLED

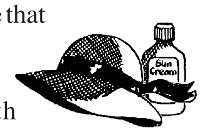
Try to avoid exposure to the sun during the hottest hours of the day, that is between 10 a.m. and 2.30 p.m. If you have to be outside in the middle of the day, head for shade, but remember that only about half the sunburning rays come directly from the sun. The other half come from the sky around us, so you will still burn while under a beach umbrella or the shade of a building. Fair skinned people who can burn severely after 15 to 20 minutes exposure will also burn after 30 to 40 minutes under a beach umbrella. At the beach, sand and water also reflect the burning rays of the sun. Cloudy days offer very little protection, particularly as without the intense heat of unfiltered sunlight, you tend to stay out longer, not realising that the burning rays can penetrate the clouds.



As well as keeping out of the sun during the hottest period of the day, the two other sun protection measures which everyone should take are the use of sunscreen preparations and protective clothing.

PROTECTION

The only way to stay in the sun and be sure that your skin is protected, is to cover up with clothing, use a sunscreen preparation on skin still exposed and wear a wide brimmed hat. Clothing should be loose fitting and long sleeved, while sun screens can be selected according to personal preference.



Hats should be of close weave, but allowing adequate ventilation, and be capable of protecting nose, ears and lips. Remember, hats cannot protect against reflected sun, so sunscreens are still needed for all exposed skin, even if it is shaded by the hat.

CARE FOR CHILDREN

Because children have more sensitive skin than adults, they run more risk of skin damage in the sun. Therefore, even more than adults, they need to cover up for their own special activities such as on the beach, playing outdoors, going to school and during recess and drill periods. While it is unlikely that sun-tanning will ever go out of fashion, young children should be kept from sustained sun exposure for as long as possible, particularly if they are fair-skinned or freckled.

While older children may be reluctant to wear protective clothing, it is vital that they continue to use appropriate sunscreen preparations.

Sunscreens should be used with caution on children under two years of age, because of their greater skin sensitivity. Make sure children learn to apply sunscreens before going into the sun, again after swimming, when lying on the beach, or if they are perspiring freely.

Figure 158.5 Sun sense article (courtesy Telecom Australia and Health Promotion Unit)

Exercise 159 Managing skindiving accidents

Questions

1. Use your textbook index to find the section on the ear and seasickness. Answer the questions below.
   a. How can heat exhaustion create problems for skindivers?
   b. What precautions can a skindiver take to withstand cold and exhaustion?
   c. What can result from starting physical activity after long nights and lack of sleep?
   d. What is some practical advice you could give a person who is seasick?
   e. List six physical complications that could effect skindiving.
   f. What types of psychological considerations could hamper skindiving?
   g. How could you avoid sunstroke while skindiving?
2. Mark in the following anatomical features in Figure 159.2:
   - Pinna
   - Auditory nerve
   - Anvil bone
   - Eardrum
   - Eustachian tube
   - Cochlea
   - Round window
   - Stirrup bone
   - Semicircular canals
   - Oval window
   - Hammer bone
3. Write a paragraph explaining how we hear.
4. How could a pierced eardrum occur and how could it be avoided?
5. Use your textbook index to find the section on seasickness and use Figure 159.2 to explain how people get seasick.
6. Mark in the following in Figures 159.3.A and 159.3.B:
   - mouth and nose open
   - mouth and nose closed
7. Use your diagrams and a paragraph to explain how the air on either side of the eardrum is equalised.

   Use + and - symbols to illustrate your answer.
8. Use your textbook index to find *barotrauma* and answer the following questions.
   a. What does the word mean?
   b. How does barotrauma affect the ear?
   c. What first aid and prevention can be carried out?
   d. If equalising is not done, what can result?
9. What are outer ear infections and how do they occur?

   What first aid can be given for outer ear infections?

10 Find the diagram of the tooth and redraw it in your notebook.

   Explain how pressure can cause pain in teeth.

11. Mark in the following in Figure 159.1:
    - Frontal sinus
    - Orbit of the eye
    - Sphenoid sinus
    - Ethmoid sinus
    - Upper jaw
    - Lower jaw
12. How should sinus pain be managed while skindiving?

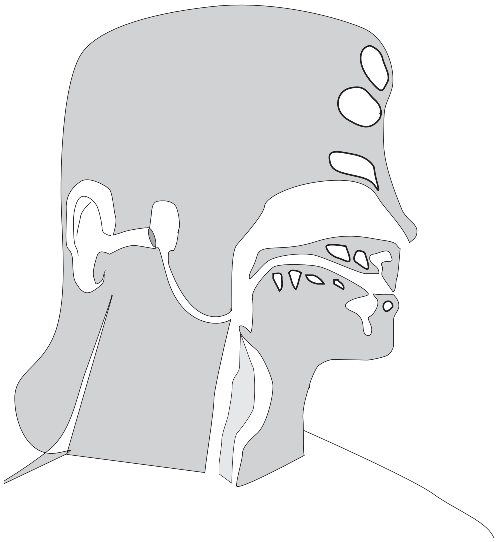


Figure 159.1 Sinuses

Figure 159.2 Parts of the ear

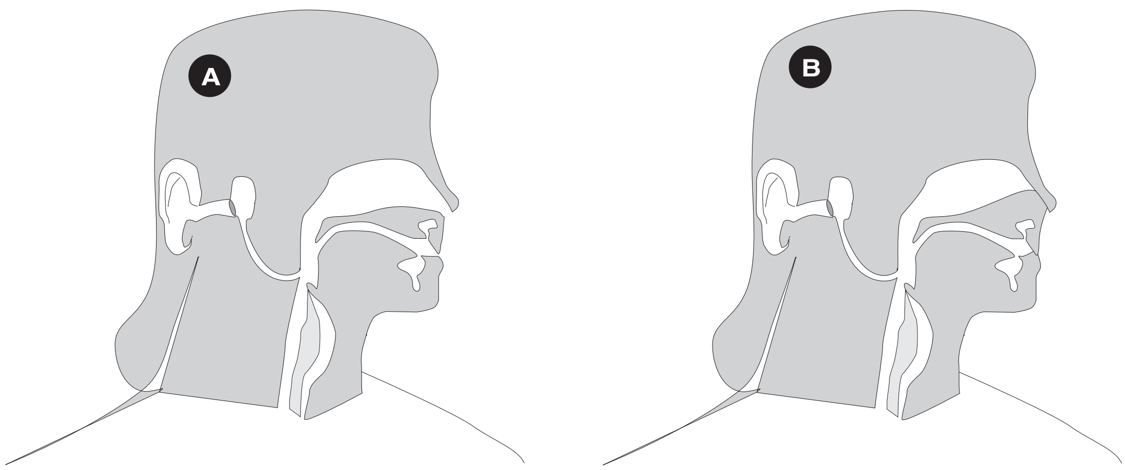


Figure 159.3 How to equalise your ear. Students may make one copy of this page so that they can attach their answers before handing in for marking.

Wet Paper

Exercise 160 Physiology for Marine Studies students

There are some basic aspects of the heart and lung systems that students of marine studies should know.

Questions

Study the diagrams opposite and use your textbook to answer the following questions.

1. What are the names of the anatomical features 1 – 6 in Figure 160.1?
2. What are the names of the parts of the heart numbered 1 – 11 in Figure 160.2?
3. Read the information box on the right and answer the following questions.
   a. What are the names of the two gases that diffuse over the walls of the alveolus?
   b. What does the rule of diffusion state?
   c. Where does carbon dioxide build up?
   d. What are the pleura?
   e. If pleura are damaged, what happens?
   f. Where is the heart located in the body of a person lying face up on the ground in front of you?
   g. What is the function of the upper chambers of the heart?
   h. What stops blood from flowing backwards?
   i. After organs have used oxygen-rich blood, what must happen?
   j. What vessels carry blood away from the heart?
   k. What vessels carry blood to the heart?
   l. If you smoke heavily, what happens to the arteries around the heart?
   m. If you were pushing down on and releasing pressure from a person's chest directly above the heart, what would be happening? Explain your answer in terms of the ventricles and atria.

Oxygen and carbon dioxide transfer

The oxygen and carbon dioxide diffuse over the cell walls of the alveolus. The rules of diffusion state that molecules will move from areas of high concentration to areas of low concentration. Oxygen from outside the system builds up in the alveolus to a high concentration and so diffuses into the blood and into the pulmonary vein. Carbon dioxide builds up in the pulmonary artery to a high concentration and so diffuses into the alveolus where it passes into the **bronchioles** and out of the system.

The lungs are surrounded by two layers of very thin membrane (the **pleura**). One layer covers the lungs and the other lines the chest wall. The closed space between the two layers (the **pleural cavity**) only contains a very thin layer of fluid to help lubricate the movement of the lungs. If the pleura are damaged, air can enter the pleural cavity and the lungs may collapse as a result.

The heart

The heart is in the middle of the chest slightly to the left. The heart beat can be felt just under the left nipple. It has two separate pumps and four chambers. The upper chambers, or **atria**, receive the blood from the lungs and body. The lower chambers, or **ventricles**, pump blood to the body or lungs. The heart needs a lot of oxygen to do this. The coronary arteries provide this essential supply.

Blood rich in oxygen from the lungs enters the heart from the pulmonary veins to the left atrium. It then passes over the **mitral** valve and passes into the left ventricle. Valves stop blood from flowing backwards into the heart. Blood is then pumped up into the left atrium where it enters the **aorta** or great artery through the **semilunar** valve. It is then pumped directly to the head or flows to the rest of the body. Blood from the rest of the body passes into the heart through the **vena cava** and into the right atrium. It is rich in dissolved carbon dioxide and must be passed quickly to the lungs for diffusion out into the bronchioles. It passes into the right ventricle over the **tricuspid valve** and into the pulmonary artery. From here it is forced into the lungs. Arteries flow away from the heart. Veins flow towards the heart.

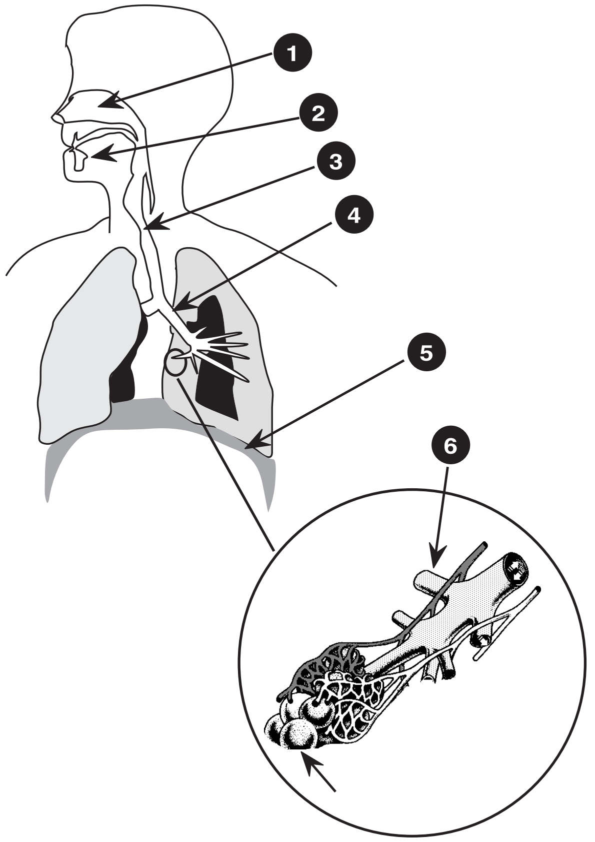


Figure 160.1 The respiratory system
Wet Paper

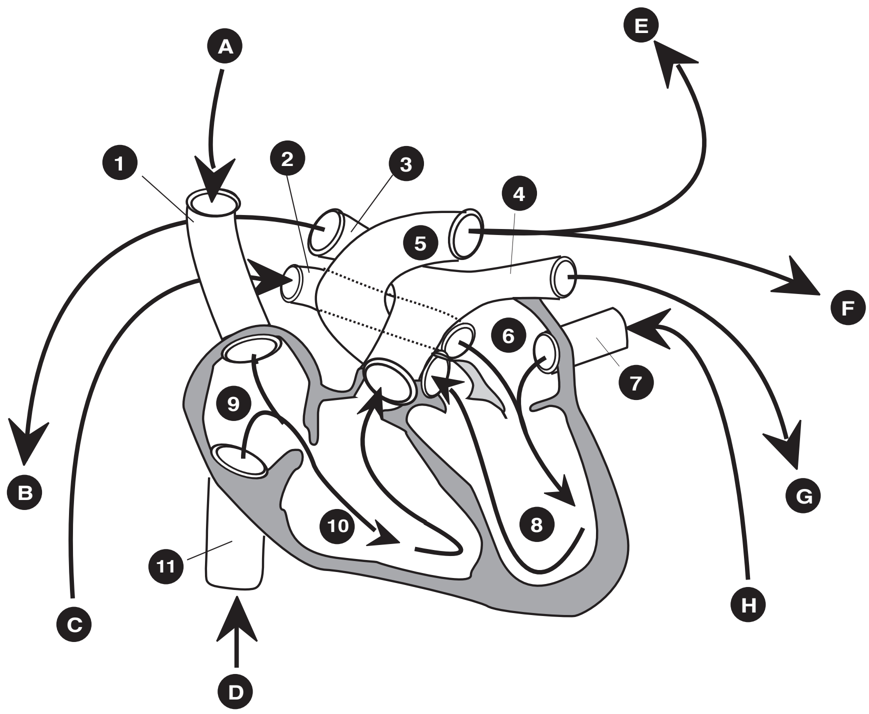


Figure 160.2 The heart
Wet Paper

EXERCISE 161
CUTS

QUESTIONS

Use your textbook and the information box to answer these questions.

1. Look at Figure 162.2. What type of animals are these?
2. Use your textbook to find out what they are covered with.
3. Minor abrasions or grazes from this animal become infected quickly. Use Figure 162.1 to explain why.
4. A Marine Studies student comes from a rock pool with a cut from a barnacle. The wound is bleeding.

   Outline the first aid you would apply.
5. Find a diagram of bacteria and redraw it to show how they multiply in a cut.
6. A student comes from the water with a deep cut. The wound is bleeding and when it is washed you notice pieces of coral grit in the wound.

   Write a paragraph explaining how you would treat this cut.
7. You are at the boat ramp and despite been told many times to wear shoes, you ignore this warning because the dog next door ate them last night and your mother has written you a note saying to excuse you from wearing shoes today.

   Unfortunately you step on a piece of glass and badly cut your foot. Blood pours everywhere and you sit down beside the boat in agony.

   a. What should you do?

   b. Your teacher, who is kind and sympathetic (as all Marine Studies teachers are), comes to your aid. How should she stop the bleeding and dress the wound to prevent infection?
8. You are sitting beside your best friend who goes to start the motor. She slips and her elbow bangs into your head, cutting you under the eye. Blood streams out and you faint. When you wake up the next day and ask the nurse what your friend did to save you, what do you think the nurse will reply?

First aid for cuts

- Thoroughly clean the wound as soon as possible after the injury.
- Remove all foreign material with a cotton bud, tweezers or toothbrush and use an antiseptic lotion.
- Apply a local antibiotic powder or ointment.
- If necessary, apply a dressing and keep the affected area dry once the dressing has been applied.
- Many marine bacteria are very resistant to some antibiotic creams. If the wound becomes infected, make sure you seek medical advice so that the marine bacteria can be identified by a pathological test and the correct antibiotic prescribed.
- Coral cuts need special attention.

  Coral is covered in a slime which can easily infect wounds. Even apparently minor grazes and abrasions must be treated promptly and carefully, or else they will become infected.

  Bacteria multiply very rapidly by binary fission.

  If cleaned and treated with a drying agent, (hydrogen peroxide or betadine), the wound will dry up thus depriving the bacteria of a moist place to grow.

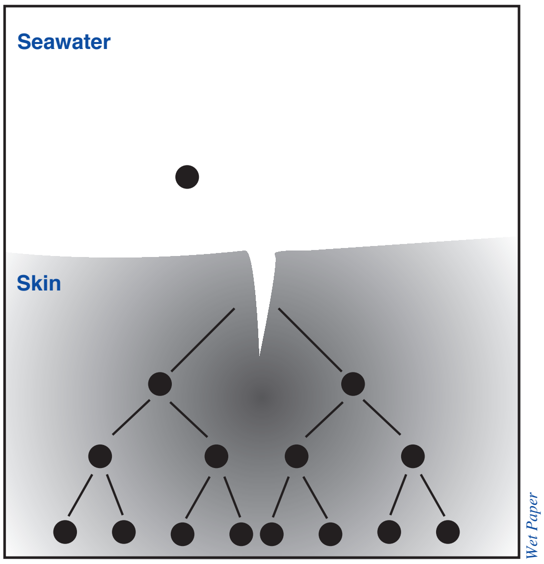


Figure 162.1 Bacteria entering a wound

Figure 162.2 A reef pool

Exercise 162 Puncture wounds

Questions

Use your textbook to find the drawing of the following animals and answer the questions below.

1. Look at Figure 163.1.
   a. What are the names of the animals shown?
   b. How can you get a puncture wound from each?
   c. What is the first aid for injuries by A?
   d. What is the first aid for injuries by B?
   e. What safety precautions should you take to avoid a puncture wound from either?
   f. How should these animals be handled?
2. Look at Figure 163.2.
   a. What are the names of the animals A – C?
   b. How do fish spines inject their venom? Use the figure shown in D to illustrate your answer.
   c. Fully label E using the diagram in your textbook,. Now write a description of how C inflicts its puncture wound.
   d. Use your textbook to write out the first aid for A, B and C, explaining the significance of hot water.
   e. What safety precautions should be taken to avoid puncture wounds from A, B or C?
3. If you catch a fish and bring it onto a boat, what can you do to prevent being stung while removing the hook from the fish?
4. Study the information boxes on page 310 and with the aid of your textbook and local knowledge, complete the table on page 311.

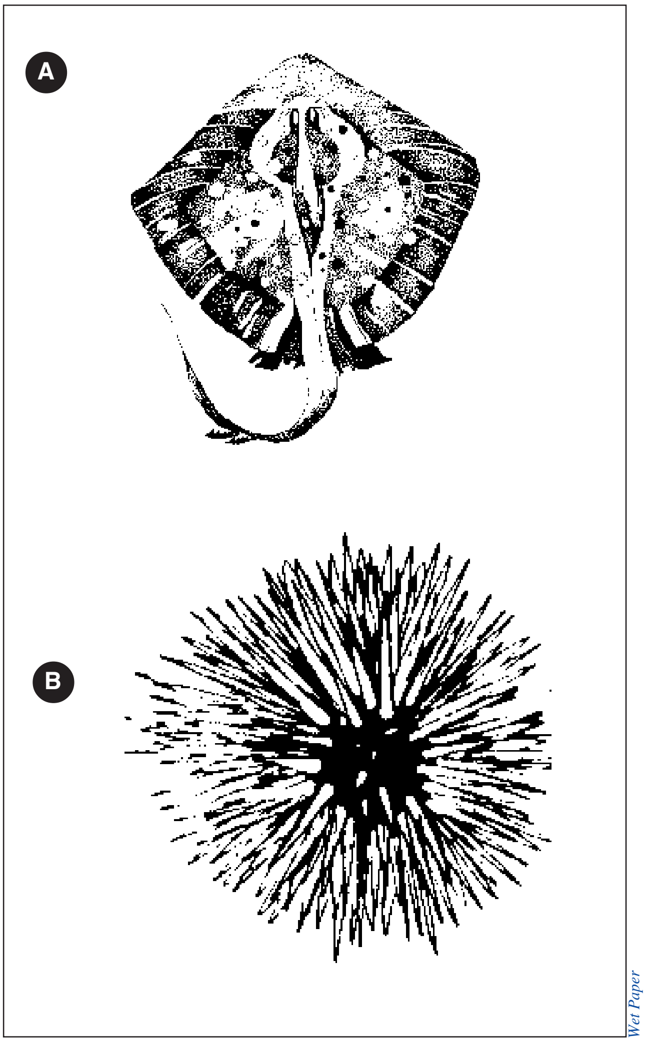


Figure 163.1 Potentially dangerous marine animals

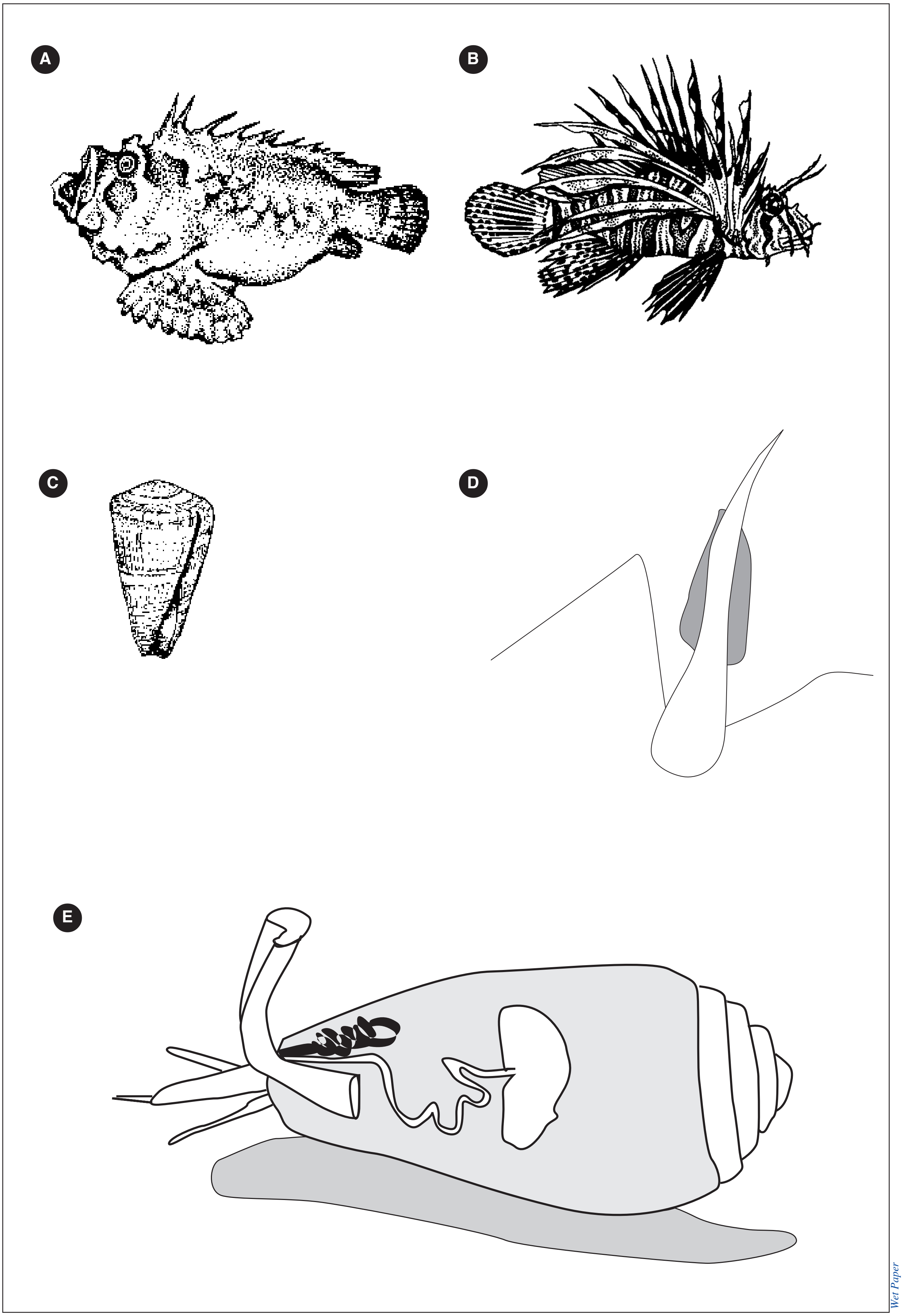


Figure 163.2 Marine animals that can cause fatal injuries

First aid for stonefish injuries

Immerse the puncture wound in hot water. Apply a pressure bandage and transport the patient immediately to medical aid.

The doctor injects a local anaesthetic solution around the wound, thus providing immediate relief to the pain. The following steps are then usually taken:

- Provision of specific stonefish antivenene, once identification of the sting is confirmed.
- Carefully incise down the puncture line and wash out the venom with sterile hot water.
- Dress and bandage the wound appropriately and give a tetanus toxoid booster injection. Arrange bed rest and supervise.

All stonefish envenomations require medical assistance.

First aid for fish puncture wounds

Remove the patient quickly from the water. People vary greatly in their reaction to fish puncture wounds.

- In the case of a puncture wound from a fish with venom on its spines, medical aid will be needed as soon as possible. There is an antivenene available for stonefish injuries.
- Seek medical assistance. This should be followed by the application of a pressure bandage to stop the spread of the venom.

  Application should be similar to that of a snake bite. In the case of an injury involving venom, the patient should be carefully monitored for respiratory failure and cardiac arrest.
- First aid for all fish spine injuries includes immersing the affected area in hot water (up to 50°C) as soon as possible to immobilise the venom.

  Test the water with the non-affected limb first to see if it is not too hot for the patient.
- If a local anaesthetic is available it should be administered to relieve the pain and calm the victim.
- The person administering First aid should be prepared for ECC and EAR.

First aid for stingray injuries

These injuries are always painful and a rescuer must be prepared for ECC and EAR if the patient's reaction is particularly bad.

As with fish spines, the affected area should be immersed in hot water (up to 50ºC) and a general anaesthetic should be applied after the wound has been thoroughly cleaned.

Seek medical assistance. The doctor will inject a local anaesthetic in order to remove all traces of the barb, its sheath and venom.

First aid for sea urchin injuries

- Remove the spine with tweezers and thoroughly clean the wound. Apply a local anaesthetic cream to relieve the pain.
- If spines are particularly hard to remove, a razor blade can be used. The skin is sliced off till the top of the spine is exposed. The blade is wedged into the side of the spine and levered out. It is recommended that this be done at the hospital under sterile conditions with a local anaesthetic.
- Cover the area with a clean dressing and seek medical advice if the patient shows any adverse reactions.

First aid for cone shell injuries

Muscular paralysis and respiratory failure can result as quickly as 10 minutes after the injury. Seek medical assistance as soon as possible.

A rescuer must be prepared for ECC and EAR. The affected limb should be immobilised and a pressure bandage should be applied as for a snake bite. No antivenene has been developed for the cone shell.

Puncture wounds management table			
Animal or problem	**Possible areas of puncture wound**	**First aid**	**Safety precautions**
Fish (including fish spines)			
Stonefish			
Stingrays			
Cone shells			
Sea urchins (Sea eggs)			
Fish hooks			
Local animals (use your local knowledge to add here if appropriate)			

Figure 163.3 Puncture wound table. Students may make one copy of this page so that they can attach their answers before handing in for marking.
Wet Paper

Exercise 163 Stings

Questions

Use your textbook to locate drawings and information on the following animals. Answer the following questions.

1. Look at Figure 164.1.
   a. What is the name of the animal shown?
   b. Where does it live?
   c. How can you get stung by it?
   d. What is the first aid for this type of sting?
2. Look at Figure 164.2
   a. What is the name of the animal shown?
   b. Where does it live?
   c. How can you get stung by it?
   d. Turn to the stinger drill page of your text book (page 85 first edition). What are the steps to be taken for the box jellyfish as shown in figure (c) of your textbook?
   e. What are the structures shown in B and C? Name the parts as shown in your textbook and write a description of how they work
3. Look at Figure 164.4.
   a. What are the names of the animals shown? Where do they live?
   b. How can you get stung? What is the appropriate first aid?
4. Complete Figure 164.3 using your textbook.
5. Read the box below and discuss it in class. Consult your school safety officer if necessary, but settle on what action you will take if you are stung.

Suggestions for first aid for stings

Since your text was written there are some changes to treatment of stings.

At time of publication the following was recommended:

1. For box jellyfish stings use vinegar and follow the bandaging procedure as shown in your textbook page 85 (first edition) for a major sting.
2. For stings that are not box jellyfish, use ice or cold water as research seems to suggest that vinegar causes more nematocysts to fire.

Resources

Write for a copy of the ASLA Marine Stingers Book to:

Surf Rescue

PO Box 2136

Fortitude Valley Q 4006

Also there is a video by Dr Peter Fenner on how to identify and treat marine stingers and is called:

Australian Jellyfish Stings

The video is available from:

Specialized Video

111 Paradise St, Mackay 4740

Telephone 079 521991

You may have to search U tube for this one

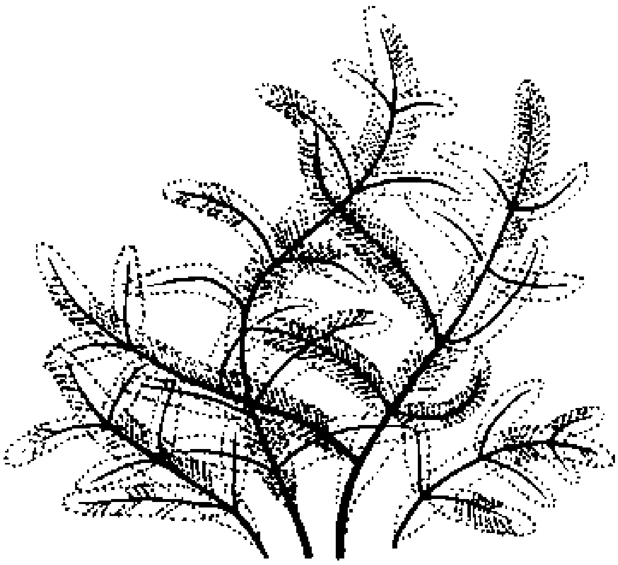


Figure 164.1 Stinging hydroid (Illustration from Project Reef Ed, Great Barrier Reef Marine Park Authority.)

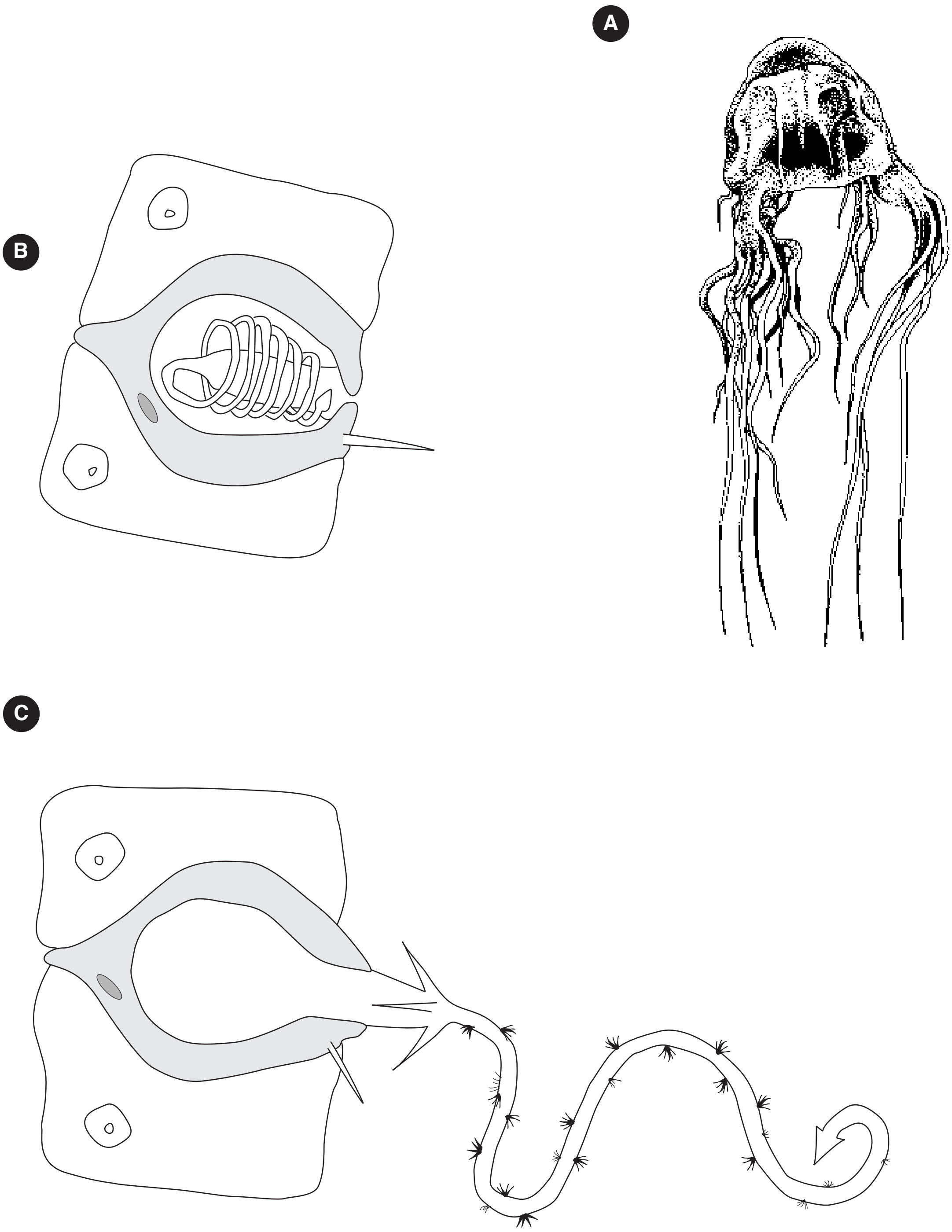


Figure 164.2 Marine stinger and stinging apparatus. Students may make one copy of this page so that they can attach their answers before handing in for marking.

Sting management table			
Animal or problem	**Possible area on the body you could be stung**	**First aid**	**Safety precautions**
Box jellyfish			
Sea jelly			
Fire weed			
Ants			
Spider			
Bee			
Local animals (use your local knowledge to add here if appropriate)			

Figure 164.3 Marine stinger management table. Students may make one copy of this page so that they can attach their answers before handing in for marking.

A

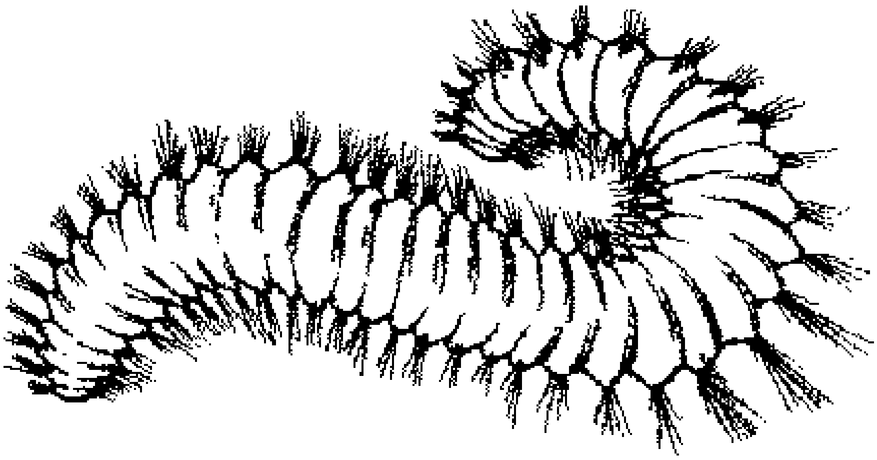


Illustration from Project Reef Ed, Great Barrier Reef Marine Park Authority.

B

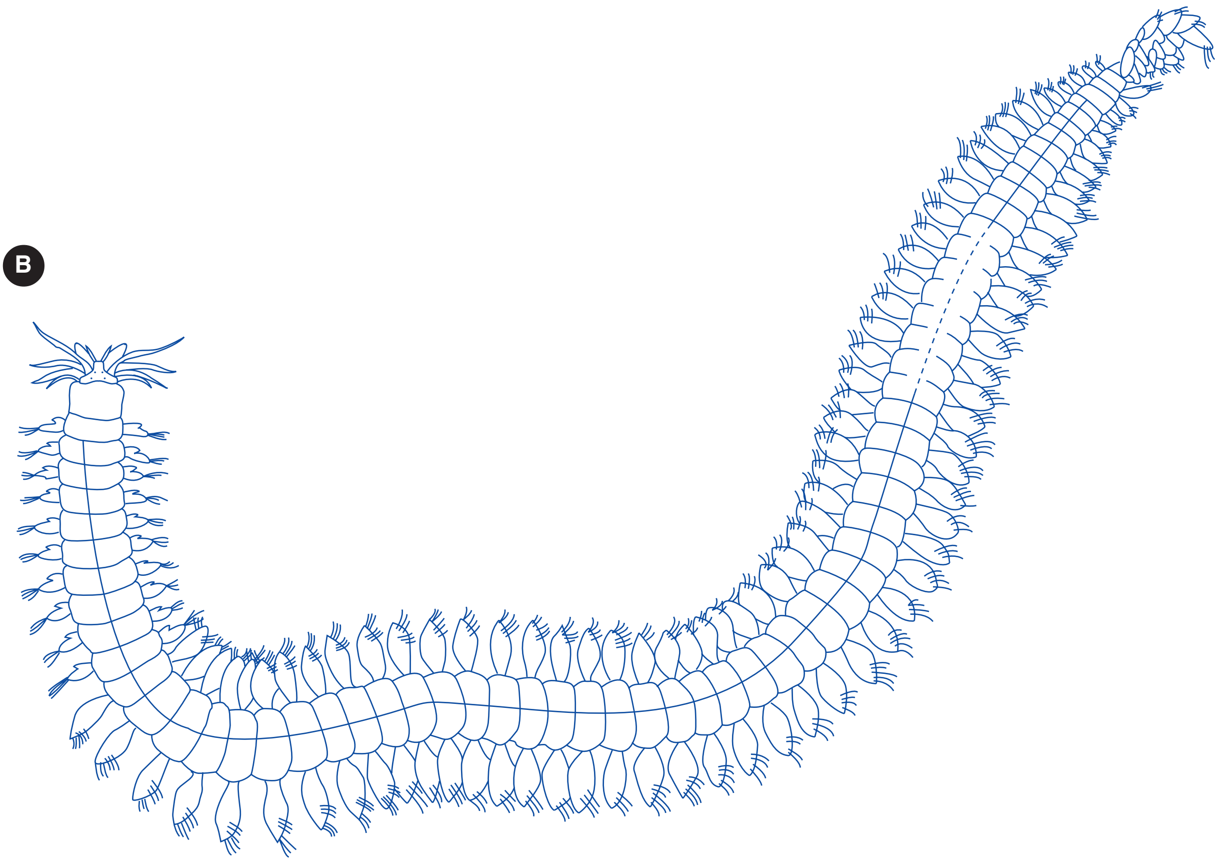


Figure 164.4 Marine animals whose bristles contain a venom

Wet Paper

Exercise 164
Bites

Questions

Use your textbook to locate drawings of the following animals and complete Figure 165.2 . Answer the questions below

1. How are bites inflicted by marine animals?
2. In your textbook, find the section which discusses the diver's death in Darwin and answer the following questions.
   a. How big was the octopus the diver captured?
   b. What did the diver allow the octopus to do?
   c. Where did the octopus end up?
   d. What did the octopus do?
   e. After a few minutes the diver complained of two difficulties. What were they?
   f. The diver managed to get to shore. What happened then?
   g. What is the moral to the story?
3. Find the story about the moray eel in the boxed section of your textbook and answer the following questions.
   a. Where was the group of students camped?
   b. What did the uncaring skindiver do in the story?
   c. Was this allowed on this island? Give reasons for your answer.
   d. The skindiver thought the animal was dead and decided to throw it at another member of the party. What happened?
   e. How did the press write up the story?
   f. Is it a common occurrence to sensationalise stories such as this in the media? Give one other example or a story in the media where marine animals have been portrayed as villains.
4. When and where should you swim to avoid a shark attack?
5. Find the boxed section in your textbook that deals with overconfidence, read it and answer the following questions.
   a. Name three things that the book identifies as unexpected things that can happen.
   b. Using examples from the sections on boating, skindiving or surfing, discuss the statement: 'It's better to be safe than sorry'.

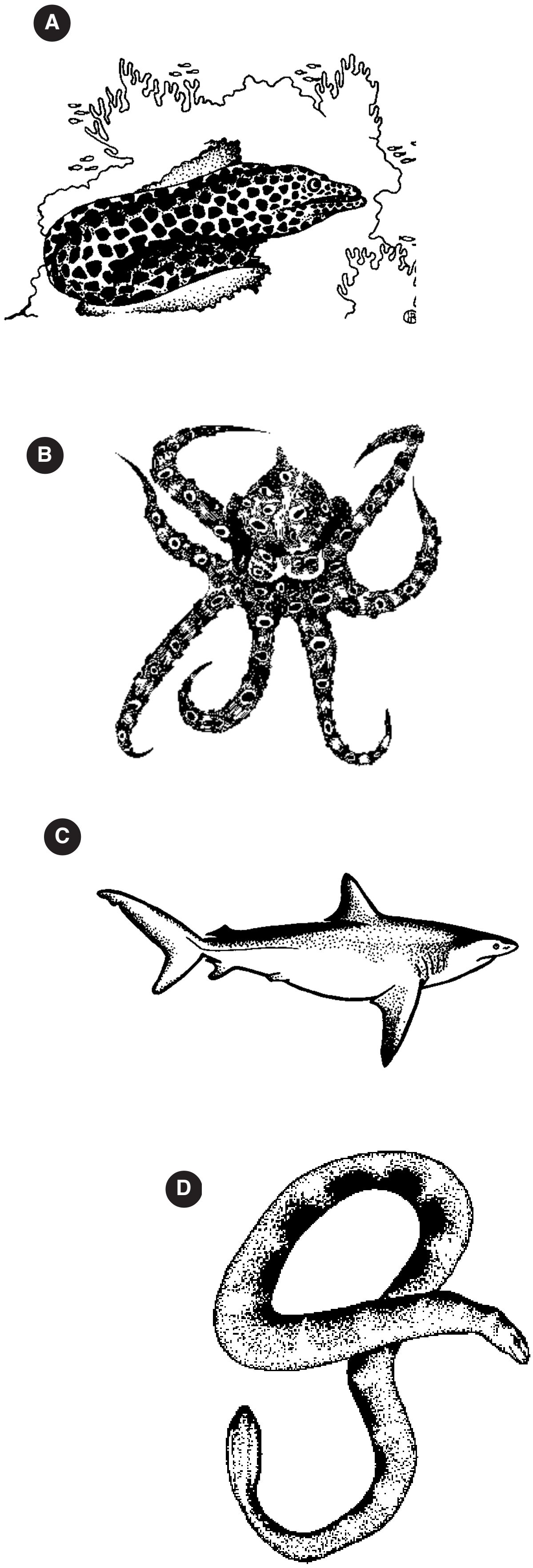


Figure 165.1 Potentially dangerous sea animals

Wet Paper

Bite management table			
Animal or problem	**Situations in which you could be bitten**	**Safety precautions**	**First aid**
White pointer shark			
Grey nurse shark			
Moray eel			
Blue-ringed octopus			
Sea snake			
Sea gull			
Local animals (use your local knowledge to add here if appropriate)			

Wet Paper

Figure 162.3 Bite management table. Students may make one copy of this page so that they can attach their answers before handing in for marking.

EXERCISE 165 HYPOTHERMIA

Australian Maritime Safety Authority
Sea Safety Education
Phone (06) 279 5972
Fax (06) 279 5858
PO Box 1108 Belconnen
ACT 2616

QUESTIONS

Use the article and information on hypothermia in your textbook to answer the following questions.

1. Mark in the following in Figures 166.4 and 166.5.
   a. The 27°C, 21°C, 16°C and 10°C summer and winter sea temperatures.
   b. The indefinite (depends on fatigue), between 12 and 40 hours, less than 12 hours, less than 6 hours and less than 3 hours expected survival times.
2. What is hypothermia and how does it affect the body?
3. Find Figure 166.2 in your textbook that shows where body heat is lost.
   a. Now mark in where the body loses heat and label the following anatomical features.
      - Heart
      - Liver
      - Kidneys
      - Blood vessels
   b. What other organs would lose heat?
   c. If a person died from hypothermia, failure of which organ is most likely?
4. Use your textbook and the AMSA brochure to mark in the following in Figure 166.2
   - The body core temperatures 37.8°C, 35°C, 32.2°C, 29.4°C and 26.7°C.
   - Where intense shivering, heart slows and unconsciousness occurs.
   - Mark in where excitation, adynamic, torpor and apparent death occur.
   - Time.

MATERIALS AND EQUIPMENT (PER GROUP)

Equipment required

- AMSA Sea Safety education article, No.2 'Hypothermia'. (see above address)
- AMSA publication 'Survival'
- copy of *Marine Studies*

Figure 166.1 The assistance of the Australian Maritime College, Tasmania, is acknowledged in providing the opportunity to take this photograph.

5. The AMSA article gives three ways to minimise body heat loss. What are they?
6. The article gives seven useful pieces of advice to avoid death. List these seven.
7. For all states of hypothermia, the article recommends rewarming. List eight ways that rewarming could occur.
8. Look at Figures 166.1 and 166.3 and write a paragraph to explain the difference between wetsuits and dry suits.

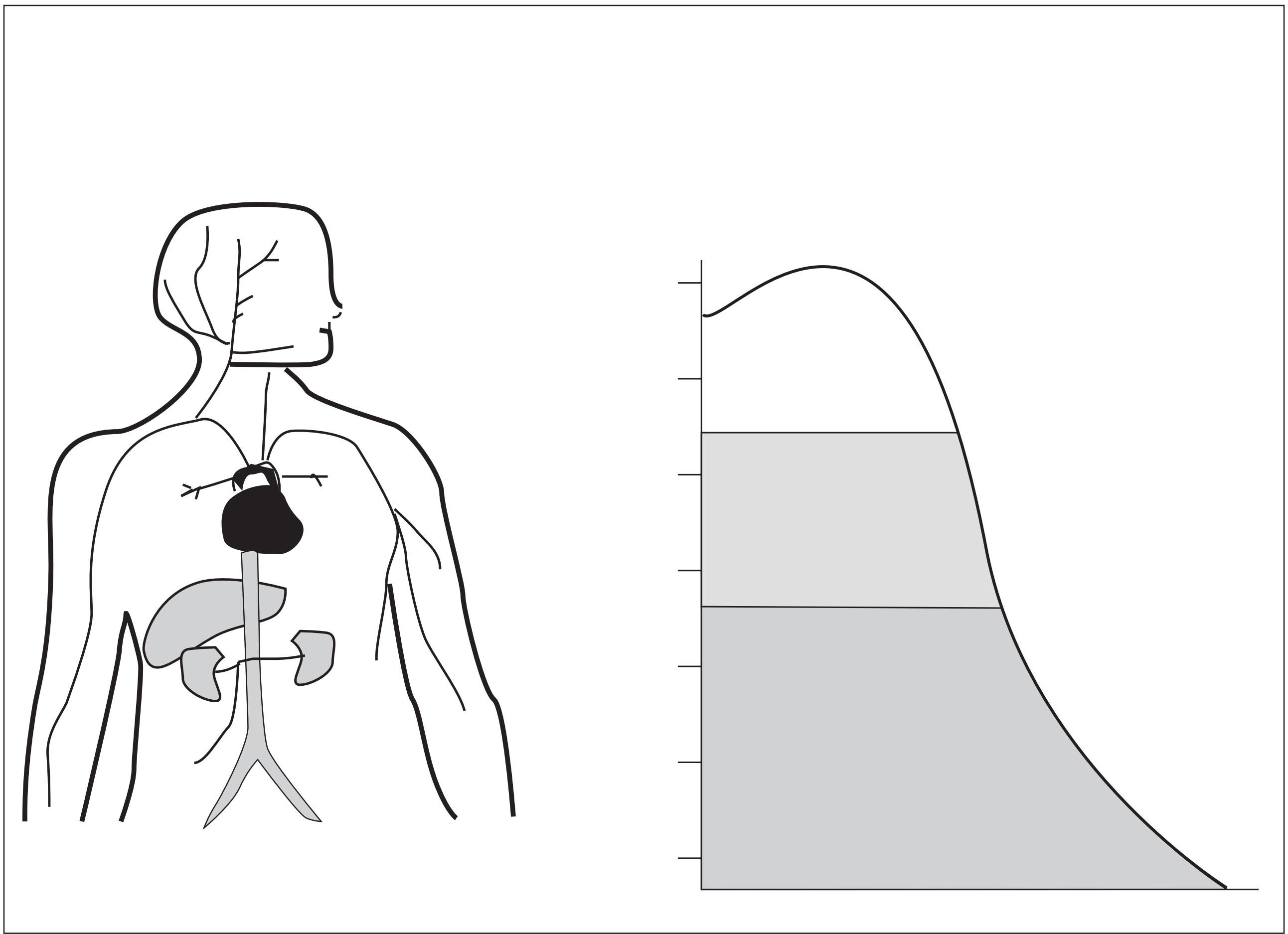


Figure 166.2 Figures for question 3 and 4
Wet Paper

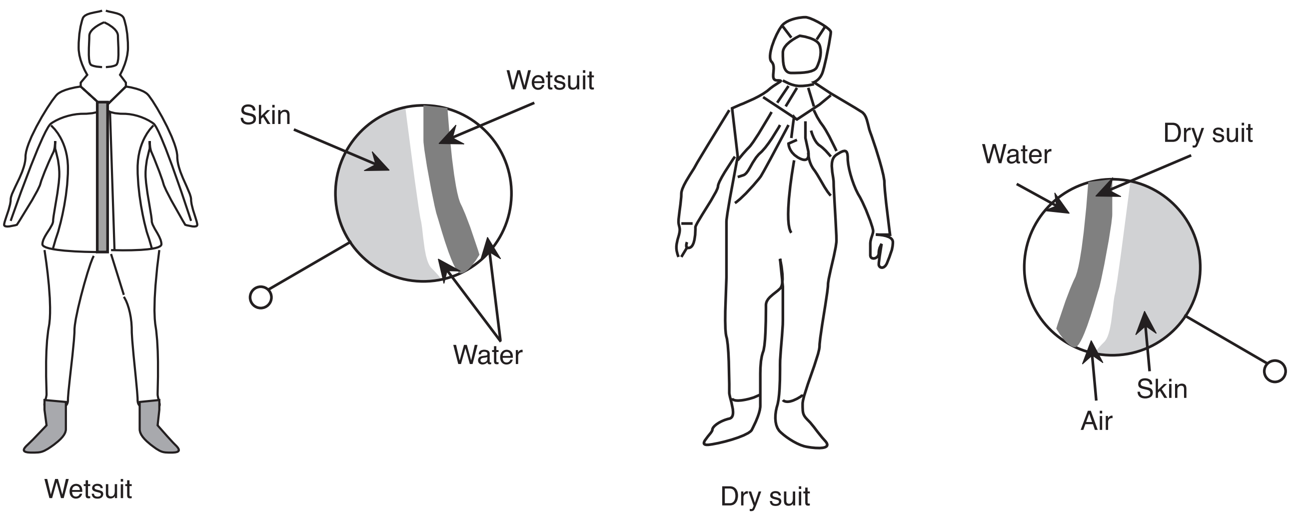


Figure 166.3 Figures for question 8
Wet Paper

Figure 166.4 Expected survival times in winter

Figure 166.5 Expected survival times in summer

EXERCISE 166 DANGEROUS MARINE ORGANISMS

Written by Tim Ryan, Maryborough State High School

ASSIGNMENT

You are to prepare a brief report on two of the following topics and present a 2 – 3 minute oral summary of your findings.

Topics

1. Fish that sting (at least 3 different species)
2. Ciguatera
3. Sharks (at least 3 different species)
4. Cone shells and blue-ringed octopus
5. Sea snakes
6. Jellyfish (at least 2 different species)
7. Other dangerous creatures (crocodiles, stingrays etc.)
8. An alternative topic – seek permission

Your report should include the following information:

- Scientific name
- Description of habitat
- Physical description
- Dangers posed
- Illustration/s
- First aid procedure/s and reference/s
- Other relevant information

Assessment

Your overall mark or grade will be based on your ability to:

a. Collect and organise information in a variety of formats e.g. tabulating, sketching.

b. Access and utilize information by relating causes of accidents and their effects.

c. Evaluate the dangers posed and the risks taken.

d. Communicate this information both orally and in writing.

Exercise 167 Cold water safety

Questions

Study Figures 168.1 and 168.2 and answer the following questions.

1. Would the wetsuits in Figure 168.1 be suitable for surfing?
2. What materials are wetsuits made from?
3. Could you use a dry suit for scuba diving? Give reasons for your answer.
4. Would you use a wetsuit like the ones shown in Figure 167.1, in Darwin? If not, why not?
5. What additions would you make to your wetsuit if you were skindiving in Tasmania?
6. Why is the surfer wearing a helmet, booties and gloves?
7. What dangers does the surfer face in entering at this spot?
8. The surf is 2 m, a slight offshore wind is blowing and there are six other local surfers out. What knowledge should the surfer have before jumping in and how is knowledge such as this gained?
9. The southern ocean is famous for the great white shark.

   Which colours and shapes are most likely to attract sharks?

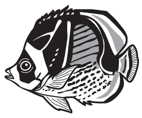
Figure 168.1 Wetsuits (photograph courtesy Cresi Sub Aqua)

Wet Paper

Figure 168.2 Surfer entering water.

EXERCISE 168
REVISION TEST

Time 60 minutes



50 Marks

Knowledge and understanding

1. Before entering an area of water to snorkel, we will need to know if the tidal current will be a problem. In an area which has a large tidal range, we can use the rule of twelfths to predict tidal flow. The tidal flow will be the greatest in:
   a. the first hour after full tide.
   b. the first hour after high tide.
   c. the third hour after high tide.
   d. 6 hours after high tide.
2. Prolonged immersion in cold water is a common cause of hypothermia. Which of the following is a recognised treatment for a victim of hypothermia?
   a. Place a blanket over the person and place in coma position.
   b. Give the casualty a hot bath.
   c. If conscious, give warm sweet drinks.
   d. All of the above.
3. Equalisation during descent is necessary because:
   a. the pressure on the ear drum is greater on the inside than the outside.
   b. the pressure on the ear drum is greater on the outside than the inside.
   c. the pressure of the air in the lung increases.
   d. the ear becomes filled with water.
4. The two chambers on the right side of the heart:
   a. collect the blood from the body and pump it to the lungs.
   b. receive oxygenated blood from the lungs and pump it around the body.
   c. are the right atrium and the vena cava.
   d. pump blood to the body.
5. The lungs are surrounded by two layers of very thin membrane. They help lubricate the movement of the lungs. If damaged, air can enter the space and the lungs may collapse. These layers form:
   a. the pleural cavity.
   b. the bronchioles.
   c. the alveoli.
   d. the pulmonary cavity.
6. The name of the vessel that carries the deoxygenated blood from the body back to the heart is the:
   a. aorta.
   b. vena cava.
   c. pulmonary vein.
   d. ventricle.
7. At the end of bronchioles are millions of sacs called:
   a. the lung cavity.
   b. bronchiole sacs.
   c. the pleural cavity.
   d. alveoli.
8. The muscular tissue which attaches to the skeleton and helps fill the lungs by moving up and down is the:
   a. cardiac muscle.
   b. pulmonary muscle.
   c. diaphragm.
   d. cartilagenous muscle.
9. The air we breath out contains approximately:
   a. 79 per cent nitrogen, 17 per cent oxygen, 4 per cent carbon dioxide.
   b. 79 per cent nitrogen, 20 per cent oxygen, 1 per cent carbon dioxide.
   c. 79 per cent carbon dioxide, 21 per cent oxygen.
   d. 85 per cent nitrogen, 10 per cent carbon dioxide, 5 per cent oxygen.
10. When the first aider arrives at the scene of an accident or emergency he/she should first:
   a. check whether there is danger to themselves or the casualty.
   b. check for a response from the casualty.
   c. start EAR before CPR.
   d. check for breathing and a pulse.
11. An unconscious person who is not breathing but has a pulse requires:
   a. CPR.
   b. EAR only.
   c. ECC only.
   d. to be placed in the lateral position.
12. The rate of application of EAR for an adult is:
   a. 4 to 6 breaths per minute.
   b. 12 to 15 breaths per minute.
   c. 15 compressions in 10 seconds.
   d. 1 inflation and 5 compressions every 5 seconds.
13. When performing EAR on a child the breaths should be:
   a. faster and shallower than on an adult.
   b. faster and deeper than on an adult.
   c. at a rate of 12 per minute.
   d. causing the sternum to rise 4 to 5 cm.
14. The cycle for one person performing CPR on an adult is:
   a. 5 breaths followed by 10 compressions in 15 secs.
   b. 2 breaths followed by 15 compressions in 15 secs.
   c. 1 breath followed by 5 compressions in 15 secs.
   d. 5 breaths followed by 10 compressions in 10 secs.

15. Shock is a progressive condition in which insufficient circulation of blood to the brain and tissue of the body may lead to a collapse of the circulatory system and death. Which of the following is **not** a sign or symptom of shock ?
    a. Pale, cold, clammy skin
    b. Slow shallow breathing
    c. Weakness, anxiety and restlessness
    d. Weak and rapid pulse
16. Which of the following is a cause of shock?
    a. Severe fright
    b. Severe bleeding
    c. Heart attack and burns
    d. All of the above
17. Coral is covered in a slime which can easily cause infection in a wound. Which of the following would be most appropriate and acceptable as treatment for of a coral cut ?
    a. Bath the wound in hot water (50°C) for a period of 15 minutes
    b. Apply a compression bandage to stop the spread of the venom
    c. Flood the area with vinegar to kill the slime
    d. Clean the wound and apply a drying agent (hydrogen peroxide)
18. Antivenene is not available for bites/stings by the following animals:
    a. Sea snake
    b. Cone shell
    c. Stonefish
    d. Blue-ringed octopus
19. The box jellyfish is so named because of its box-like shape with four fleshy protrusions. What are these protrusions called that hang from each corner of the jelly?
    a. Penailia
    b. Pedalia
    c. Redula
    d. Proboscus
20. The treatment for a person stung by the nematocysts on the tentacles on a box jellyfish is to flood the area with vinegar. Vinegar is used to:
    a. relieve pain.
    b. sterilise the wound.
    c. deactivate any undischarged nematocysts.
    d. prevent swelling.
21. Answer true (T) or false (F) to the following statements.
    a. The first aid for all fish spine injuries includes immersing the affected area in hot water (up to 50°C).
    b. Very few people have ever died in Australia from a cone shell envenomenation.
    c. In a cone shell the venom is forced, under pressure, down the venom duct and into the pharynx.
    d. The cone shell can be lifted when holding the blunt end.
    e. All stingrays have venom associated with their barbs.
    f. A constrictive bandage should immediately be applied to a box jellyfish sting to stop the spread of the venom.
    g. You can not feel the injection of poison from a blue-ringed octopus.
    h. When performing ECC on young children the sternum should be compressed only 1 cm.
    i. EAR + ECC = CPR
    j. The semicircular canals are responsible for balance and if disturbed may induce seasickness.

(5 marks)

Information processing and reasoning

1. This question refers to Figure 169.1
    a. In what month is the external temperature lowest? What was the average temperature ?
    b. How many calories per 24 hours were produced in the month of May ?
    c. If a temperature of 15°C is reached, how many calories of energy were produced in 24 hours ?
    d. Suggest a reason/hypothesis to explain the relationship shown in this graph.
    e. Suggest how the metabolic rate may be changed.

(10 marks)

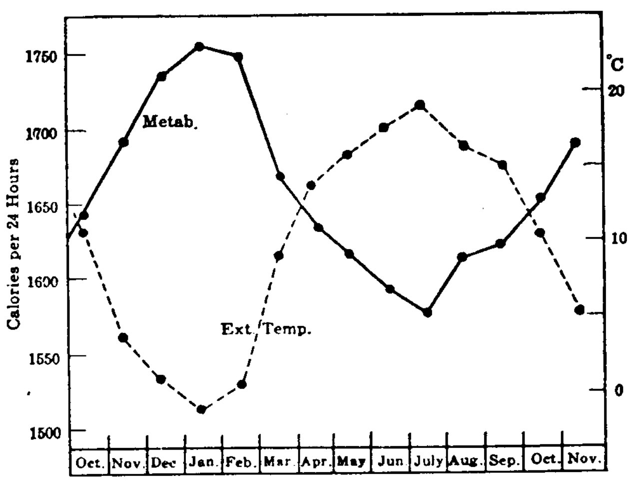


Figure 169.1 Temperature and metabolic rate

2. Refer to Figure 169.2 and answer these questions.

   a. Discuss the significance of this data to emergency rescue organisations in Victoria and Tasmania. What advice may these agencies give to skippers to increase their chances of survival in water after a boating mishap?

   (2 marks)

   b. Where on the body would be the areas of greatest heat loss? Discuss your reasoning.

   (1 mark)

   c. How could heat loss from these areas be minimised?

   (1 mark)

3. Refer to the graph in Figure 169.3 and answer these questions.

   A survivor of a boating accident has just been plucked from the water. His heart rate is slow and irregular and he has lost some of his memory.

   a. What is his probable body temperature?

   b. In what stage of hypothermia is the patient?

   c. If the water temperature is 20°C, estimate the time he has been in the water

   Use information from both figures and explain how you arrived at your answer.

   d. It is not true that alcohol helps you keep warm in an exposure situation. Tests have shown that drinking alcohol increases the speed at which the body cools by 20 per cent Suggest why this is so. What might be survival time in water off Mackay if you drink alcohol?

   e. How would this situation change if a survivor decided to swim for shore? Give your reason.

   f. Why should you pat the survivor dry and not rub him dry?

   g. Why should you not place the survivor in a blanket?

   h. How should you treat hypothermia?

   (10 marks)

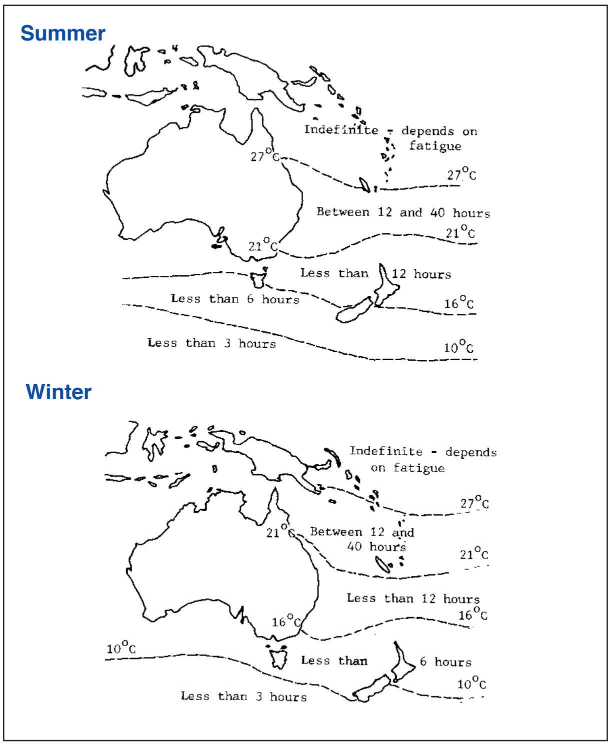


Figure 169.2 Human survival time summer and winter (After Queensland Transport).

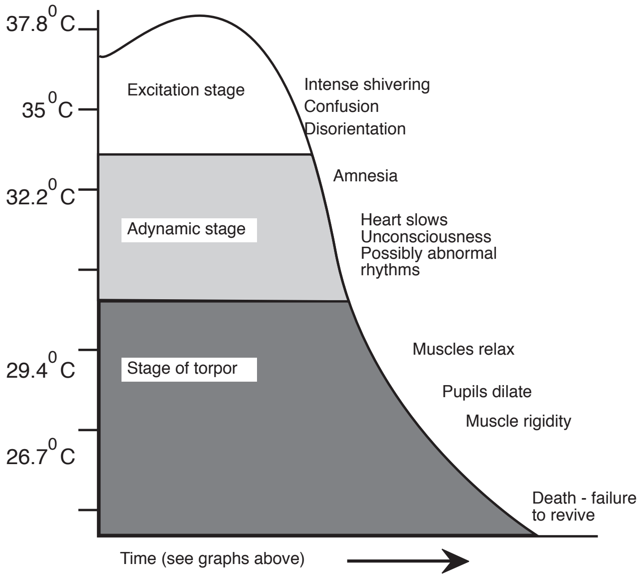


Figure 169.3 Graph for question 3

Wet Paper

Answers

1. c	8. c	15. b
2. c	9. b	16. d
3. b	10. a	17. d
4. a	11. b	18. b
5. a	12. b	19. b
6. b	13. a	20. c
7. d	14. b	21. see text

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