



CANDIDATE
NAME

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CENTRE
NUMBER

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CANDIDATE
NUMBER

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9693/33

May/June 2023

1 hour 45 minutes

You must answer on the question paper.

No additional materials are needed.

- 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.

- 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.

Section A

Answer **all** questions in this section.

- 1 (a) The life cycle of jellyfish has two different forms – a free-swimming medusa and a sessile polyp. This is similar to the life cycle of coral polyps.

Name the phylum to which jellyfish belong.

..... [1]

- (b) Fig. 1.1 shows part of a food web containing jellyfish.

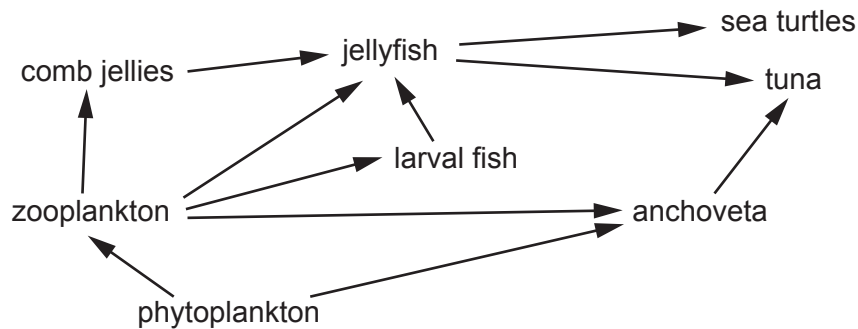


Fig. 1.1

Over the past 20 years, jellyfish numbers have increased. Commercial fishing is one of the factors blamed for this increase.

Use the information in Fig. 1.1 to explain how commercial fishing could have contributed to this increase.

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..... [3]

- (c) Some female jellyfish can produce 45000 eggs per day. Males and females gather in vast swarms to spawn. Swarms are increasing in size and frequency.

Suggest **and** explain how these swarms have caused problems for the fishing industry and for desalination plants.

fishing industry

.....

desalination plants

.....

[2]

- (d) Jellyfish naturally produce mucus (slime), which is especially rich in nitrogen. The amount of mucus increases when jellyfish are under stress, for example in waters affected by pollution, such as an oil spill.

Some specialised bacteria are able to break down crude oil in a marine oil spill, using it as an energy source to grow and reproduce.

Table 1.1 shows the effect of adding these bacteria to sea water containing crude oil with and without jellyfish mucus.

Table 1.1

day	number of bacteria cells per cm ³	
	sea water + crude oil + bacteria	sea water + crude oil + bacteria + jellyfish mucus
0	3.0×10^7	3.0×10^7
7	4.1×10^7	1.0×10^8
14	5.0×10^7	1.3×10^8

- (i) Use the information provided to describe **and** explain the effect of jellyfish mucus on the breakdown of oil by bacteria.

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..... [3]

- (ii) Many cosmetics contain plastic microbeads, which are then washed away in waste water. The microbeads are so small that they pass straight through water treatment works and are released into the oceans.

Suggest how jellyfish mucus could be used to reduce the amount of plastic microbeads released into the oceans.

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..... [2]

[Total: 11]

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2 The delta of the Mekong river covers an area of 40 000 hectares in south eastern Vietnam.

(a) Describe how a delta is formed.

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..... [2]

(b) Up until 1990 the delta was a major rice-growing region, with very few other forms of agriculture. Since 1990 diversification has been encouraged, including growing rice and shrimp together. Vietnam is now a major producer of shrimp for export.

Fig. 2.1 shows a typical rice field, surrounded by earth banks.



Fig. 2.1

Fig. 2.2 shows a traditional method of growing rice and shrimp together at the same time.

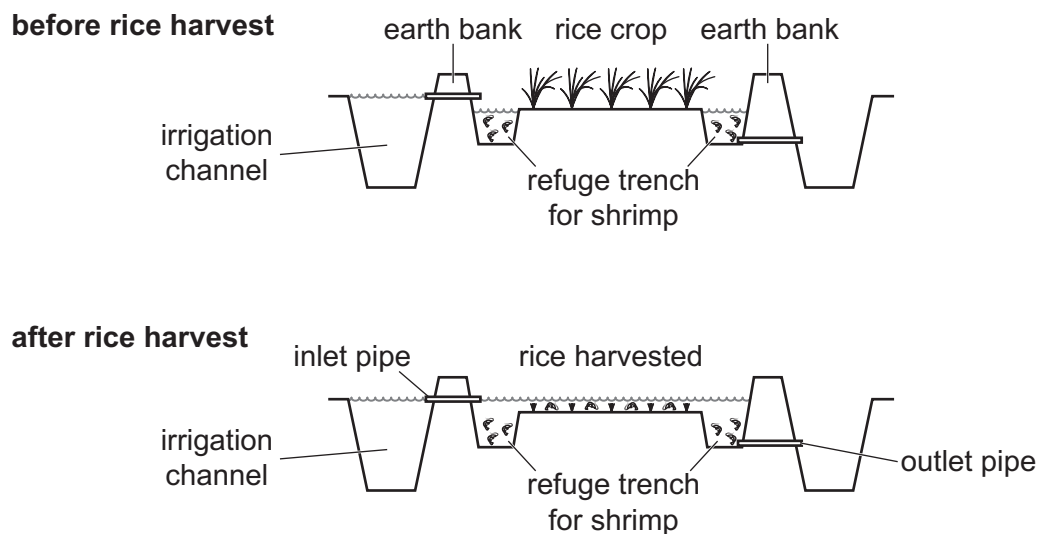


Fig. 2.2

After the rice has been harvested, the pond is flooded with sea water, allowing the shrimp to feed on natural food in the pond. The shrimp are harvested after a few months by draining the pond completely. The pond is then allowed to dry out and calcium salts are added regularly.

- (i) State why the pond is allowed to dry out after each harvest.

.....
 [1]

- (ii) Suggest how calcium salts benefit shrimp **and** why these need to be added regularly.

.....

 [2]

- (iii) The pond is re-filled with a mixture of tidal water and river water when gates in the irrigation channels are opened. This allows wild juvenile shrimp and other marine species to reach the ponds.

Suggest why the supply of wild juvenile shrimp from the sea has decreased over time **and** why harvested shrimp have become smaller in size.

.....

 [2]

- (iv) A disadvantage of this method of shrimp culture is that yields are low compared with yields from intensive systems.

Suggest an advantage of this method of shrimp culture compared with intensive systems.

.....
 [1]

- (c) Rising sea levels are affecting this method of culturing shrimp and rice. Increased winter flooding of low-lying land in the delta by sea water is increasing the concentration of salt in the soil. During the summer months there are heavy rain showers, increasing the flow of fresh water in the river.

Farmers are therefore having to adapt. They are changing to rotational culture, growing shrimp in winter and rice in summer.

Use all the information provided to suggest how the climate and design of the ponds make them suitable for rotational culture.

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..... [4]

[Total: 12]

- 3 (a) Fig. 3.1 shows golden samphire (*Limbarda crithmoides*) growing in the splash zone of a rocky shore. Golden samphire has thick, fleshy leaves.



Fig. 3.1

Explain the advantage of thick, fleshy leaves to plants living in the splash zone.

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..... [1]

(b) Fig. 3.2 shows the appearance of a strip of flower stalk from golden samphire.

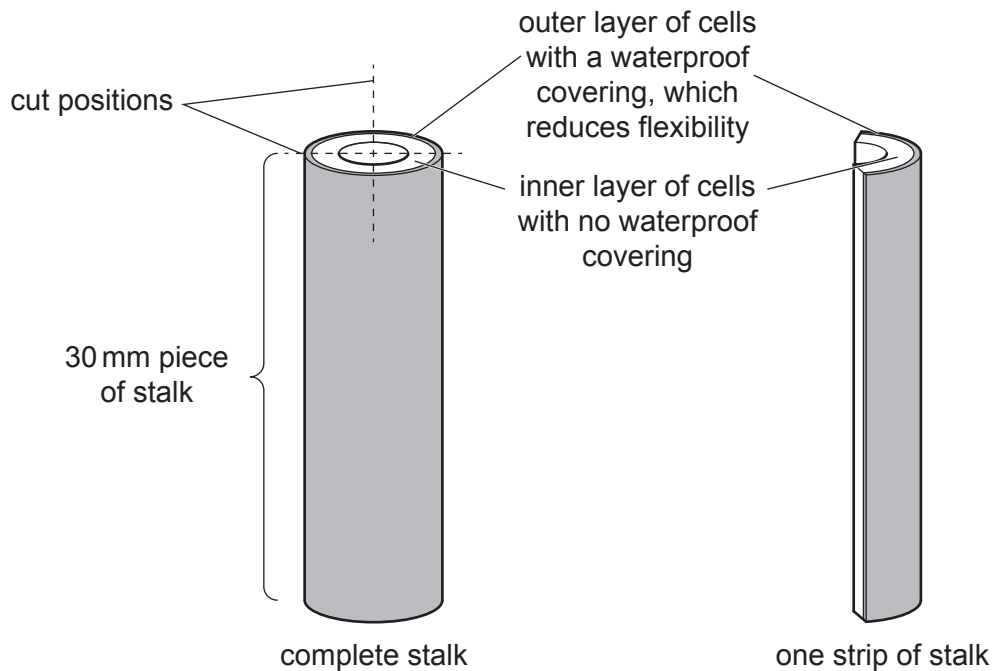


Fig. 3.2

Fig. 3.3 shows the appearance of one of the strips, viewed from one end, after soaking in distilled water for 15 minutes.

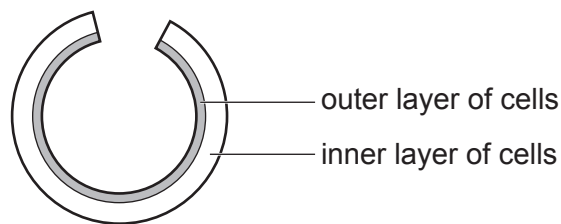


Fig. 3.3

Use the information provided in Fig. 3.2 and Fig. 3.3 to explain the change in the appearance of the strip in terms of water potential.

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..... [3]

- (c) Placing strips in different sucrose solutions affects the angle and direction of curvature of the strips.

Fig. 3.4 shows the appearance of strips of golden samphire flower stalk that have been immersed in different sucrose solutions made from 1 mol dm^{-3} solution.

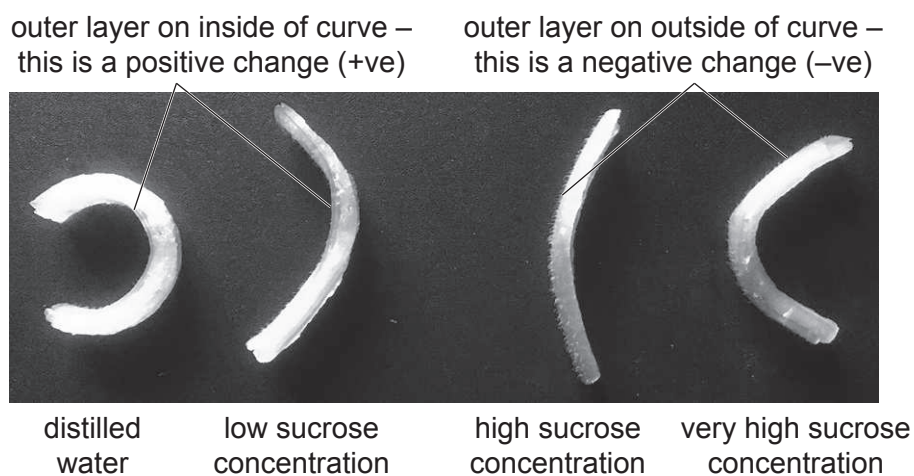


Fig. 3.4

- (i) Use Fig. 3.4 to sketch a graph on Fig. 3.5 to show how the concentration of sucrose solution affects the angle of curvature of the strips.

Label both axes.



Fig. 3.5

[3]

- (ii) Indicate on the graph the point where the sucrose concentration is equivalent to the water potential of the tissues in the flower stalk. [1]
- (iii) Use Fig. 3.5 to suggest the appearance of the strip of golden samphire flower stalk that has been immersed in a sucrose solution that has the **same** water potential as the cells in the strip.

..... [1]

[Total: 9]

- 4 (a) Table 4.1 shows the rates of photosynthesis of a green macroalga in different colours of light.

Table 4.1

colour of light	rate of photosynthesis / arbitrary units
white	31
red	21
green	4
blue	18

- (i) Complete the sentences about white light and coloured light.

Different colours of light have different

White light is made up of

[2]

- (ii) Use the data from Table 4.1 and your own knowledge to explain why green macroalgae are usually found in shallow water.

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..... [4]

- (iii) Suggest **and** explain how the rates of photosynthesis shown in Table 4.1 would differ if the green macroalga was replaced by a red macroalga.

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..... [2]

(b) Fig. 4.1 compares the absorption and action spectrum of another macroalga.

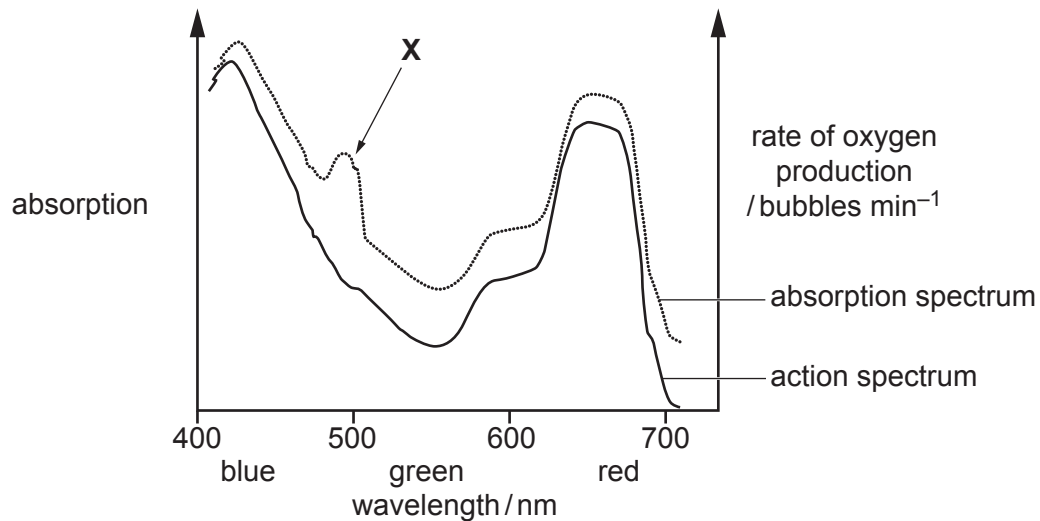


Fig. 4.1

- (i) State the meanings of the terms absorption spectrum and action spectrum.

absorption spectrum

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action spectrum

.....

[2]

- (ii) The increase in absorption at wavelengths close to 500 nm, indicated by **X** on Fig. 4.1, is due to the presence of carotenoid pigments.

Use Fig. 4.1 to explain the role of carotenoids in photosynthesis.

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..... [3]

[Total: 13]

6 (a) Discuss the importance of coral reefs to humans.

[5]

(b) Outline the sources of carbon available to marine organisms, **and** state why an increase in these sources poses a threat to hard corals.

[7]

[Total: 12]

7 Describe ecotourism **and** outline how it can be used as a strategy to conserve marine species.

[8]

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