Marine Science for Australian Students
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Q1. Echo sounders work by transmitting sound waves with frequencies between 10 kHz and 100kHz. These sound waves are reflected off the sea floor back to the transducer. The time taken for the sound wave to return is measured and used to calculate the depth.

Q2. Students' own diagram. See Fig 11.1 Ocean floor topography
The continental shelf is usually flat because it is built up with sediment run off from the continent.

Q3.

	Asthenosphere	Lithosphere
Location	Beneath lithosphere	Upper layer of mantle
Composition	Plastic	Cool, relatively rigid rock
Density	3.5g/cm3	2.8-3.3g/cm3

For diagram, see Fig 15.1 Composition of lithospheres and asthenospheres

Q4. 50% of the earth's surface is deep ocean basin floor, which is made up of abyssal
plains and abyssal hills.

Q5. The continental slope can be as great as 45°, but has an average slope of 25°. The
continental rise is much less: a gradient of about 1:300.

Q6. Submarine canyons are large valleys that cut into the continental shelf. Murray Canyon is near Kangaroo Island off the South Australian coast. Ancient rivers may have formed these canyons.

Q7. The bathyscape Trieste was able to descend to over 10 000 metres deep by taking
on sea water as ballast (making its density higher). The Trieste could then sink. To ascend the Trieste releases its ballast.

Q8. See Fig 14.1: The composition of the earth.

Q9. Sial is a light coloured, low density granitic rock made of silica and alumina (density 2.8 g/cm^3). Sima is a darker coloured, higher density basaltic rock made of silica and magnesia (density ≅ 3.0g/cm^3).
Sial floats on sima because it is less dense.

Q.10 The 1982 Law of the Sea states that Australia has sovereign rights to resources out as far as the seaward edge of the continental rise (see Fig 13.1). Where

tectonic plates rift apart, it is difficult to accurately define our borders with Indonesia and New Zealand.

Case Study 1.1
p29

Q1. The CSIRO explored the sea floor east of Tasmania; collecting profiles, surface-
sediment sampling, core sampling and dredging. The results have improved scientists' understanding of the nature and history of the region.

1. Gondwana- a supercontinent of South America, Africa, Antarctica, India and Australia.
Abyssal plain- the main region of the deep-ocean floor, that is flat and smoo
Metamorphic Rock- rock that has been transformed by heat and pressu
Hydrocarbon deposit- Oil, gas and coal deposits formed by the d decomposi of organic matter
Seismic profile- a cross sectional diagram of the sea floor.

2. Student's own diagram
3. The eastern offshore margin of Tasmania extends 100 km offshore
4. With a one-tonne piston cover and ten metre sampling pipe, data can be obtained relating to many thousands of years of climate change, revealed by examining a core sample from Bass Lake.

Case Study 1.2 p31

Q1. Knowledge of the variations of the earth's magnetic and gravitational field can
tell oceanographers a great deal about the history, nature and character of the sea bed.

Q2. These studies will give us a more detailed understanding of parts of the sea bed.

Q3. Bathymetric data- information that tells us about the shape, character and biodiversity of the sea floor.
Sedimentary strata- different layers of sediment on top of one another

Q4. Multi-beam sonar systems can map depths between 300 and 5 000 metres. Only
1-2% of the sea floor has been mapped.

Q5. Commercial enterprises that take advantage of this research could be asked to contribute towards the cost of the research, but government organisations should continue the research (my opinion only- student answers may vary). Most of this research has taken place around Tasmania, but has also included Torres Straight, the Great Barrier Reef, Northwest Shelf and the southeastern continental shelf.

Q6. Student diagram of Fig 30.2, with explanation.

Q7. A sea bed habitat map is a map showing different types of habitats on the sea floor, and is important because some habitats are more vulnerable than others, and need to be considered when making managerial decisions.

Q8. A typical habitat map includes maps of bathymetry, topographic relief, sediment,
type and geological nature of substratum.

Q9. Areas as large as 10 000 sq km can be mapped in 2-3 weeks, so 15 000 - 20 000
sq km could be mapped in a month.

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KNOWLEDGE

Q.1 In 1912, Alfred Wegener and Frank Taylor proposed the theory of continental drift. Some evidence that supports continental drift is:

- that earthquakes originate at plate margins;
- ocean ridges have little sediment build-up;
- continents have been measured to be moving apart at 3cm/year;
- volcanic island chains in the Pacific.

Q.2 Pangaea was the super continent when it was believed all continents were joined
together. This split up to form two smaller super continents: Gondwanaland and Laurasia.

Q.3 Large marine reptiles inhabited much of Queensland 100-200 million years ago,
when it was flooded by an inland sea.

Q.4 The CSIRO is developing the following techniques for assessing sea bed environments:

- Satellite imagery;
- Special acoustic tools;
- Computers to record high-frequency echoes
- Sophisticated processing techniques and software
- Videos and deep-sea camera systems.

Q.5 When a plate has a weak spot on it, volcanic islands can form, such as the Hawaiian Island chains in the Pacific.

Q.6 The Australian plate is moving north at 2cm/year.

Q.7 Subduction: when two continental plates collide and move under each other.
Earthquakes: earthquakes occur as a result of pressure build-up when tectonic plates move.