Marine Science

For Australian Students

Marine Radio Worksheets

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WORKSHEET 1 PRINCIPLES OF TRANSMISSION

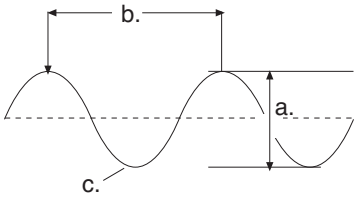
All illustrations this page drawn by Wet Paper

Answer the following questions

1. Describe the principles of radio transmission as discovered by Hertz in 1888.

2. What is a carrier wave?

3. Write the names of the parts of a radio wave identified a – c in the diagram of the radio wave below



a. _____

b. _____

c. _____

4. Define the following terms:

   a. modulation

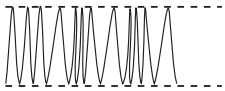
   b. skip

   c. radiotelephony

5. Outline the 'theory of propagation'.

6. Name the type of modulation shown below.

Modulation A



Modulation B

7. Explain why 'sky waves' travel further than 'ground waves'.

8. How might 'skip' be a problem when using a marine radio?

WORKSHEET 2 EPIRB

1. What does the term EPIRB stand for?

2. What happens when it is activated and what frequency does it transmit on?

3. How far away can the signals be transmitted?

4. What number should you ring if an EPIRB is inadvertently switched on?

5. What are the responsibilities of the Rescue Co-ordination Centre?

6. Where are Australia's local user terminals located?

7. Look at Figure 11.2 on page 11 and answer the following questions.
   a. Forecast the result of an activated EPIRB off the Queensland coast .

   b. What do the terms SAR, LUT and RCC, stand for?

Research questions

1. What development has made EPIRBs more effective as distress signals?

2. Which beacon is recommended for boats operating beyond 900 km offshore?

3. What is the fundamental difference between EPIRB and Marine Radio transmissions?

4. Complete these sentence: 121.5 MHz Beacon: Time to relay signal accurately _____ 406 MHz Beacon: Time to relay signal accurately _____ (see fact file page 12)

5. Read the article on the page opposite about the adventures of Don Ling. Now use the arguments presented in the article to write two sentences on the importance of carrying an EPIRB.

WORKSHEET 3 TRANSCEIVER CONTROLS

Complete the following table identifying the parts of the marine transceiver labelled 1–14 in Figure 6.1 below (courtesy GME electrophone). Some research may be necessary with your local rescue organisation.

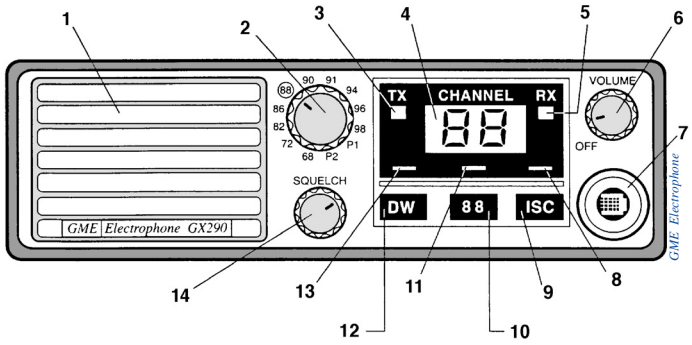


Figure 6.1

NO	Name	Function
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		

WORKSHEET 4 TYPES OF CALLS

1. Complete the following table of channel usage

Type of call	27MHz	VHF	MF / HF
Distress and initial calling			
Supplementary distress and urgency			
Non-commercial			
Professional fishing service			
Commercial service (including charter vessels)			

2. What does the antenna in a marine radio equipment system do?

3. What does the power supply to a marine radio do?

4. Name three types of marine radio.

5. Name five uses small boat operators can make of a 27MHz radio transceiver.

6. What channel is a 27 MHz usually left on and why?

7. What channel is a VHF usually left on and why?

8. On what types of radio is a marine radio qualification required?

9. Why is it useful to have a marine radio qualification when you only have a 27 MHz equipment?

10. Complete the table on the advantages and disadvantages of different types of radios.

Radio Type	27MHz	VHF	MF / HF
Advantages			
Disadvantages			

WORKSHEET 5 DIGITAL SELECTIVE CALLING

1. What do the abbreviations GMDSS and DSC stand for?

2. State two advantages of digital selective calling.

3. What information does a DSC alert contain?

4. Will digital selective calling be set up on 27 MHz equipment?

5. While the main use for DSC by small vessels will be for distress, urgency and safety purposes, what other uses can it have?

6. How is a ship station identified using DSC techniques?

7. How does a DSC system reduce the amount of calls received on a marine radio?

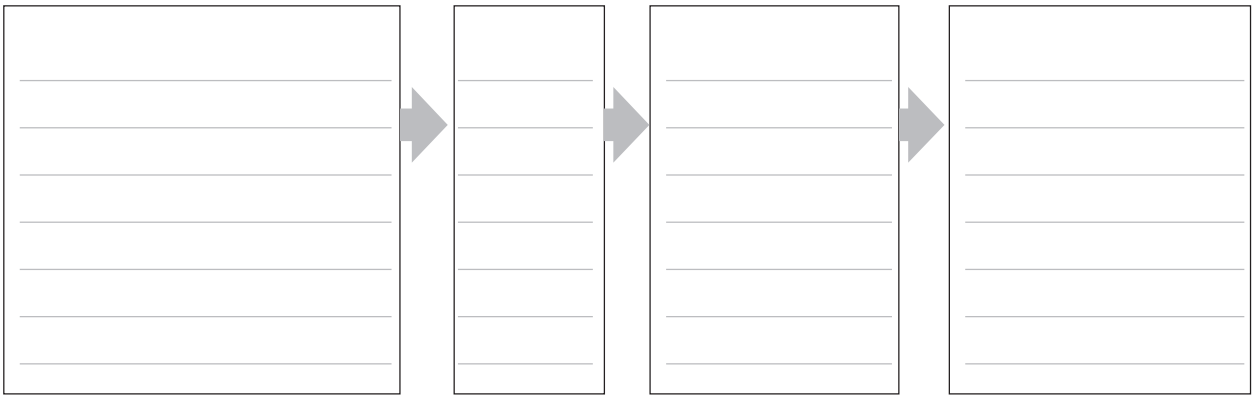
8. The use of DSC in small ships in Australia is in its genesis. What does this mean?

9. What are the international digital selective calling frequencies for VHF and MF / HF?

10. How will DSC techniques reduce watchkeeping by ships, coast and limited coast stations?

11. Write down in order the four steps to correctly transmit a digital selective calling distress alert and subsequent distress call and message if your vessel the *Anne Margaret* which is a 42 foot catamaran sailing across the Tasman Sea has just hit a submerged ship container and you are taking in water fast.

    Your position is 100 nautical miles south-east of Sydney and there are three people on board.



12. How do you cancel an inadvertent DSC distress alert?

13. What action should be taken when an operator receives a DSC distress alert?

14. Write down in order the steps necessary to correctly transmit a digital selective calling safety alert and subsequent radiotelephony safety call and message.

WORKSHEET 6 MARINE RADIO

based on an original worksheet by Mark Collins, Maryborough State High School

1. Match up the word from list A with one in list B

List A	List B
Verify	Reduce to one channel
ISC switch	27.88 MHz
VHF distress channel	27.80 MHz
27 MHz distress channel	Check your information and advise me
Squelch control	Eliminates electrical interference
ROMEO	Message received and understood
	Repeat your message
	Channel 16
	Reduces background noise

2. Complete the phonetics for the following letters.

K	N	W	F
O	D	I	L

3. Unscramble the following letters to find a marine radio related word.

a. RAILEA	b. ETMNRRTISAT
c NNNARETA	d. CPNIOOMRHE
e. ROEWP	f. TEHZR
g. WSEVA	h. LAIGSN
i. EMIRAN	j. ROIDA

4. Discuss four important voice procedures that are needed for good voice communications.

5. Why are radio silence periods enforced and when do they occur?

6. Why is it important to maintain a watch on your radio?

WORKSHEET 7 TUNING A MARINE TRANSCEIVER

based on an original exercise by Mark Rickard, Benowa State High School
(Should only be performed under the control of a qualified marine radio operator.
See also Section 7)

You will need

- A radio box or radio set as shown in Figure 11.1
- To protect your sea safety investment (the radio), ensure that microphone and antenna connections are secured before proceeding.
- If constructing a mobile unit as shown in Figure 11.1, 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 and that terminals are not shorted.
  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.

What to do

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)
3. 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.
4. Before transmitting, listen carefully for long enough to be satisfied that interference will not be caused to a station already using that channel.
5. Check the time to ensure a radio silence period is not operational.
6. You are now ready to transmit.

Figure 11.1 Tuning a marine radio using a mobile 27 mhZ base station

WORKSHEET 8 SENDING A MESSAGE

Answer the questions below.

1. a. Why is it necessary to say the vessel's name three times?

   b. What is normal local radio procedure?

2. What is the most commonly used radio frequency in your area for transmitting local traffic?

3. On what channel do operators listen in for messages?

4. To what channel do they normally transfer?

5. How would you say each of the following?

   - 21
   - 6.34
   - 6 am
   - 3.35 pm
   - $131.34
   - 14
   - 12 noon
   - 10.25 pm

6. You are leaving port with three children and two adults on board. Your vessel is the *Tubby* and you are travelling 12Nm to St. Bees Island. You intend getting there at 10.30 in the morning. Write out your message to the local rescue station.

7. You want to test if your radio is working with the local rescue organisation. Write out your message to the local rescue station.

WORKSHEET 9 PHRASES AND MEANINGS

Complete the following table

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
CQ	
Wilco	

WORKSHEET 10 PHONETIC ALPHABET

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. Suggest a reason for the emphasis of the underlined syllables when using certain words.

3. Divide the following into syllables:
   - Preparation
   - Communication
   - Radio
   - Station

4. 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.

5. Write your own name on the front of your notebook using the phonetic alphabet.

6. Write a message to the student next to you using the phonetic alphabet.

7. 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?

8. Common radio terms are ETA and ETD. What do these terms stand for and where might they be commonly used?

9. Suggest why the phonetic alphabet was developed and why some of the words were selected.

10. Why is it important to keep your message as brief as possible?

WORKSHEET 11 RADIO TELEPHONY ALARM SIGNALS

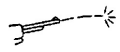
1. What is the purpose of a radiotelephony alarm signal?

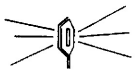
2. What type of sound do you hear if you receive a radiotelephony alarm signal?

3. How is the radiotelephony alarm signal transmitted by a coast station different to one produced by a vessel at sea?

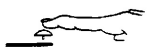
4. Describe an alarm signal that is used to preceed an urgent cyclone or storm warning?

5. Complete the diagrams below of common distress signals.

1. 

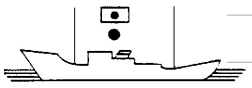
2. 

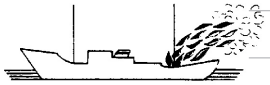
3. 

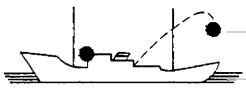
4. 

5. 

6. 

7. 

8. 

9. 

10. 

11. 

12. 

WORKSHEET 12 DISTRESS SIGNALS

1. You are out at sea and have a distress situation on your vessel. The battery on your boat is not functioning and the radio is dead. You have no EPIRB on board the vessel.

   Suggest two types of signal you would use in the following situations. Explain the reason for your choice.

At night	Sunny day	Foggy morning	Cloudy day

2. You have just hit a submerged reef and your vessel is taking water rapidly. It is a sunny day and you spot a large trawler in the distance but you are unable to locate your signalling mirror.

   Suggest an alternative signalling device that may be on the vessel to attract the vessel's attention using the sun's rays.

3. What is the Morse code for S.O.S. or distress? Why is this method seldom used these days?

4. Who has the authority to send a Mayday message on a vessel's radio?

5. Select one of the following topics to research in the library.
   a. Why the flags for the letters 'n' and 'c' are used for distress.
   b. Fog signals used in international waters.
   c. The different type of day shapes that can be used and what they mean.
   d. The different flag signals for the letters of the alphabet and what they mean.

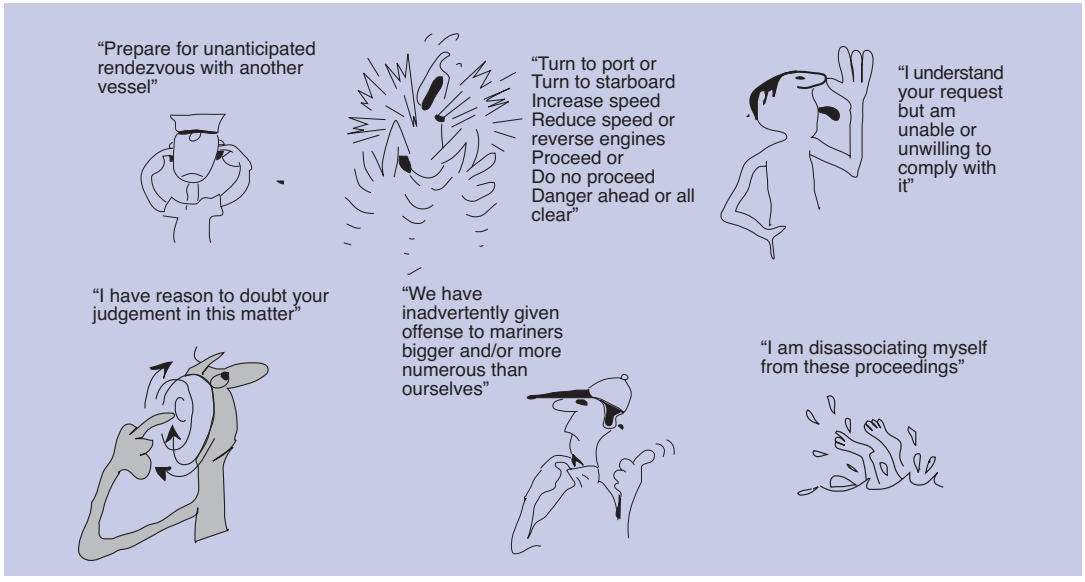


Figure 16.1 Non-standard hand signals for use by coxswain on bow to communicate with skipper in wheelhouse while manoeuvring in close quarters prior to docking

WORKSHEET 13 MAYDAY RESEARCH QUESTIONS

1. List equipment considered by the yachtsman as vital for safety during offshore passages.

2. 27 MHz Radio is most used by which marine groups?

3. How is the EPIRB activated and deployed?

4. Why are EPIRBs still activated when vessels have sent distress messages by marine radio?

5. What other distress signals are commonly used by mariners in trouble?

6. Why should abandoning ship be a last resort?

7. What are some of the features built into inflatable life rafts?

8. List the commentator's key survival tips on a life raft.

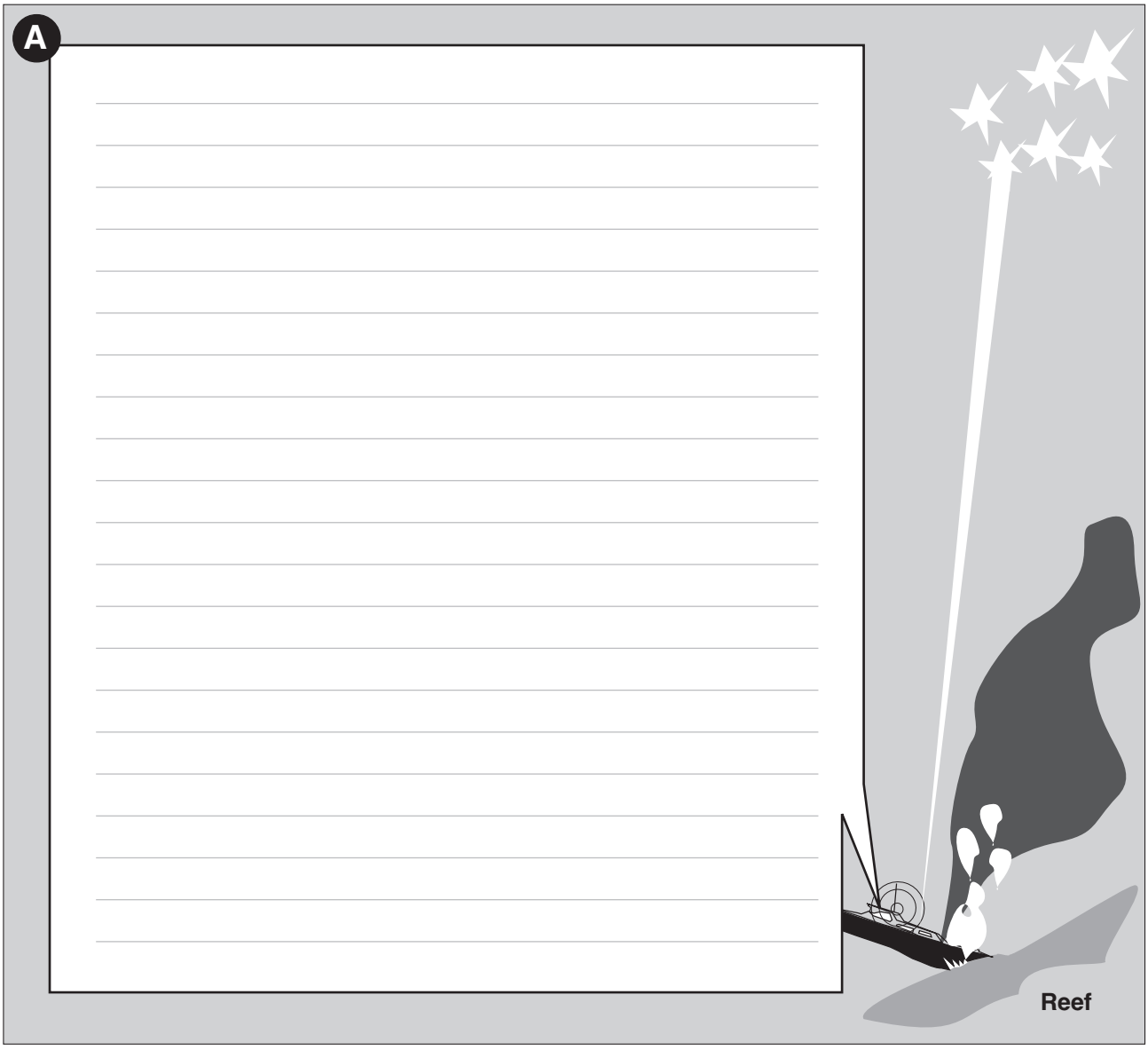
9. What is the function of the local user terminals at Albany and Bundaberg? (Remember the video is out of date)

10. What resources can the Maritime Rescue Coordination Centre call upon in emergency rescue situations?

Worksheet 14 Mayday

Sea Witch VL 1234 has just sailed onto Maclean Reef and is holed badly.

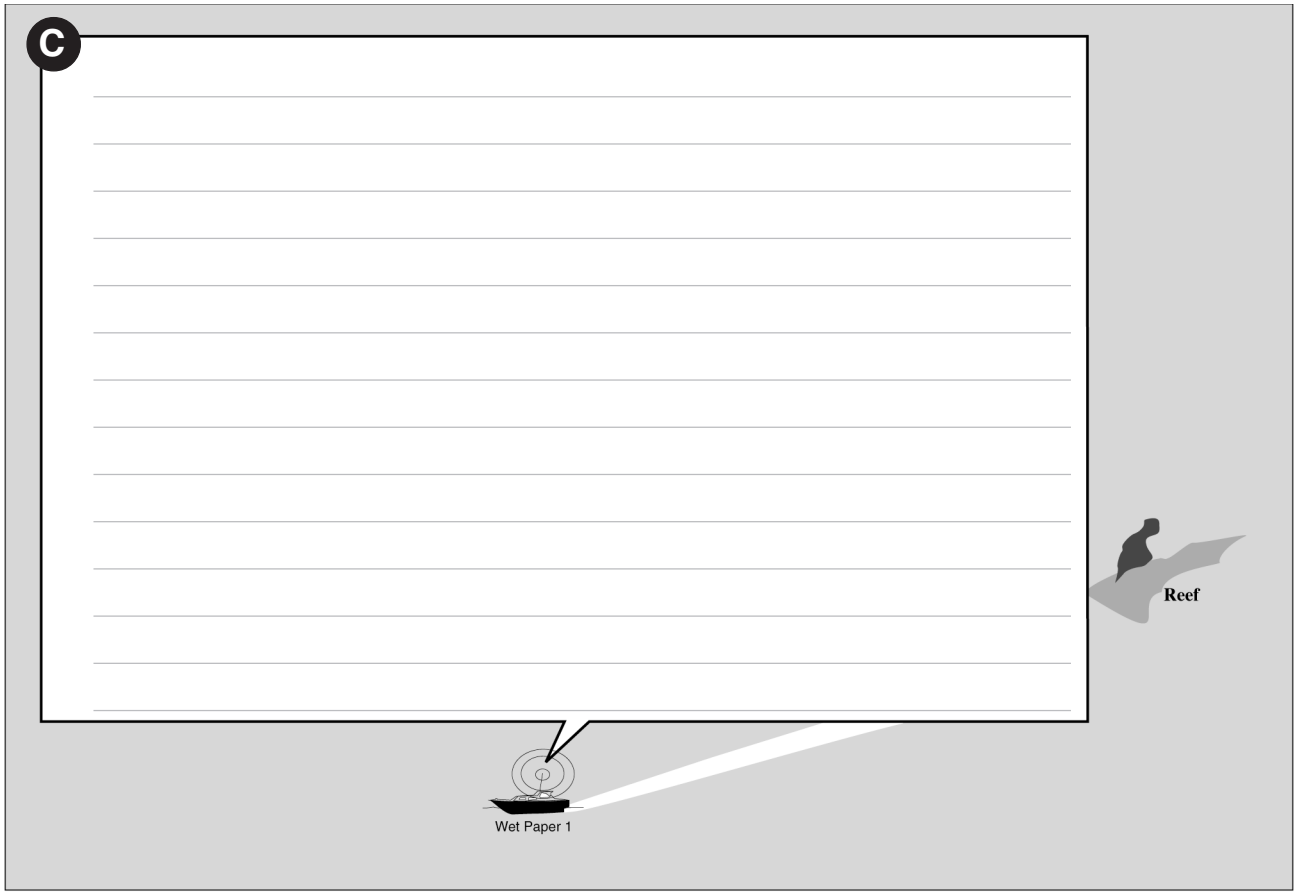
1. Use the speech bubble A below to write out your Mayday call.



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*. It appears no other vessel has responded. You are 10 nautical miles from Maclean Reef. Use speech bubble B to write out your response.

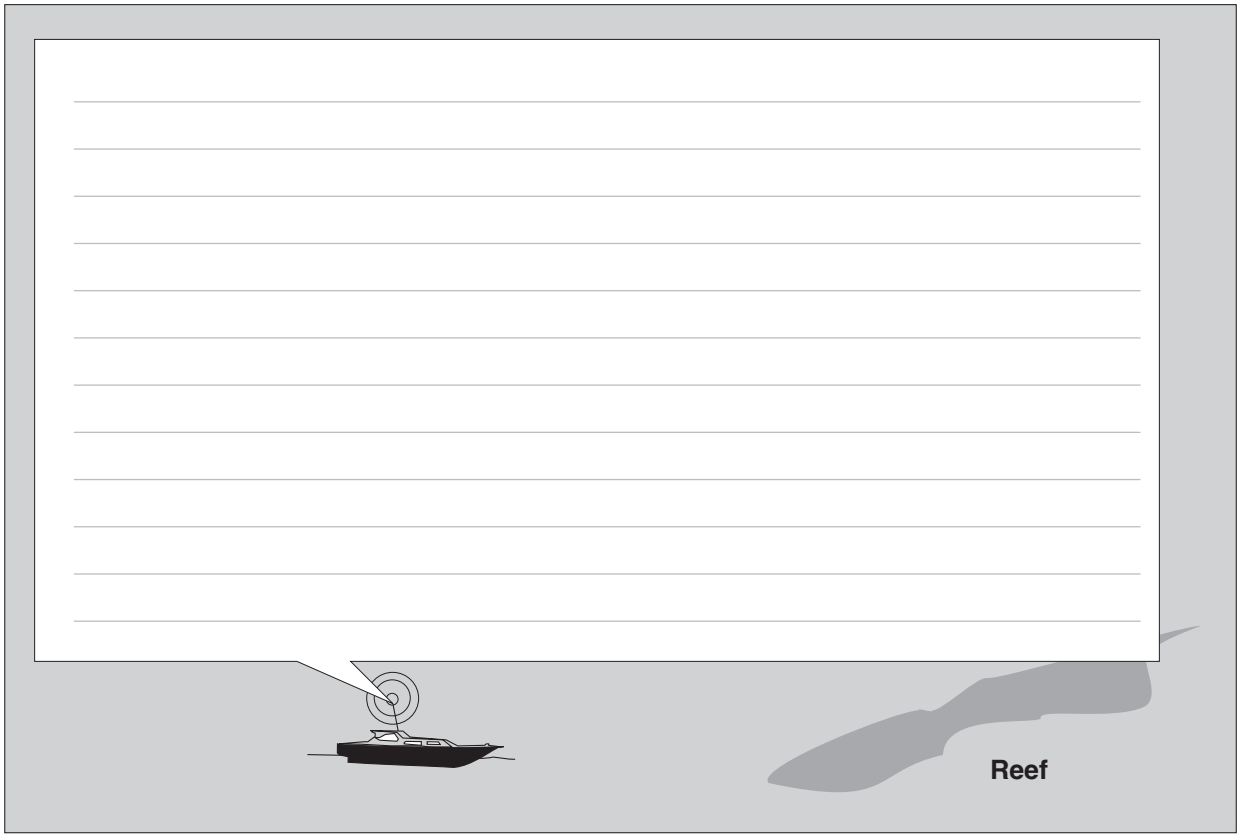
4. The crew are rescued and the danger has passed. Use speech bubble C to write out how to finish the distress situation.



Worksheet 15 Pan Pan

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 bubble below 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. Complete the following sentences by adding the correct word.

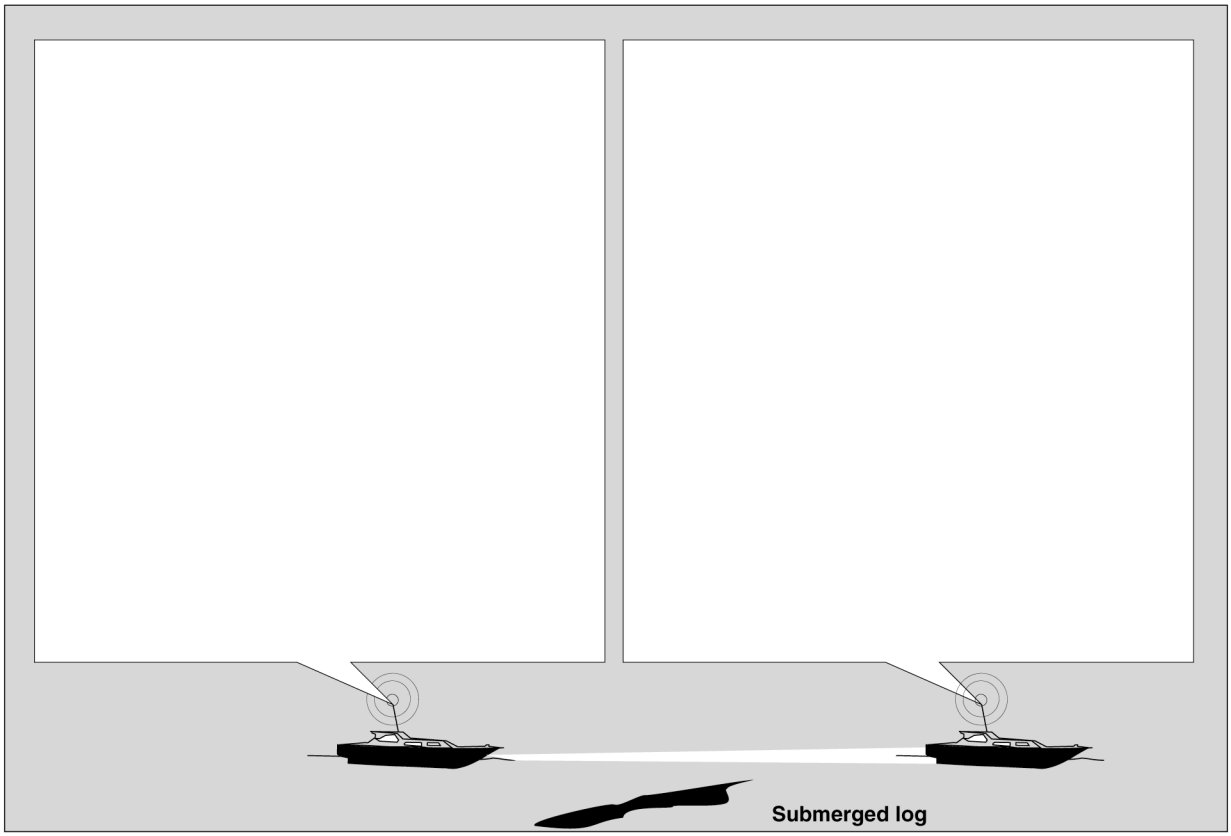
A Pan Pan message is a ..... signal concerning the safety of a .....

or ..... or the ..... of a person.

WORKSHEET 16 SAY-CURE-E-TAY

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 bubble below to write out a SAY-CURE-E-TAY signal.



2. Give two other examples of when you would send a SAY-CURE-E-TAY message.

3. Why are SAY-CURE-E-TAY messages important?

4. Complete the sentence:
   A SAY-CURE-E-TAY message is a ..... signal.

WORKSHEET 17 FIND-A-WORD PUZZLE

S A F E T Y Y L V J A K X R A D I O R R G O U T A
Y F R E Q U E N C Y H Y C A L L S I G N J S S X N
W A R N I N G S F S R O M E O A F B L O G U R R T
L F J A L A R M S I G N A L J U U I W J J M W I E
S K Y W A V E S I M Z B A T T E R Y Z G Z K U L N
E Z D I G I T A L K B M O D U L A T I O N C Y Z N
B M F L Y L P B F T R A N S M I T T E R O T H O A
J V E S V U D A U R G E N C Y B Y A L E I T Q J B
W Y G J Y P A N P A N C E Y O E E L S C U U J I Q
H E R T Z U E P I R B G U U I J A C G E D U A L S
D I S T R E S S V Y Z B E A C O N B Q I U O V E R
Y E O G M D S S E M E R G E N C Y G X V V N U A J
L J H X B D X L X S P U A A L V H F P E T B Z V S
P K A R V L B T R A N S C E I V E R V R D H O S E
W D M V D P R O P A G A T I O N J S E C U R I T E
N T R K N O T S M I C R O P H O N E X R P V E U L
L T P S C Q M A Y D A Y E W M T X P D C U S M C O
U K Z C W G Q D M P H O N E T I C Y D S C O I G N
K J A E O O J S Q U E L C H I N M A R S A T E K C
C L A R I F E R Q I K A E X J J X C H A N N E L E

Word list

RADIO
ROMEO
BEACON
ANTENNA
FREQUENCY
MODULATION
PHONETIC
LOG
KNOTS
GMDSS
VHF
PANPAN
EMERGENCY
RECEIVER
SKYWAVES
SQUELCH
SEELONCE
URGENCY
OUT
INMARSAT
DIGITAL
MAYDAY
HERTZ
TRANSMITTER
OVER
CHANNEL
BATTERY
SAFETY
ALARMSIGNAL
CALLSIGN
SECURITE
EPIRB
TRANSCEIVER
MICROPHONE
PROPAGATION
CLARIFER
DISTRESS
CQ
DSC
WARNINGS

WORKSHEET 18 CONNECTING A 27MHZ TRANSCEIVER

Based on an original exercise by Mark Rickard and Kelvin Rogers, Benowa State High School

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 antenna 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?

13. What is the electrolyte that is found in a battery and why then does care have to be taken when handling batteries?

14. What effect does a build-up of the white-green powder on the terminals of the lead acid battery have on the functioning of the battery?

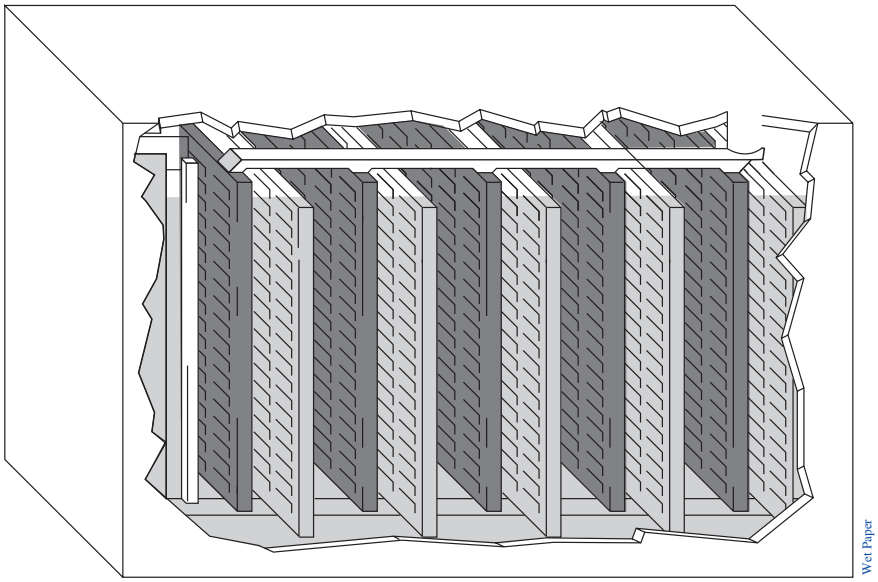
WORKSHEET 19 INSTALLATION AND FAULTS

Complete the following table:

Component	Where component is located	Care that needs to be taken
Antenna and fittings		
Microphone		
Radio earth		
Fuse box		
Battery acid level		
Battery terminals		
Battery charging		

Worksheet 20 The battery

1. Complete the missing parts of the battery in the diagram below. Then label the important components.



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. Complete the following sentence (see page 47)

   Batteries are an essential part of the _____ system of a larger boat with a _____ used to crank the engine.

8. What are two simple rules to follow when using a battery?

9. What is a hydrometer and how is it used to test a battery?

WORKSHEET 21 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 26.1, 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

_____

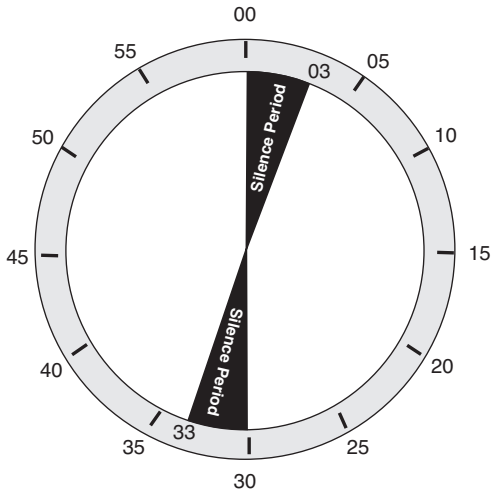
Call sign of my boat

_____

My boat's name

_____

Other details



Wet Paper

Figure 26.1 Sample quick reference sticker

WORKSHEET 22 LOGGING OF MESSAGES

Table courtesy ACA

Student radio log

Station _____

Date and time	Station/MMS/from	Station/MMS/to	Details of calls, signals & distress working	Frequency/channel

Worksheet 23 Review questions

1. What does the word ‘skip’ mean?

2. What are the three major parts of a marine radio equipment system?

3. What is the function of the transmitter and what type of radio waves does it produce? Once these waves are produced how are they modulated?

4. What is the function of the receiver and how are radio skywaves reconverted to sound?

5. What does the antenna in a marine radio equipment system do?

6. Name three types of marine radio.

7. What is an EPIRB and what does it do?

8. Name five ways small boat operators can use 27 MHz radio transceivers.

9. What channel is a 27MHz set usually left on and why?

10. What channel is a VHF set normally left on and why?

11. When is a radio operators certificate of proficiency required?

12. Draw a diagram to show how a geostationary satellite receives and sends radio signals.

13. How are EPIRBs located using satellites?

14. Give an example of a radio communication using normal traffic procedures.

15. What is a radio silence period and draw a diagram to illustrate what it means.

16. What does the word 'securite' mean?

17. Give an example of a SECURITE message.

18. What is the term for an urgency signal and when should it be used?

19. Give an example of how an urgency signal is used.

20. What is the term used for a distress signal and when should it be used?

21. Give an example of a MAYDAY call.

22. You become involved in a MAYDAY situation and you cannot provide assistance. What do you do?

23. How can an antenna become faulty?

24. What is a blown fuse and how can you tell it has occurred?

25. List main points about marine batteries that affect good radio transmission.

WORKSHEET 24 THEORY TEST

Your vessel's name is *Wet Paper* and you are positioned 30 nautical miles south-east of Cape Morteon. Your vessel is an 8.5 metre cabin cruiser with a red hull and a white superstructure. You have four persons on board with you and you're heading in a northerly direction. Your radio call sign is VLM 1234 and you have a VHF transceiver with digital selective calling and a 27 MHz radio. You have a life raft, EPIRB and all other safety equipment required by law.

Outline the message you, as skipper, would send in the following situations:

1. You have just sighted a large red ship container floating just below the surface at your present position. You consider this a hazard to shipping as it is in the main shipping channel.

2. Your vessel has suffered engine failure and you have been unable to repair the fault. You are now drifting but you are not in any immediate danger. Please use a digital selective calling alert as part of your message.

3. You have just received a distress message from the vessel *Seahunter*, call sign VNN884 on the 27 MHz set. The message indicates this vessel is sinking and is positioned 20 nautical miles south-east of Cape Morteon. You are in a position to provide assistance and believe you can reach the strickened vessel in 45 minutes.

4. You have just received a message from the vessel *Cool Charm* which is on fire after an explosion in the engine compartment. The fire is uncontrollable and they are abandoning ship into a life raft. Their position 50 nautical miles north-east of Cape Morteon. Because of limited fuel and distance from the vessel you are unable to help. You continue to monitor the distress frequency and record that no other station has responded to the message within 10 minutes.

5. Your vessel has just had a collision with another submerged shipping container and is taking in water fast through a large hole on the port side. The pumps have been unable to keep up with the intake of water and you predict you will only be able to stay afloat for 10 minutes. Use your 27 MHz set to send the appropriate message.

WORKSHEET 25 REVISION TEST

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. MF/HF
   c. AM radio
   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. 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
9. 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
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 words
    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 antenna has been broken
    c. the antenna had a bad connection
    d. the battery is low on charge

16. 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 λ = wavelength

(3 marks)

17. Refers to Figure 32.1 below. 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 (2 bel) 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?

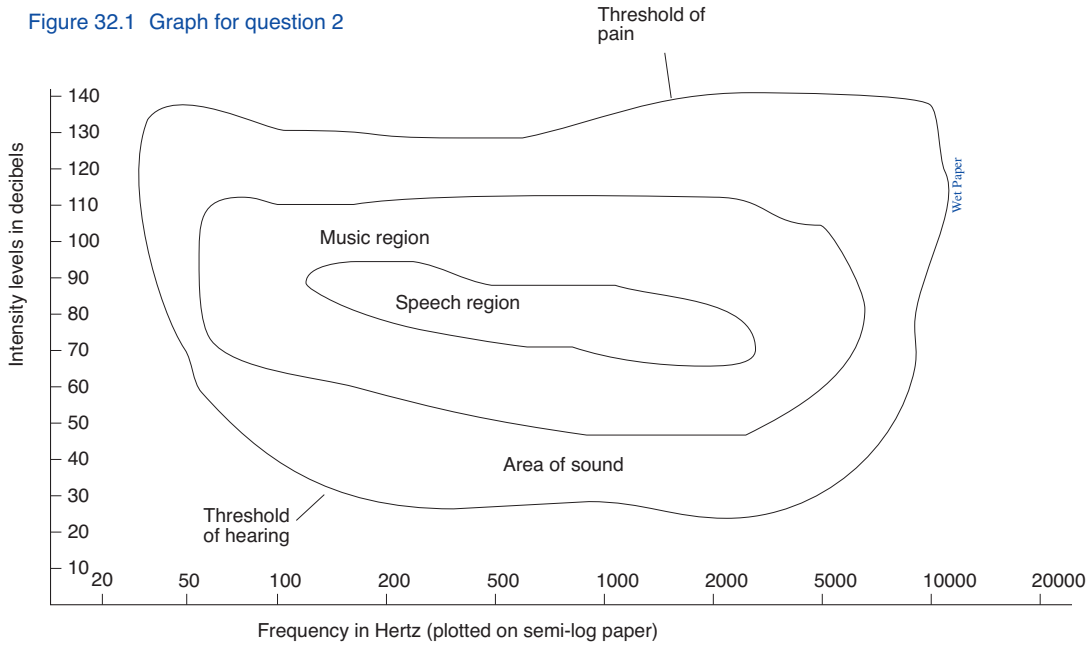
d. At what intensity of sound will 5000 Hz reach its threshold of pain?

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 still be heard? (10 marks)

Figure 32.1 Graph for question 2



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