

CANDIDATE
NAME

CENTRE
NUMBER

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

CANDIDATE
NUMBER

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



MARINE SCIENCE

9693/03

Paper 3 A2 Structured Questions

May/June 2018

1 hour 30 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Write your answers in the spaces provided on the Question Paper.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

This document consists of **18** printed pages and **2** blank pages.

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

1 (a) Seaweeds are algae that are important marine producers.

Fig. 1.1 shows the habitat and typical depth at which three different seaweeds are found.

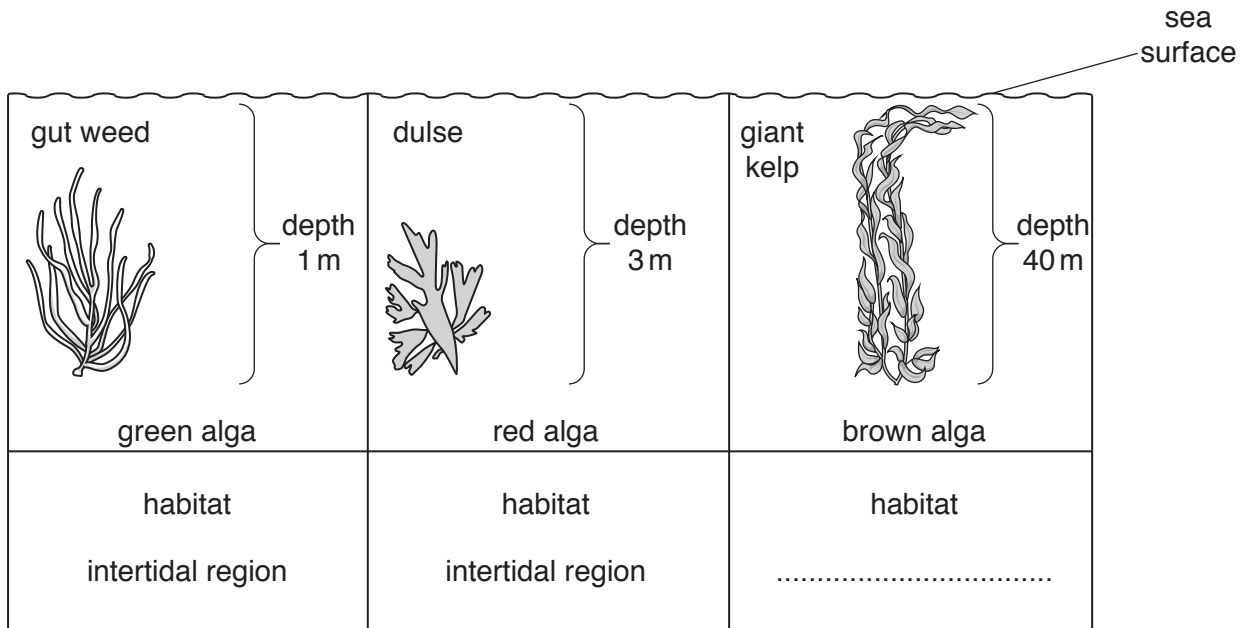


Fig. 1.1

Complete Fig. 1.1 by stating the habitat for giant kelp. [1]

(b) Pigments in algae trap light energy for photosynthesis.

Complete Table 1.1 to show which pigments are present in red and brown algae.

Table 1.1

| pigment | green algae | red algae | brown algae |
|---------------|-------------|-----------|-------------|
| chlorophyll a | present | ..... | ..... |
| xanthophyll | absent | ..... | ..... |
| phycobilin | absent | ..... | ..... |

[2]

2 (a) State why the salinity of a muddy shore changes very little while the tide is out.

.....

[1]

(b) An investigation was carried out into the ability of the graceful rock crab, *Metacarcinus gracilis*, to adapt to water of different salinities.

Aerated sea water was pumped through four tanks of different salinities. Fifteen adult crabs were placed in each tank. They were left for several hours at a constant temperature.

A sample of body fluid was then removed from each crab and its concentration measured.

Table 2.1 shows the results of this experiment.

Table 2.1

| concentration of water sample/arbitrary units | mean concentration of body fluid of crabs /arbitrary units |
|---|--|
| 927 | 930 |
| 735 | 735 |
| 521 | 545 |
| 275 | 423 |

(i) Suggest why the crabs were kept at a constant temperature during the experiment.

.....

[1]

(ii) Suggest why the water was aerated during the experiment.

.....

[1]

(iii) Describe how these results show that these crabs are osmoconformers.

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

(c) Unlike crabs, bony fish are not osmoconformers.

(i) Explain why marine bony fish need to regulate the concentration of their body fluids.

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

(ii) Describe how marine bony fish regulate the concentration of their body fluids.

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

[Total: 10]

- 3 Fig. 3.1 shows a northern lobster, which is an important seafood export for south west Nova Scotia, Canada.



Fig. 3.1

Northern lobsters are a cold water species that live in burrows and crevices in a rocky substrate. They are active nocturnal hunters. Outside their burrows, juveniles are prey for many fish species, especially cod.

Breeding occurs during the summer months when they also moult to replace their hard outer shell.

- (a) (i) Use the information to suggest why lobsters are caught in traps and not by benthic trawling.

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

- (ii) Suggest why the fishing season does not include the summer months.

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

- (d) The coastline around south west Nova Scotia is a mixture of rocky areas and sandy bays. When the season opens, 1500 lobster boats race to claim the best fishing locations.

Suggest why fishing boats need to race to claim their fishing locations.

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

- (e) Concrete artificial reefs have been designed for lobsters and other high value marine species. Lobsters begin to colonise these reefs in two years. After seven years, the reefs are fully functional.

- (i) Suggest why an artificial reef takes seven years to become fully functional.

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

- (ii) Suggest how artificial reefs could be used to increase the lobster catch in Nova Scotia.

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

[Total: 12]

- 4 (a) Table 4.1 shows the habitat of each stage in the life cycle of tuna and grouper.

Table 4.1

| stage in life cycle | habitat | |
|---------------------|---------------------------|-------------------------------------|
| | tuna | grouper |
| egg | free-floating in plankton | ..... |
| larva | ..... | seagrass beds and mangroves |
| juvenile | ..... | seagrass beds then migrate offshore |
| adult | open ocean | ..... |

Complete Table 4.1 by naming the habitat for each stage of the life cycle of tuna and grouper.

[4]

- (b) Read the information about bluefin tuna aquaculture (also called tuna ranching) in the Mediterranean Sea and in the Pacific Ocean.

Bluefin tuna aquaculture involves catching two-year-old juvenile wild tuna and towing them in cages to the aquaculture site. Growth continues in large net cages in the sea (sea cages) until they reach market size.

Tuna are difficult to keep in sea cages because they are easily disturbed by light, noise or small changes in the water temperature. Collisions with the walls of the sea cages are common. Damage to their skin lowers their market value and in many cases causes death.

Tuna are fed on wild caught mackerel, sardines and squid and need to eat 10% of their body weight per day. Small fragments of the food fish break off when eaten and are lost to the sea bed below the cages.

- (i) Use the information to suggest why growing tuna in sea cages is considered a partly extensive and partly intensive type of aquaculture.

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

- (ii) In the wild, bluefin tuna become sexually mature between 9 and 12 years old.

Use the information about tuna aquaculture to explain why the breeding age of bluefin tuna might make the supply of wild juveniles unsustainable in the future.

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

(iii) Suggest **two** reasons why an alternative food source, consisting of pellets made from dried fish waste, is being developed for the tuna in sea cages.

1

.....

2

.....

[2]

(iv) Scientists in Japan have recently obtained fertilised eggs from adult tuna reared and bred in captivity.

Use the information about tuna aquaculture to suggest why only 2% of these eggs survive to become adult fish.

.....

.....

.....

.....

.....

[2]

(c) Wild tuna stocks have decreased by 50% in the last decade. Captive bred tuna could supply 50% of the Japanese domestic market in a few years.

Suggest **two** benefits of selling captive bred tuna, rather than tuna raised from young fish caught in the wild.

1

.....

2

.....

[2]

[Total: 14]

- (i) Suggest why mackerel and bluefin tuna are forced to migrate north during the summer months.

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

- (ii) Use the information provided to state **one** way in which the local population in Greenland has suffered economically from the effects of global warming.

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

- (iii) Use the information provided to suggest **one** way in which the local population in Greenland could benefit economically from the effects of global warming.

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

- (c) The light colour of ice reflects more heat from the sun than the darker surface of rocks or soil.

A study in 2016 found that soot from wildfires and dust from erosion are causing the ice surface in Greenland to darken.

Suggest **and** explain the likely effect of a darker ice surface on global warming.

.....
.....
.....
.....
.....
.....
.....
.....
.....[3]

[Total: 9]

- 6 Sea turtles spend their lives in the sea. They migrate thousands of miles to reach their breeding grounds.

All species of sea turtle are listed as threatened or endangered.

Fig. 6.1 shows the change in the number of loggerhead sea turtle nests on beaches in Florida from 1989 to 2005. Other species show a similar pattern.

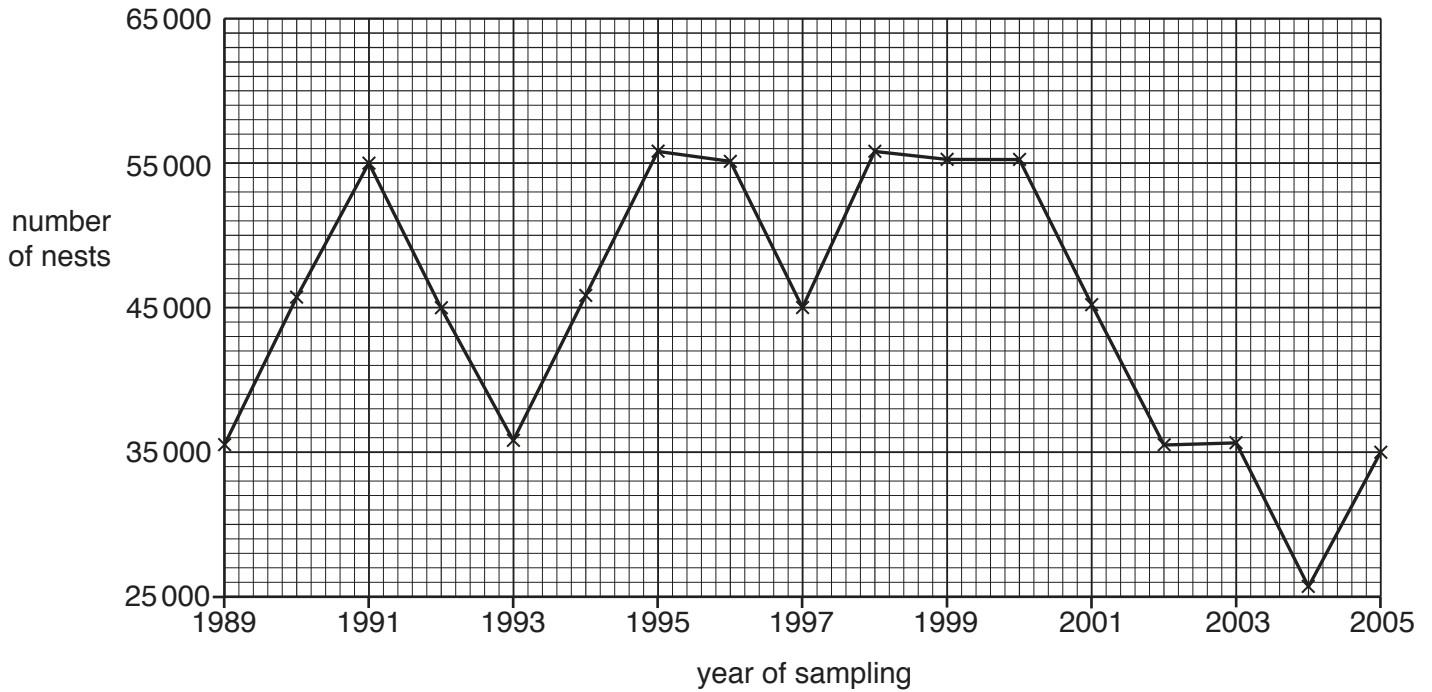


Fig. 6.1

- (a) Describe the trend shown in Fig. 6.1.

.....

.....

.....

.....

.....

.....[2]

(b) Female sea turtles leave the sea to lay their eggs on sandy beaches. When the eggs hatch, usually at night, the young use the horizon and reflected light of the moon and stars to reach the sea.

(i) Suggest **two** ways in which increased human activity **on beaches** may have contributed to sea turtles becoming endangered.

1

2

[2]

(ii) Suggest **two** other human actions **in the ocean** that could present a risk to sea turtle survival.

1

2

[2]

(c) Loggerhead sea turtles take between 25 and 30 years to become sexually mature. Females mate once every three years, making up to three nests with about 100 eggs in each. An average of one egg per nest survives to reach breeding age.

Conservation programmes in Florida started in the 1980s.

(i) Suggest **one** way each of the following actions could help more loggerhead sea turtles to survive.

marking and covering nests with netting

.....
.....

keeping a 24-hour watch over the nests during the hatching time

.....
.....

[2]

- (ii) An article from a Florida newspaper in 2013 claimed that these conservation efforts have had some success in increasing the population of loggerhead sea turtles.

Table 6.1 shows the data on which this claim was based. Indicator beaches are those used as a measure of turtle nesting success.

Table 6.1

| year of survey | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|-------------|-------------|-------------|-------------|-------------|
| number of nests on indicator beaches | 2060 | 3135 | 1980 | 3506 | 2910 |
| number of nests in the whole of Florida | 39 000 | 35 000 | 44 000 | 41 000 | 58 000 |

Describe how the data in Table 6.1 support the claim that the population of loggerhead sea turtles is increasing.

.....

.....

.....

.....

.....

.....[2]

[Total: 10]

- 7 (a) One of the reasons for variation in phenotype between individual members of a species is that they have different versions of genes.

Selective breeding programmes in fish have been used to increase growth rate, give disease resistance, and give an earlier age of sexual maturity.

- (i) State what is meant by each of the following terms.

gene

.....

phenotype

.....

selective breeding

.....

[3]

- (ii) State why selective breeding for each of the following features could increase profits for a fish farmer.

increase in growth rate

.....

disease resistance

.....

earlier age of sexual maturity

.....

[3]

- (b) Infectious pancreatic necrosis (IPN) is a fatal viral disease that affects farmed salmon.

Selective breeding was used to produce salmon resistant to IPN. Laboratory tests were carried out to compare selectively bred salmon with farmed salmon that had not been selectively bred.

Three groups of fish were kept in separate tanks:

group **A**: selectively bred salmon

group **B**: non-selectively bred salmon

group **C**: non-selectively bred salmon

Group **A** and group **B** were exposed to IPN. Every five days the percentage of salmon that were still living (percentage survival) was calculated. Table 7.1 shows the results of the tests.

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 International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

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