Cambridge International AS & A Level

CANDIDATE
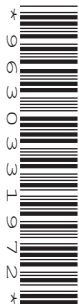NAME

CENTRE
NUMBER

CANDIDATE
NUMBER

MARINE SCIENCE **9693/13**

Paper 1 AS Level Theory **May/June 2023**

1 hour 45 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS
● Answer **all** questions.
● Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
● Write your name, centre number and candidate number in the boxes at the top of the page.
● Write your answer to each question in the space provided.
● Do **not** use an erasable pen or correction fluid.
● Do **not** write on any bar codes.
● You may use a calculator.
● You should show all your working and use appropriate units.

INFORMATION
● The total mark for this paper is 75.
● The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Any blank pages are indicated.

[Turn over

Section A

Answer **all** questions in this section.

1 Fig. 1.1 shows a map of the Mediterranean Sea.
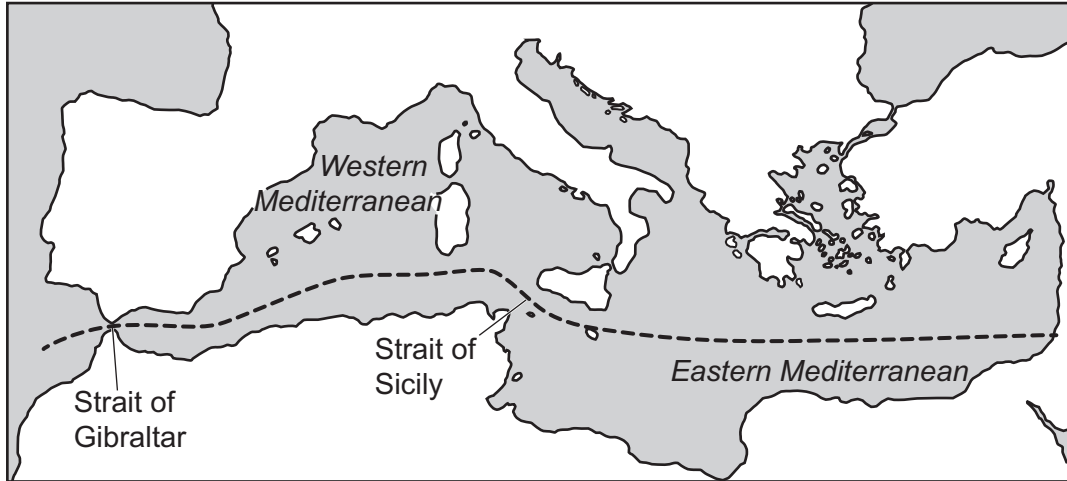

Fig. 1.1

A cross-section of the Mediterranean Sea along the dashed black line is shown in Fig. 1.2. The arrows show the direction of movement of water.
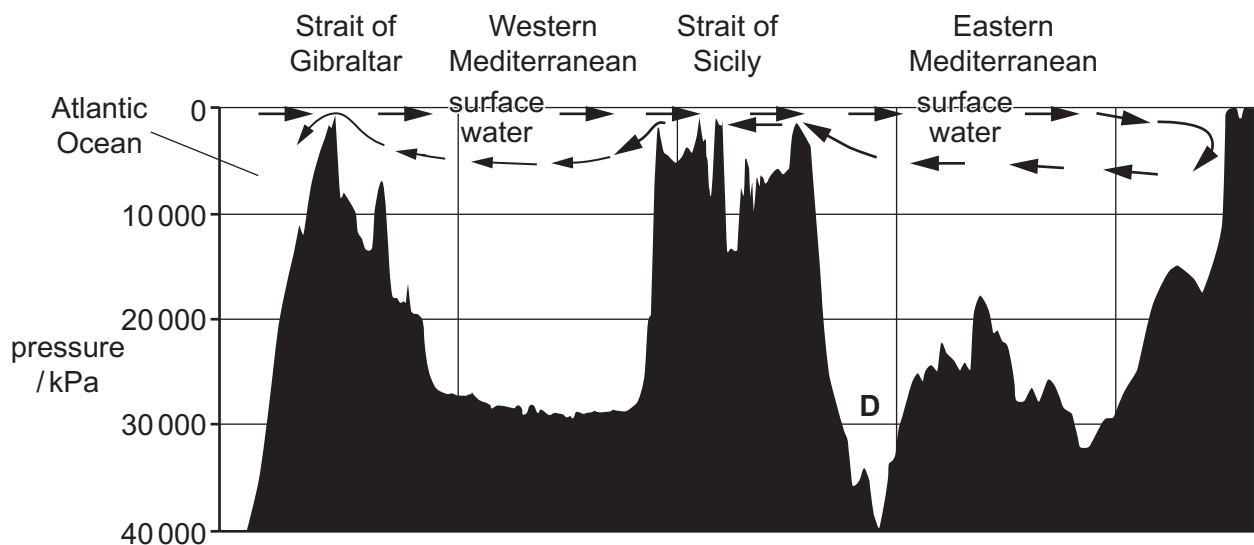
Fig. 1.2

(a) (i) Label Fig. 1.2 to show:
- the trench
- the abyssal plain.

[2]

(ii) Describe how an abyssal plain is formed.

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.... [3]

(b) Every 10 metres of depth increases the pressure by 100 kPa.

Use the information provided to calculate the maximum depth shown in Fig. 1.2.

.... m [1]

(c) The Strait of Gibraltar is 13 km wide. The Strait of Sicily is 145 km wide.

The highest salinity is found at point **D** in Fig. 1.2.

Use the information provided to explain why the salinity is highest at point **D**.

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.... [4]

[Total: 10]

2   Fig. 2.1 shows a map of the Pacific Ocean and the surrounding countries.
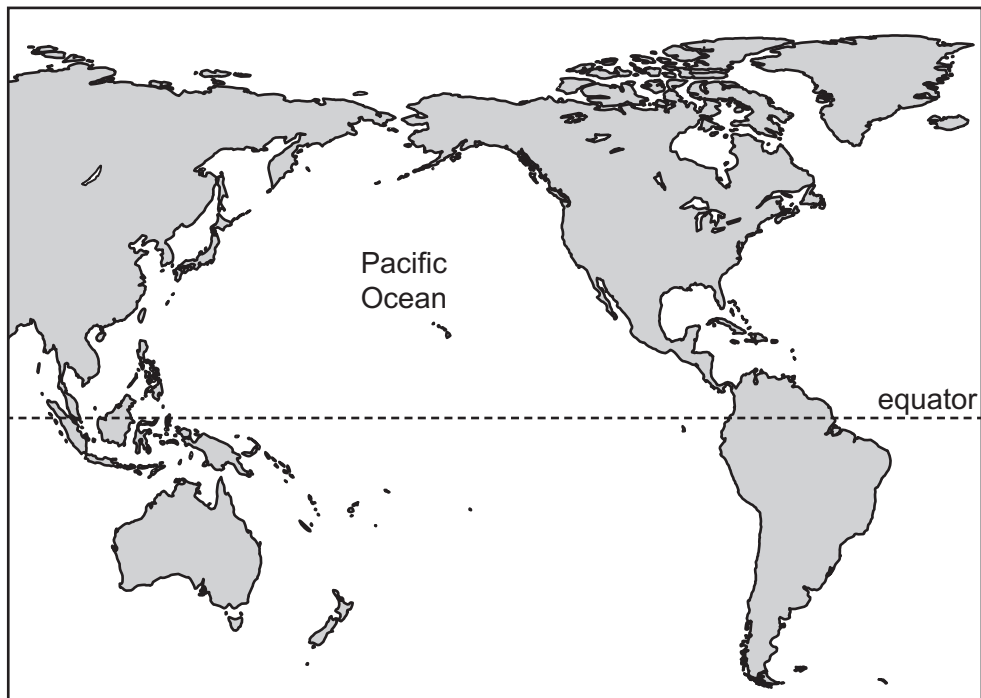
Fig. 2.1

(a) The El Niño Southern Oscillation, ENSO, occurs in the Pacific Ocean. ENSO has two different phases, El Niño and La Niña.

Complete Table 2.1 to state if the factors listed **increase** or **decrease** during El Niño and La Niña events.

Table 2.1

factors	El Niño	La Niña
sea surface temperature in the eastern Pacific	....	....
speed of easterly winds	....	....
rainfall in the western Pacific	....	....

[3]

(b) During the 2016 El Niño event, tidal ranges were higher than expected in some coastal areas of western South America. This was because higher than predicted high tides were experienced.

(i) Explain what is meant by tidal range.

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.... [1]

(ii) Suggest reasons for higher than predicted tides during an El Niño event in western South America.

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.... [2]

(c) **(i)** Suggest why increased fish populations are observed in the eastern Pacific during La Niña event years.

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.... [3]

(ii) Tuna are predators of anchoveta.

Suggest **one** method that can be used to monitor tuna population sizes during La Niña events.

.... [1]

[Total: 10]

3 (a) Fig. 3.1 shows a view from above of paleomagnetic stripes on part of a sea bed.

The key shows the ages of the rocks.

Key
☐ 0–1 million years old
☐ 1–3 million years old
☐ 3–5 million years old
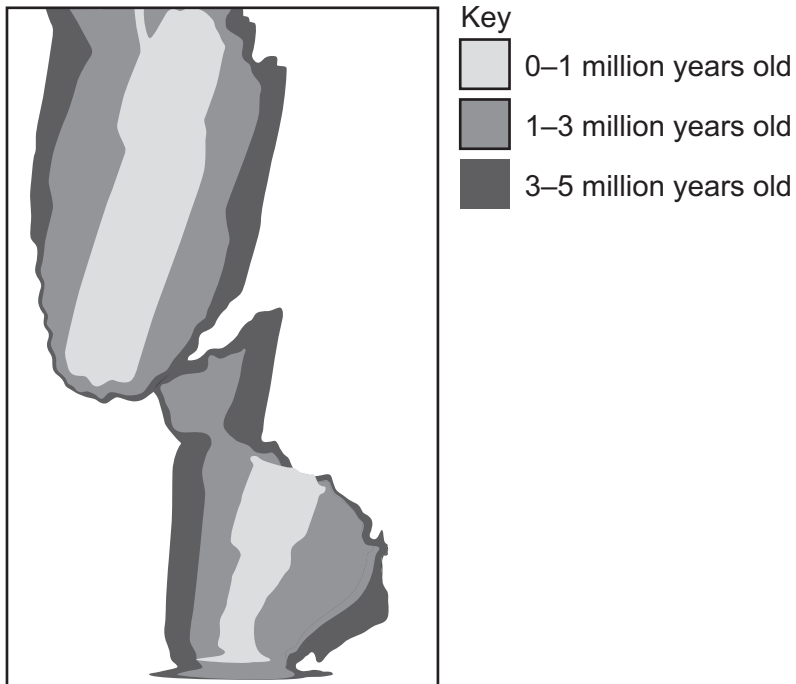
Fig. 3.1

(i) On Fig. 3.1, draw a single straight line along the position of the transform boundary. [1]

(ii) Define the term transform boundary.

....

.... [1]

(iii) On Fig. 3.1, label with an **X** the zone where a mid-ocean ridge would be found. [1]

(iv) Paleomagnetic stripes in the rocks on the ocean floor provide evidence for the theory of plate tectonics.

State **three** other pieces of evidence for this theory.

1 ....

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2 ....

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3 ....

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[3]

(b) (i) Underwater volcanoes are found at plate boundaries.

These volcanoes may release argon gas, which has a low solubility in water.

Bubbles of argon gas then rise to the surface.

Use kinetic particle theory to explain why changing temperature and pressure affects the volume of the bubbles as they rise.

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(ii) Explain how an erupting underwater volcano may affect the density of the surrounding water.

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.... [2]

(iii) The ability of water to act as a solvent is related to the structure of its molecules.

Draw a diagram to show the structure of a water molecule, including the electron arrangement within the molecule.

[2]

[Total: 14]

4 (a) Manta rays live in a close relationship with remora fish.

Describe the relationship between manta rays and remora fish.

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.... [3]

(b) (i) Manta rays are cartilaginous fish. Remora fish are bony fish.

State **two** features of remora fish that are **not** found in manta rays.

1 ....

2 ....
[2]

(ii) Both species belong to the same phylum.

State **two** features that would be seen in the development of **all** species of this phylum.

1 ....

2 ....
[2]

(c) Killer whales prey on manta rays.

Manta rays feed on zooplankton.

(i) Explain the term zooplankton.

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.... [2]

(ii) Draw a food chain with four trophic levels, using the information given in **(b)** and **(c)**, to show how the killer whale obtains energy.

[2]

[Total: 11]

Section B

Answer **all** questions in this section.

5 Mangrove forests grow on the shores of many tropical and subtropical countries.

(a) Discuss the ecological **and** economic importance of mangrove forests.

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.... [7]

(b) The red mangrove tree, *Rhizophora mangle*, has many adaptations that enable it to survive.

Explain how the red mangrove tree is adapted to the abiotic factors found in the mangrove ecosystem.

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[Total: 15]

6 Describe the carbon cycle in a marine ecosystem.

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.... [9]

7   Species from the open ocean and organisms living on coral reefs have different types of niche.

Explain the meaning of the term niche using examples from coral reefs **and** the open ocean.

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.... [6]

14

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