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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

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MARINE SCIENCE **9693/33**

Paper 3 A Level Theory **May/June 2024**

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.

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Section A

Answer **all** questions in this section.

1 Hay Point in Queensland, Australia, is one of the largest ports for coal export in the world.

Fig. 1.1 shows the location of Hay Point.

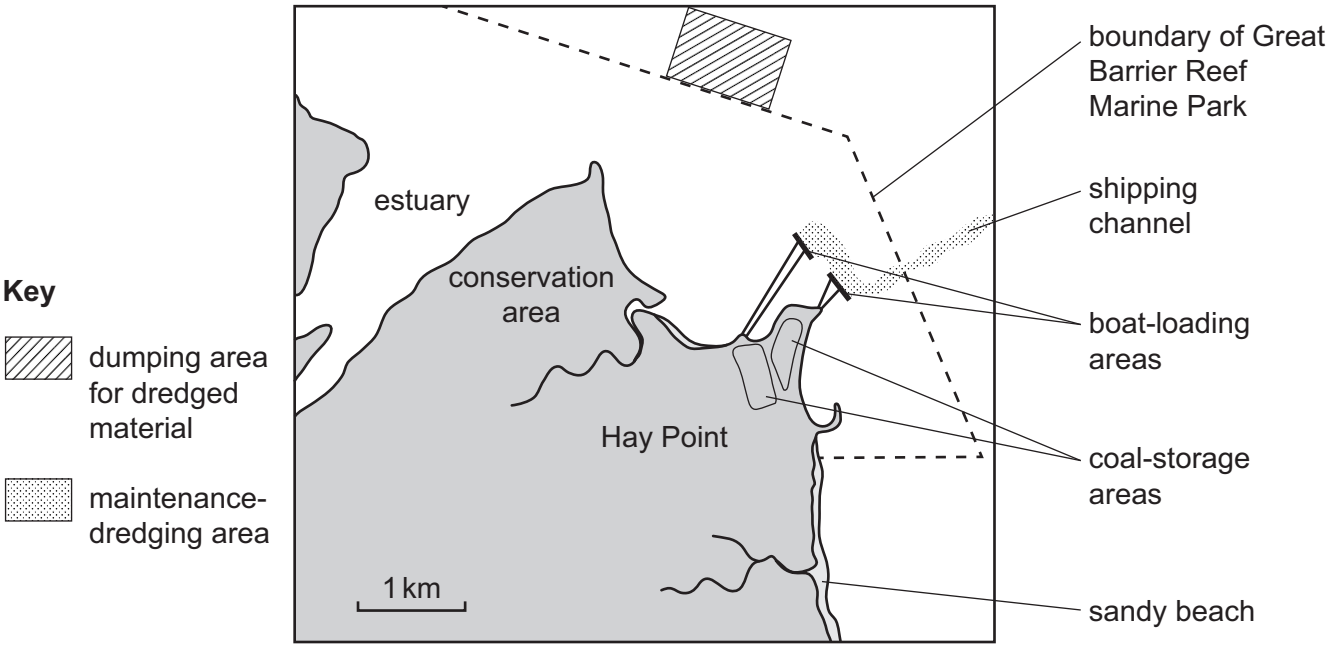

Fig. 1.1

(a) Long roads connect the coal-storage areas with the boat-loading areas due to the high tidal range at Hay Point.

State the meaning of the term tidal range.

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..... [1]

(b) Hay Point is an important tourist destination for visits to the Great Barrier Reef. The reef is a few kilometres offshore and is a World Heritage Site.

At the beginning of 2019, severe flooding in the area caused a significant amount of sediment to be washed from local rivers into the sea around Hay Point.

(i) Suggest the impact of **increased sediment** on corals in the Great Barrier Reef.

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(ii) Suggest **three** further impacts that a significant quantity of **fresh water** would have on the sea water at Hay Point.

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[3]

(c) In February 2019 the Port Authority was granted permission to carry out maintenance dredging of the shipping channel and to dump one million tonnes of sediment along part of the Great Barrier Reef.

Suggest **and** explain the possible effect of the maintenance dredging on local fish stocks.

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[Total: 12]

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2 **(a)** Providing efficient aeration is a key requirement for aquaculture systems.

(i) Explain why efficient aeration is important in aquaculture systems.

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(ii) Explain why efficient aeration is more important in intensive aquaculture systems than in extensive aquaculture systems.

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(b) Various methods are used to provide aeration. These include:

- surface aerators, such as rotating paddlewheels
- jet aerators, which force air from the surface into the water at high pressure.

Suggest **one** reason why these aerators are **not** very efficient at delivering oxygen into the water.

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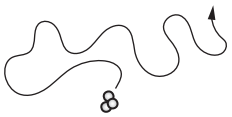
..... [1]

(c) Another, more efficient way of delivering air is by using an air diffuser, which releases the air in small bubbles.

The size of the small bubbles released from different diffusers varies.

Table 2.1 compares the different features of each size of bubble.

Table 2.1

type of bubble	typical size of bubble	route bubble takes to reach surface	speed of rising to surface
fine bubble	100 to 3000 μm		more than 6 mm s^{-1}
microbubble	20 to 100 μm		10^{-3} mm s^{-1}
nanobubble	less than 1 μm		10^{-2} μm s^{-1}

Use the information in Table 2.1 to suggest why many aquaculture systems are replacing diffusers that release fine or microbubbles with diffusers that release nanobubbles.

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[Total: 9]

3 **(a)** Salmon aquaculture usually involves two different stages:

- breeding adult salmon in tanks in a hatchery, where fry are raised to smolt
- transferring smolt to net cages in shallow water just offshore, usually in sheltered inlets, so that they can grow to adult size.

List **three** abiotic factors, other than aeration, which need to be controlled in a hatchery, but which cannot be controlled in net cages. For each factor, explain how it is controlled in a hatchery.

factor 1 .....

how controlled .....

factor 2 .....

how controlled .....

factor 3 .....

how controlled .....

[3]

(b) Salmon in hatcheries and in net cages are fed on pelleted food. The pellets can be of two types:

- floating pellets, which float on the surface for around an hour before sinking
- sinking pellets, which sink immediately.

Suggest **two** advantages of floating pellets over sinking pellets.

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[2]

(c) In 2019, 2.6 million adult salmon died in net cages in Canada. Over the previous 12 days, the sea water temperature had suddenly increased from 13 °C to between 17 °C and 21 °C.

Scientists noticed that, during this temperature increase, the salmon moved to the deepest water at the bottom of the net cage.

(i) Suggest why salmon moved to the bottom of the net cage.

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(ii) Explain how this behaviour could have increased the number of salmon deaths.

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(iii) Suggest **one** reason why the sudden increase in sea water temperature might **not** provide evidence for global warming.

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[Total: 11]

4 **(a)** Seagrasses have a global distribution. Seagrass beds are highly productive and economically valuable habitats.

(i) Explain why seagrass beds are highly productive.

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(ii) Explain why seagrass beds are considered to be economically valuable habitats.

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(b) Recent research on the islands of Orkney, UK, has studied the effect of microplastics on seagrass.

State **two** environmental factors which cause large pieces of plastic to break down to form microplastics.

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2 .....

[2]

(c) Researchers wanted to find out if seagrass beds could act as microplastic sinks.

Microplastic sinks are areas where microplastics build up.

Samples were collected from three different areas:

- bare sediment away from seagrass beds
- sediment in a seagrass bed
- seagrass leaves.

The results are shown in Table 4.1.

Table 4.1

sample area	number of samples	mean number of microplastic particles per sample
bare sediment	5	3.40
sediment in a seagrass bed	20	5.65
seagrass leaves	60	4.25

(i) Use the results in Table 4.1 to explain whether seagrass beds could be considered as microplastic sinks.

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(ii) With reference to the results in Table 4.1, suggest the impact of microplastics on primary consumers.

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[Total: 13]

Section B

Answer **all** questions in this section.

5 Describe the light-dependent stage in photosynthesis.

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6 **(a)** Discuss the role of the IWC (International Whaling Commission) moratorium in conservation.

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(b) Compare fertilisation and subsequent investment in the care of offspring in sharks and whales.

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[Total: 13]

7 Outline the conditions required for the formation of a mangrove forest **and** suggest the benefits of replanting mangroves to fisheries.

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