



## Cambridge International AS & A Level

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**MARINE SCIENCE**

**9693/03**

Paper 3 A Level Theory

**For examination from 2022**

SPECIMEN PAPER

**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

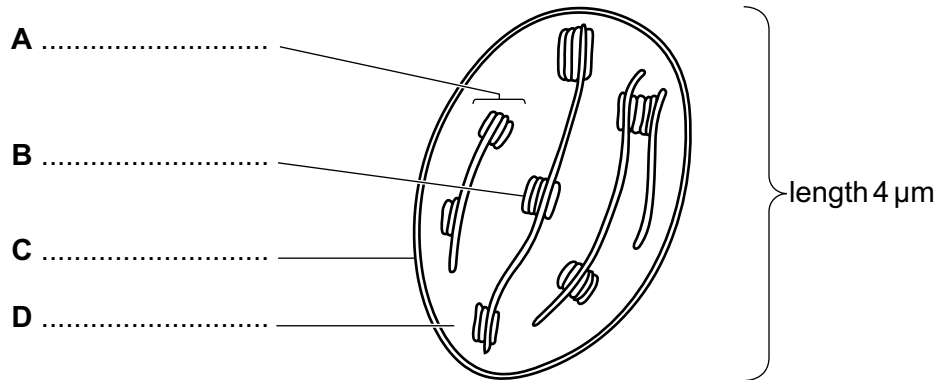
- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Blank pages are indicated.

**Section A**

Answer **all** questions in this section.

1 Fig. 1.1 shows the structure of a chloroplast.



**Fig. 1.1**

(a) (i) On Fig. 1.1, name parts **A**, **B**, **C** and **D**. [3]

(ii) State where chlorophyll and accessory pigments are found in a chloroplast.

..... [1]

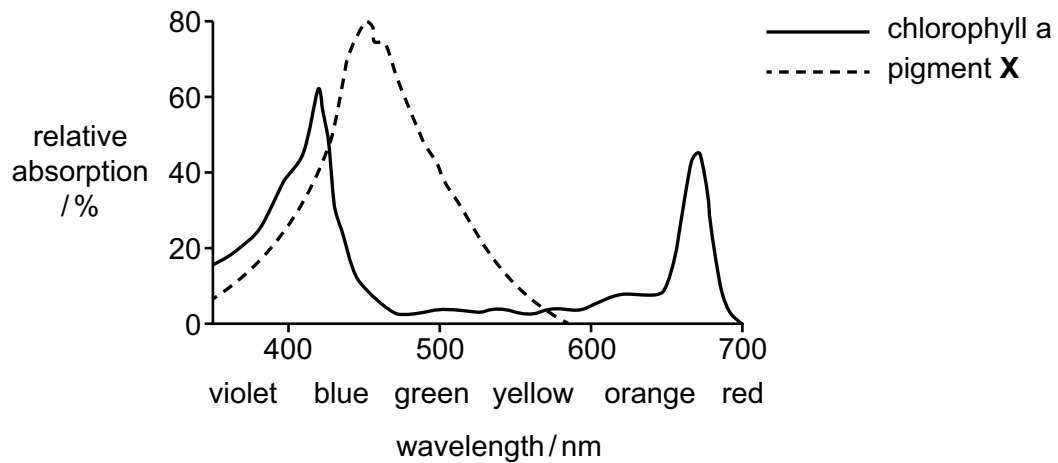
(iii) Describe the role of chlorophyll in the light-dependent stage of photosynthesis.

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 ..... [3]

(iv) Suggest why the rate of biomass production in marine algae is less in shaded areas of a rocky shore compared with unshaded areas.

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 .....  
 .....  
 ..... [2]

(b) Fig. 1.2 shows the absorption spectra of chlorophyll a and pigment X, found in some marine algae.



**Fig. 1.2**

Use the information in Fig. 1.2 and your own knowledge to suggest the zone on a rocky shore where marine algae containing these pigments could be found.

Give reasons for your answer.

zone .....

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reasons .....

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[4]

[Total: 13]

2 Fig. 2.1 shows the life cycle of a marine shrimp and the habitat of each stage.

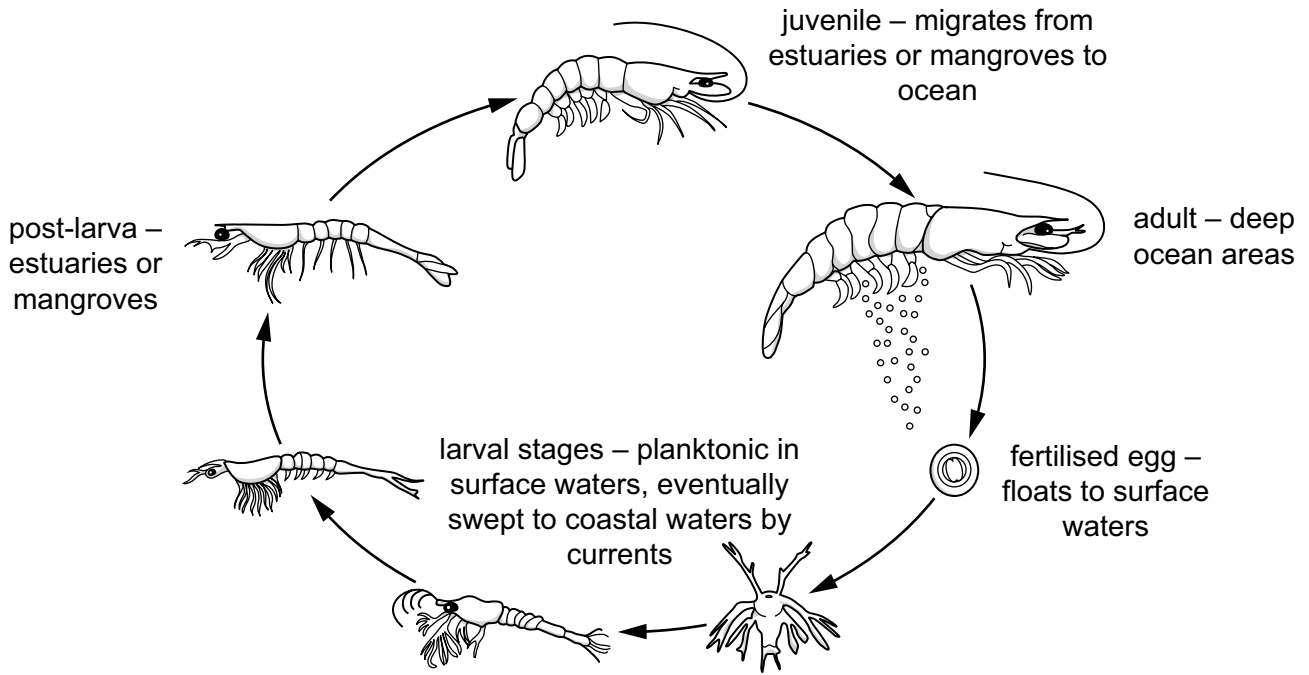


Fig. 2.1

(a) (i) State **two** reasons why the shrimp life cycle in Fig. 2.1 is described as a complex life cycle and not a simple life cycle.

1 .....

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2 .....

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[2]

(ii) Suggest **two** advantages to shrimp of having more than one habitat during its life cycle.

1 .....

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2 .....

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[2]

- (b) Shrimp aquaculture in Asia is increasing annually. Shrimp are grown in large ponds lined with mud. The ponds are stocked with post-larvae, which feed on phytoplankton in the ponds.

In the past, most shrimp farmers collected post-larvae from the wild, to restock their ponds.

- (i) Suggest a possible disadvantage of this method.

.....  
..... [1]

- (ii) Now, most shrimp farmers buy their post-larvae from hatcheries. The majority of the sorting and counting of the post-larvae supplied is done by hand and is often inaccurate.

Recently a Canadian company has developed a device, which uses automated technology to count the larval stages, sort them and work out how much feed to use during cultivation at the hatchery.

Suggest how buying post-larvae from a hatchery which uses this technology could benefit the shrimp farmer.

.....  
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..... [2]

- (c) (i) Many farmers add fertiliser to the ponds in the form of rice bran. The rice bran is rich in nitrogen compounds that can be used by phytoplankton. Shrimp do not eat rice bran.

Suggest how the nitrogen compounds in fertiliser benefit the shrimp.

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..... [2]

- (ii) The pH of water in the shrimp ponds fluctuates during the day and may become too high. Carbohydrates in the fertiliser added to the ponds are a source of carbon for the bacteria that live in the mud lining the ponds.

Use this information to explain how the use of carbohydrates in the fertiliser by the bacteria could result in a reduction of the pH of the water.

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..... [3]

[Total: 12]

- 3 Fig. 3.1 shows South Bay, part of a large estuary in California, United States of America. The area is becoming more popular as a year-round tourist destination.

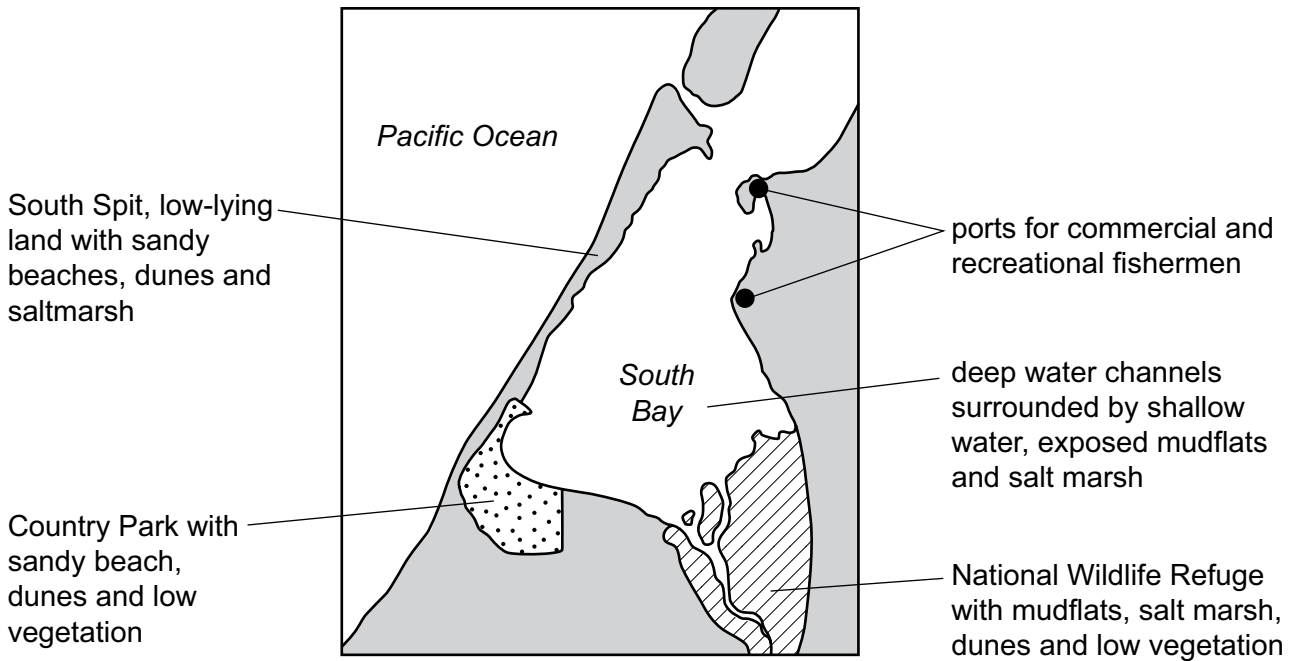


Fig. 3.1

South Bay is important for its variety of habitats, including salt marsh, mudflats and sand dunes, which are all managed to promote biodiversity.

Invasive species such as cordgrass and a new species of marram grass now pose a threat to biodiversity.

- (a) (i) Explain the meaning of invasive species.

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 ..... [2]

- (ii) Cordgrass now dominates an estimated 90% of salt marshes in the bay and is spreading into mudflats via seeds and fast-growing underground rhizomes. Cordgrass is gradually being removed by regular cutting at ground level.

Suggest **one** advantage and **one** disadvantage of removing the cordgrass by cutting instead of spraying chemicals to kill the plants.

advantage .....

.....

disadvantage .....

.....

[2]

- (iii) The invasive species of marram grass grows across sand dunes at a faster rate than the local species, forming dense clumps, which quickly cover the dune.

Fig. 3.2 shows the western snowy plover, a small shorebird listed as endangered. It feeds on sandy beaches and nests in dunes with little vegetation and areas of low vegetation, close to the shore.



Fig. 3.2

State the meaning of endangered species.

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..... [1]

- (iv) Use all the information provided to suggest **and** explain why numbers of western snowy plover are decreasing around South Bay.

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..... [4]



(b) Ships carry sea water in large tanks for stability when carrying different cargo loads. Water is usually pumped into the ship in one port and discharged in another as new cargo load is taken up. Ships entering South Bay are required to discharge their water far out at sea, before entering the harbour area.

(i) Suggest how this requirement could help to reduce the spread of invasive species to South Bay.

.....  
..... [1]

The ports of South Bay are connected to the Pacific Ocean by deep water channels. Sediment is continually washed into the bay from low-lying land and rivers. Sediment is also brought into the bay by daily tidal flow, especially during winter storms.

Annual dredging removes the sediment to maintain the depth of these channels. The sediment is added to the tidal marsh around the bay, which encourages vegetation growth.

(ii) Suggest how adding sediment to the tidal marsh will benefit the local human communities living around South Bay.

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..... [3]

[Total: 13]

- 4 Giant kelp forests are found in cool-water seas. The giant kelp is food for sea urchins, which are food for rock lobsters.

Around the coast of Tasmania, rock lobster fishing is an important source of income. Overfishing of rock lobster resulted in fishing restrictions being implemented. Fig. 4.1 shows the effect of fishing restrictions on the food chain of rock lobster.

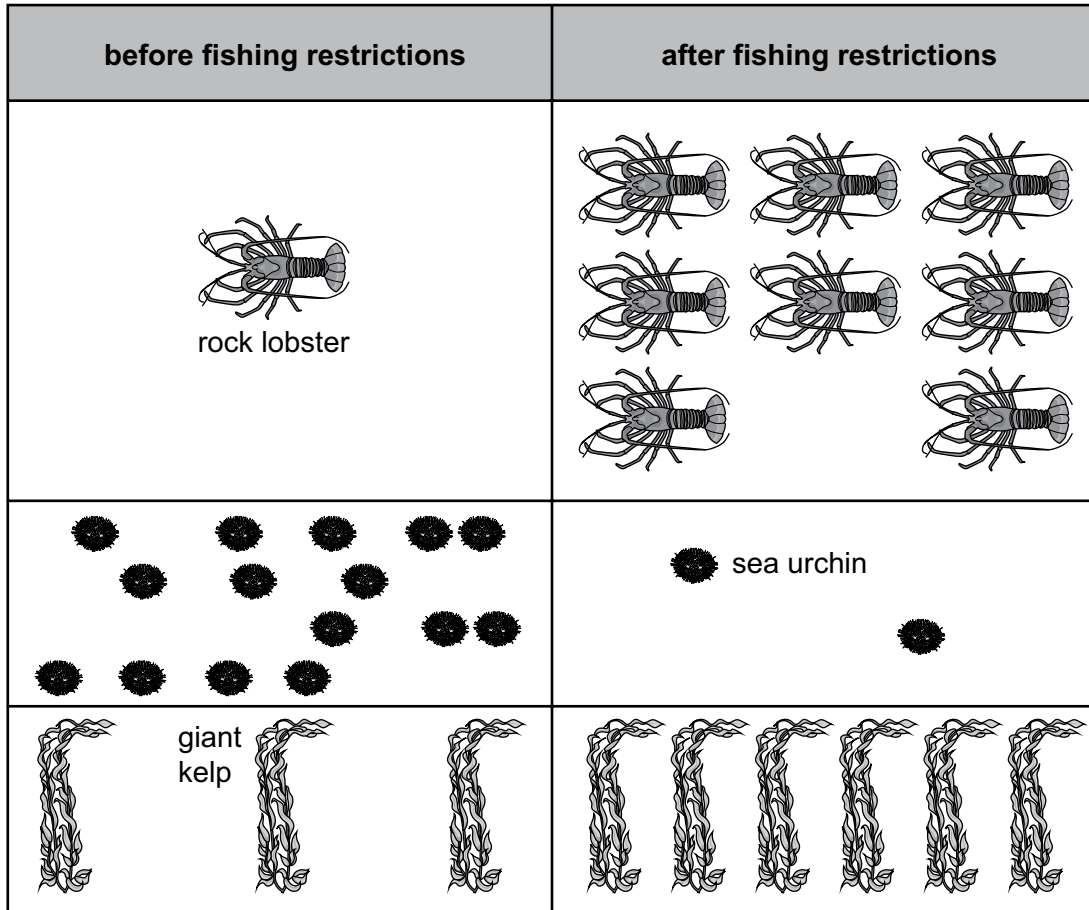


Fig. 4.1

- (a) Use the information in Fig. 4.1 to suggest how fishing restrictions helped to maintain a sustainable food chain for rock lobster fishing.

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..... [2]

Fig. 4.2 shows the surface water currents around southern Australia and Tasmania.

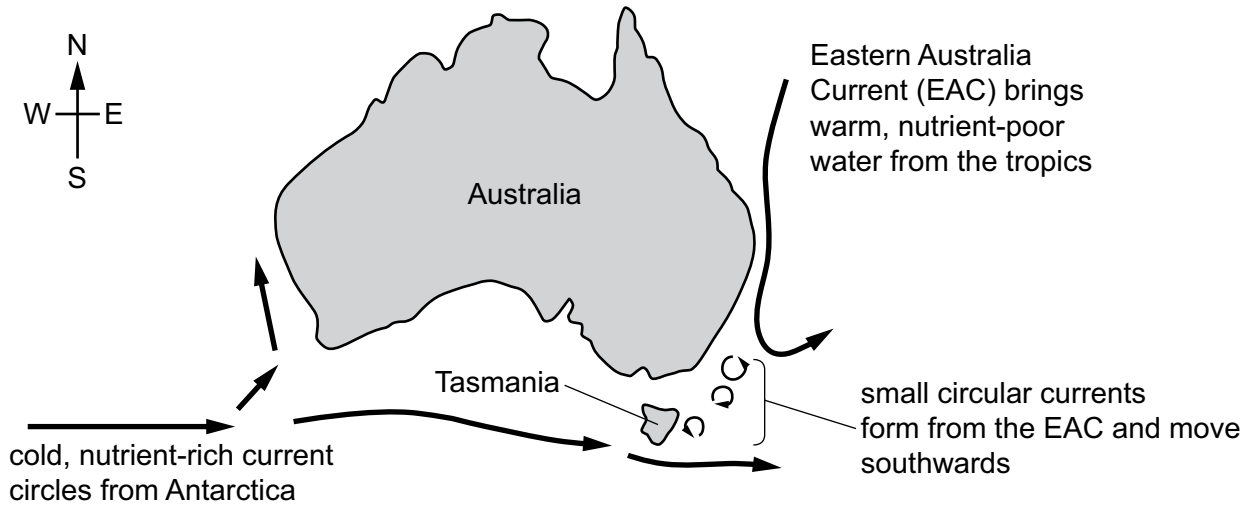


Fig. 4.2

During the past 60 years, the EAC has been gradually moving further south and the frequency of the small circular currents has been increasing.

Long-spined sea urchins are a tropical species that have gradually invaded east Tasmanian waters where they have been able to spawn.

(b) Identify the evidence in this information that could suggest that global warming is happening.

.....  
..... [1]

(c) In the year 2000, kelp forests were found all around the coast of Tasmania. By 2017 the kelp forest on the east coast had decreased by 95%.

Use all the information provided in **Question 4** to suggest **and** explain why this decrease in giant kelp forests occurred along the east coast, but not along the west coast of Tasmania.

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..... [4]

[Total: 7]



(b) Discuss strategies to limit the release of plastics and microplastics into the marine ecosystem.

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[Total: 15]

6 Describe the structure of the cell surface membrane.

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..... [6]



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*Copyright Acknowledgements:*

Question 2                    © J F Wickens & D O'C Lee; *Crustacean Farming, Ranching and Culture*; Blackwell Science Ltd; 2002.  
Question 3(a)(iii)        © Ref: M9YBA0; Natural History Collection/Alamy Stock Photo; *MORRO BAY, Calif. (April 8, 2008) Western snowy plovers on the beach*; www.alamy.com

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