



CANDIDATE  
NAME

|  |
|--|
|  |
|--|

CENTRE  
NUMBER

|  |  |  |  |  |
|--|--|--|--|--|
|  |  |  |  |  |
|--|--|--|--|--|

CANDIDATE  
NUMBER

|  |  |  |  |
|--|--|--|--|
|  |  |  |  |
|--|--|--|--|

## 9693/13

May/June 2020

**1 hour 30 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 **20** pages. Blank pages are indicated.



Answer **all** the questions in the spaces provided.

- 1 The red alga, *Delisea pulchra*, is a seaweed that is part of the community on a rocky shore. This alga is eaten by sea urchins and other consumers, including marine snails.

(a) (i) Explain the meaning of the term *community*.

.....

.....

.....

..... [2]

(ii) State the trophic level of consumers that eat red algae.

..... [1]

(iii) Suggest **and** explain the effect on the population of marine snails if the sea urchin population increases.

.....

.....

.....

..... [2]

(iv) Explain why all of the energy stored within the red algae is **not** passed to consumers.

.....

.....

.....

.....

.....

..... [3]

(b) Some species of alga contain chemicals that deter animals from eating the algae.

Suggest the effect of these chemicals on the efficiency of energy transfer between trophic levels.

.....

..... [1]

[Total: 9]

2 The formation of a delta is affected by the balance between erosion and sedimentation.

(a) Describe the processes that lead to the formation of a delta.

.....

.....

.....

.....

.....

.....

..... [4]

(b) Fig. 2.1 shows two satellite images of part of a delta.

Image **A** was taken before a tropical cyclone (hurricane or typhoon), and image **B** was taken two days after the tropical cyclone.

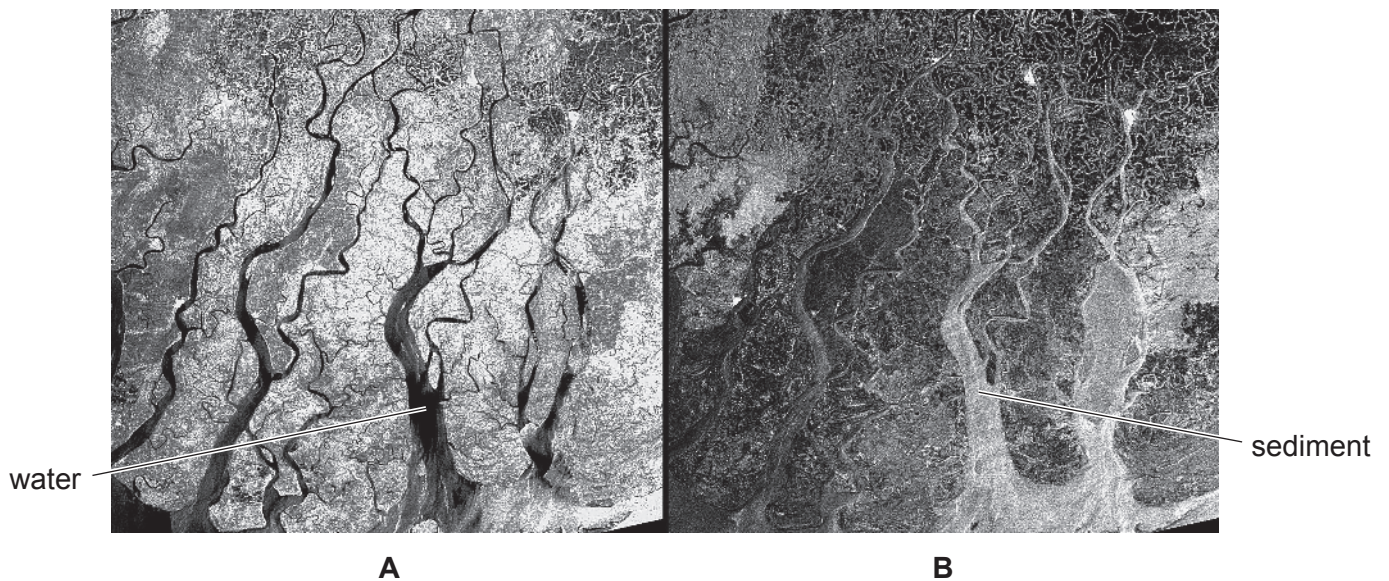


Fig. 2.1

With reference to Fig. 2.1, suggest the effects of the tropical cyclone on the human coastal communities on the delta.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (c) Tropical cyclones lead to an increase in precipitation.

Explain the effect of precipitation on the salinity of sea water.

.....

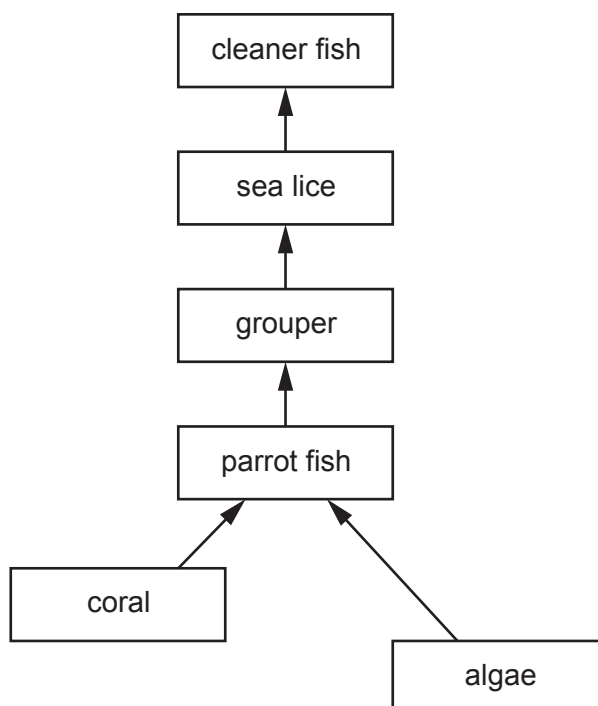
.....

.....

..... [2]

[Total: 10]

- 3 (a) Fig. 3.1 shows part of a marine food web.



**Fig. 3.1**

- (i) Sea lice are small animals that live and feed on the body of grouper and other fish.

Name the type of relationship between sea lice and grouper.

..... [1]

- (ii) Damselfish and surgeonfish both eat algae and are both the prey of grouper.

Use this information to add damselfish and surgeonfish to Fig. 3.1.

[3]

- (iii) Explain how the relationship between cleaner fish and grouper shows mutualism.

.....

.....

.....

.....

.....

.....

..... [3]

- (b) Pyramids of energy always have a large base, narrowing towards the top.

Explain, with reference to a marine example, why pyramids of numbers are not always this shape.

You may use a diagram to help with your answer.

.....

.....

.....

.....

.....

.....[3]

[Total: 10]

- 4 (a) Fig. 4.1 shows two types of artificial reef.

Reef **A** is made from a metal structure and old bicycles.

Reef **B** is made from specially manufactured blocks of concrete.



**A**



**B**

**Fig. 4.1**

- (i) Explain how artificial reefs protect shores from storm damage.

.....

.....

.....

.....

.....

..... [3]

- (ii) Suggest **one** advantage and **one** disadvantage of using reef **A** rather than reef **B** for protecting shorelines.

advantage of reef **A**

.....

.....

disadvantage of reef **A**

.....

.....

[2]

- (iii) Scientists have investigated artificial reefs that are made of a mixture of both reef **A** and reef **B**, and artificial reefs made of just one type of reef. They measured the effect of mixing the types of reef on biodiversity.

State **one** possible hypothesis for this investigation.

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

- (b) State **three** factors, other than storm damage, that can lead to coral reef erosion.

1 .....  
2 .....  
3 ..... [3]

[Total: 9]

5 Producers in food webs at hydrothermal vents use chemosynthesis.

(a) Outline **one** difference and **one** similarity between chemosynthesis and photosynthesis.

difference

.....  
.....

similarity

.....  
.....

[2]

(b) Describe how hydrothermal vents form.

.....  
.....  
.....  
.....  
.....  
.....

[3]

(c) Marine mining companies are planning to explore hydrothermal vents.

(i) Suggest why the conditions at hydrothermal vents make exploration difficult.

.....  
.....  
.....  
.....

[2]

(ii) Suggest why mining companies are interested in exploring hydrothermal vents.

.....  
.....

[1]

- (iii) Explain how mining at hydrothermal vents could affect productivity in the surrounding food webs.

.....

.....

.....

.....

.....

..... [3]

[Total: 11]



- 6 Parts of the Southern Ocean are described as high nitrate low chlorophyll (HNLC) regions.

Nitrates contain nitrogen.

- (a) State a biological use of nitrogen.

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

- (b) Scientists investigated the effect of volcanic ash on phytoplankton growth. Phytoplankton are small photosynthetic organisms.

Scientists collected samples of surface water from a Southern Ocean HNLC region.

The samples were divided into two groups.

- The samples in group **A** had nothing added.
- The samples in group **B** had volcanic ash added.

The samples were incubated for 48 hours to allow phytoplankton growth.

- (i) State the function of the samples in group **A**.

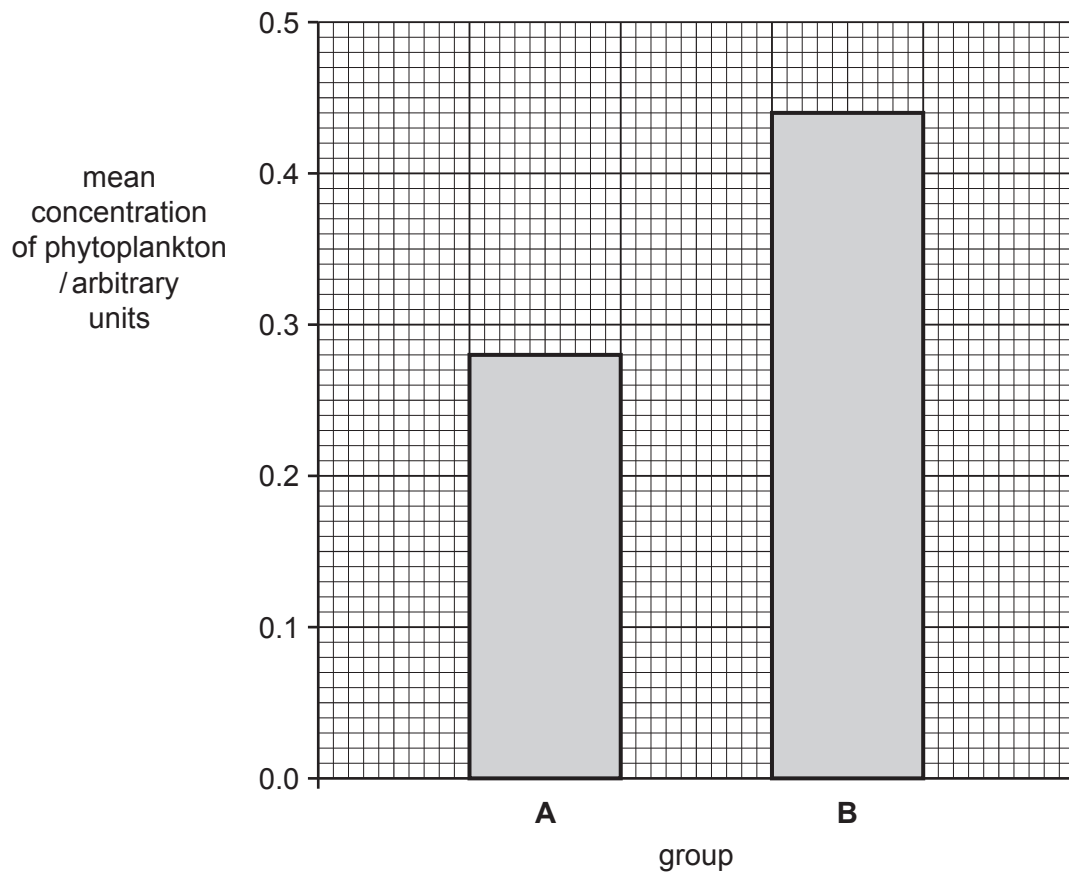
.....  
 ..... [1]

- (ii) The samples in group **A** and group **B** were kept at the same light intensity.

State **one** other factor that should have been kept constant.

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

Fig. 6.1 shows the mean concentration of phytoplankton after 48 hours.



**Fig. 6.1**

- (iii) Calculate the difference between the mean concentration of phytoplankton in group **A** and group **B**.

..... a.u.  
[1]

- (iv) Use your answer from (b)(iii) to calculate the percentage increase in mean concentration of phytoplankton between group **A** and group **B**.

..... %  
[1]

- (v) Volcanic ash contains many nutrients, including magnesium.

Explain the effect of adding volcanic ash containing magnesium to the samples of phytoplankton in group **B**.

.....

.....

.....

.....

.....

..... [3]

- (c) Describe how minerals in ash from volcanoes on land can enter sea water.

.....

.....

.....

..... [2]

- (d) Explain how calcium in the sea water can become part of sediments on the sea bed.

.....

.....

.....

.....

.....

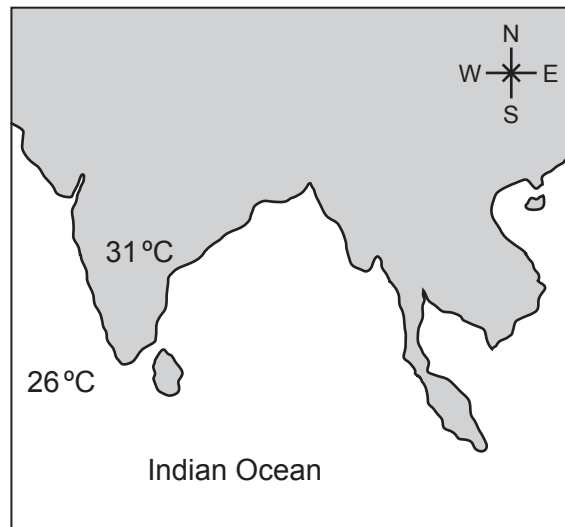
.....

.....

..... [4]

[Total: 14]

- 7 Fig. 7.1 shows the mean surface temperatures in two locations, on land and in the Indian Ocean, in summer.



**Fig. 7.1**

- (a) (i) Describe how the temperatures of the land and Indian Ocean shown in Fig. 7.1 give rise to the summer monsoon winds.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (ii) Outline how the temperatures of the land and Indian ocean shown in Fig. 7.1 differ in winter compared with summer.

.....

.....

.....

..... [2]

- (b) In the Indian Ocean, the depth of the thermocline changes between summer and winter.

Suggest **two** reasons why the depth of the thermocline changes.

- 1 .....
- .....
- 2 .....
- .....
- [2]

- (c) Tropical cyclones (hurricanes or typhoons) can form in the Indian Ocean.

Describe the role of latent heat in the formation of tropical cyclones.

- .....
- .....
- .....
- .....
- .....
- .....
- .....
- .....
- ..... [4]

[Total: 12]

**BLANK PAGE**



**BLANK PAGE**

---

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at [www.cambridgeinternational.org](http://www.cambridgeinternational.org) after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.