Diploma Programme
Programme du diplôme
Programa del Diploma

Biology
Standard level
Paper 2

Monday 1 May 2017 (afternoon)

Candidate session number

1 hour 15 minutes

Instructions to candidates

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer one question.
- Write your answers in the boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[50 marks]**.

2217 – 6011

20 pages

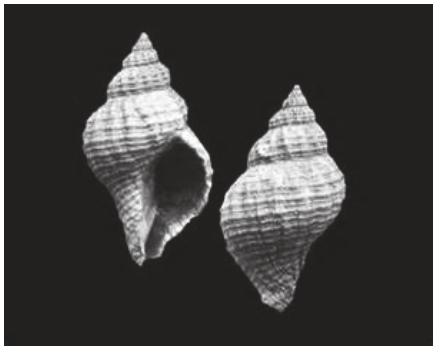
Section A

Answer **all** questions. Write your answers in the boxes provided.

1. Native oyster populations are decreasing where rivers meet the ocean along the northwest coast of North America. These oyster populations are being attacked by a gastropod.

Adult oyster, *Ostrea lurida*

[Source: © International Baccalaureate Organization 2017]



Adult gastropod shell, *Urosalpinx cinerea*

[Source: © International Baccalaureate Organization 2017]

It is known that oysters and gastropods have hard parts composed of calcium carbonate and that ocean acidification is increasing. Studies were carried out using juvenile oysters and gastropods to investigate the effects of acidification on the decrease in the population of oysters.

The first step was to raise oysters in two different mesocosms. One had seawater at a normal concentration of CO_2 and the other had sea water with a high concentration of CO_2. Gastropods were raised in two further mesocosms with normal and high CO_2 concentrations respectively.

(a) Outline how acidified sea water could affect the shells of the oyster. [1]

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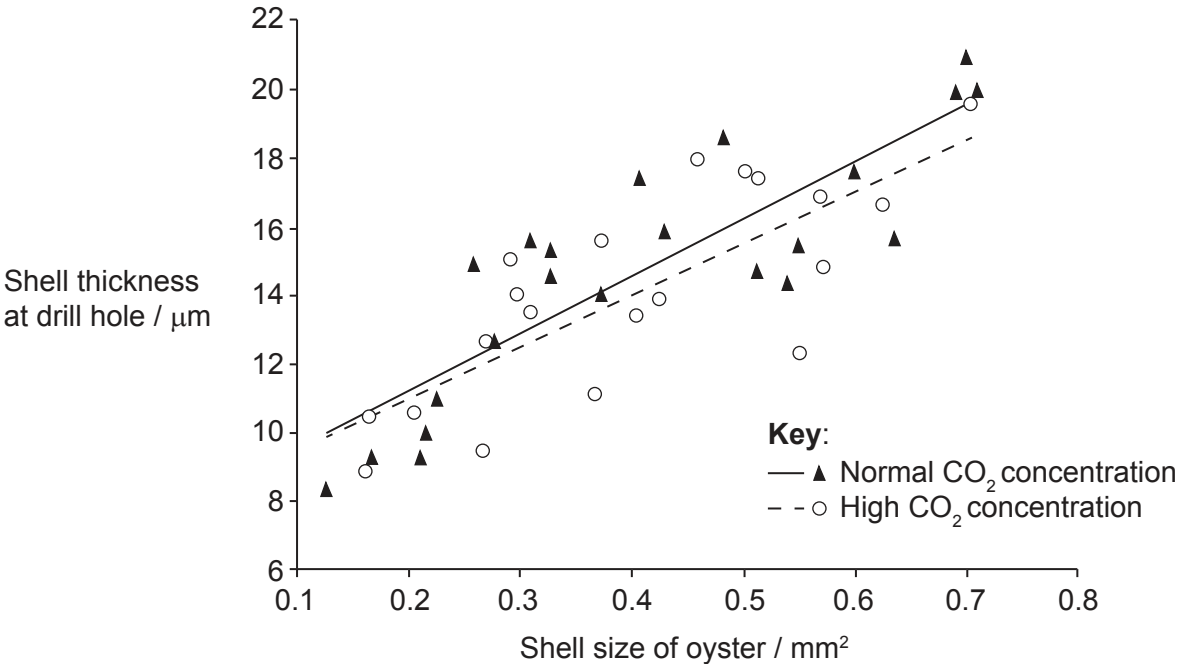
(Question 1 continued)

A juvenile gastropod will attack a juvenile oyster by using its tongue-like structure (radula) to drill a hole through the oyster shell. Once the hole has been drilled, the gastropod sucks out the soft flesh. Researchers investigated the shell thickness at the site of the drill hole in relation to the size of the oyster. The results are seen in this graph.



[Source: E Sanford *et al*. (2014) *Proceedings of the Royal Society B*, 281, by permission of the Royal Society.]

(b) Outline the trends shown in the data in the graph. [2]

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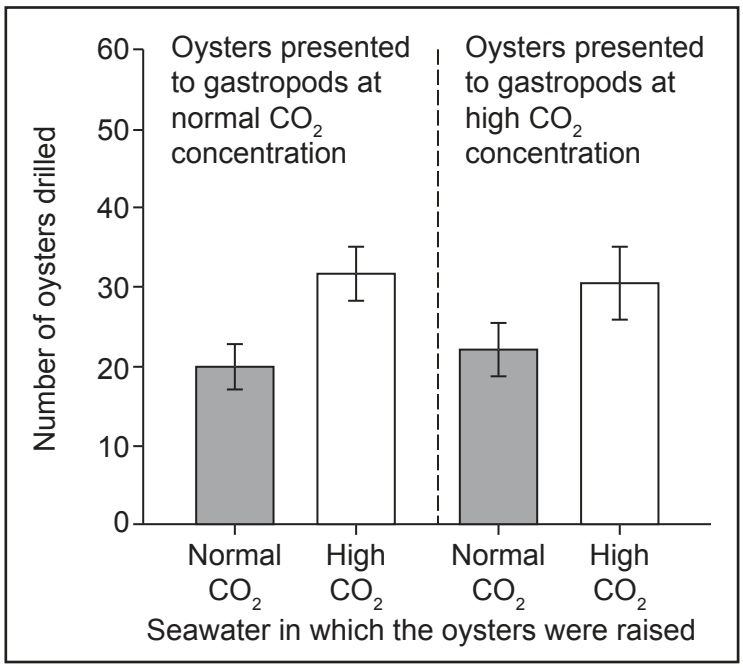
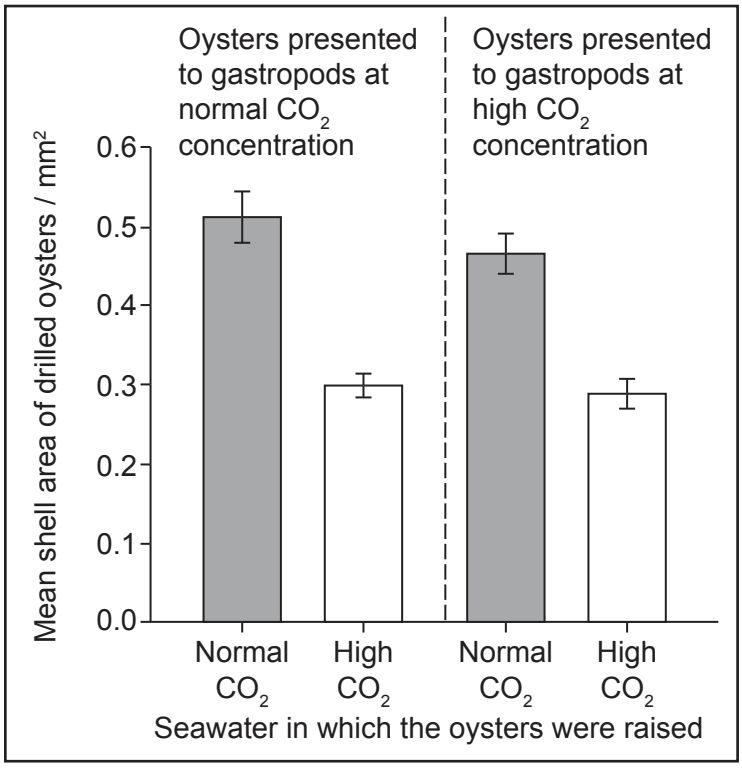
(Question 1 continued)

Equal numbers of oysters raised in seawater with a normal CO_2 concentration and in seawater with a high CO_2 concentration were then presented together to the gastropod predators in seawater with a normal CO_2 concentration. The same numbers of oysters from the two groups were also presented together to the gastropods in seawater with a high CO_2 concentration. The bar charts show how many of the oysters were drilled by the gastropods and the mean size of drilled oysters.





[Source: © International Baccalaureate Organization 2017]

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(Question 1 continued)

(c) Estimate how much smaller drilled oysters raised in seawater at a high CO_2 concentration were than drilled oysters raised in seawater at a normal CO_2 concentration. [1]

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(d) (i) Deduce from the data in the bar charts which factors were and were not correlated significantly with the number of oysters drilled by the gastropods. [2]

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(ii) Suggest reasons for the differences in the numbers of oysters drilled, as shown in the bar charts. [2]

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(iii) The radula in a gastropod is hard but not made of calcium carbonate. Outline how this statement is supported by the drilling success of the gastropods in seawater with normal or high CO_2 concentrations. [2]

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(Question 1 continued)

(e) Using all the data, evaluate how CO_2 concentrations affect the development of oysters and their predation by gastropods. [2]

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will not be marked.

2. Pictured below are Louis Pasteur's original drawings of swan-necked flasks.

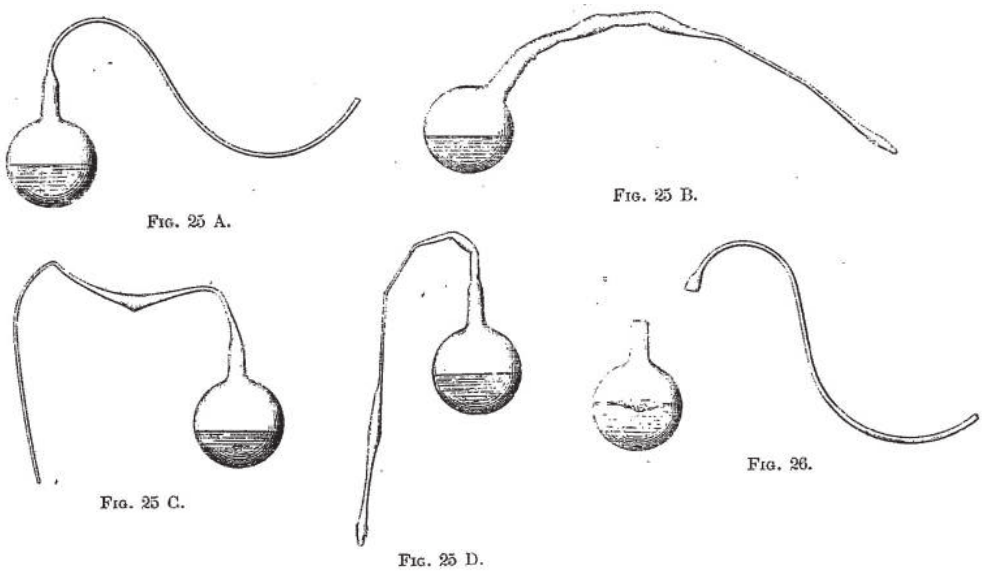

Fig. 25 A.

Fig. 25 B.

Fig. 25 C.

Fig. 25 D.

Fig. 26.

[Source: L Pasteur and L Pasteur Vallery-Radot, (1922), *Œuvres de Pasteur*, *Vol II Fermentations et générations dites spontanées*, pages 260–261]

(a) Describe how Pasteur's experiments provided convincing evidence to falsify the concept of spontaneous generation. [3]

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(Question 2 continued)

(b) State the function of life in *Paramecium* that is carried out by:

(i) cilia. [1]

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(ii) the contractile vacuole. [1]

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(c) Discuss the advantages and disadvantages of the use of adult stem cells. [3]

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(d) Explain the role of decomposers in an ecosystem. [2]

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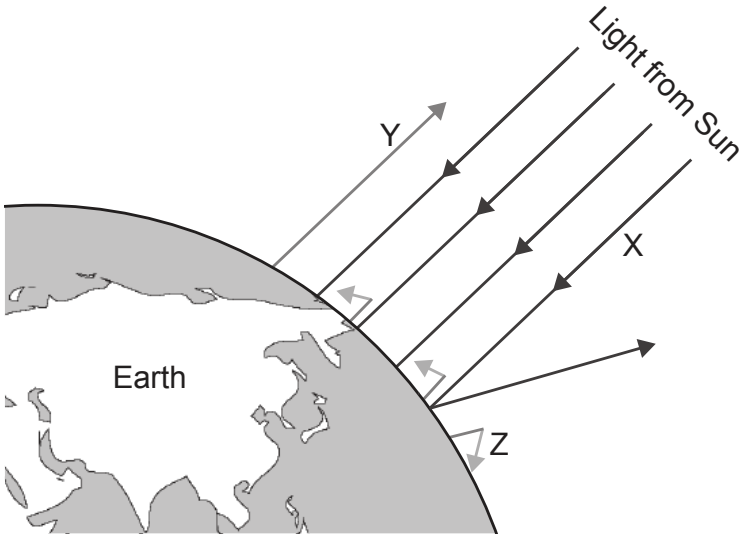
3. The diagram shows the greenhouse effect.



[Source: © International Baccalaureate Organization 2017]

(a) State the type of wavelength of the radiation labelled X and Y. [2]

X: . . . . . .

Y: . . . . . .

(b) Outline reasons for the change occurring at Z. [2]

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(c) The short-tailed albatross (*Phoebastria albatrus*) nests and breeds on remote low-lying coral islands in the Pacific Ocean. Predict how global warming may threaten the survival of such an ocean bird. [1]

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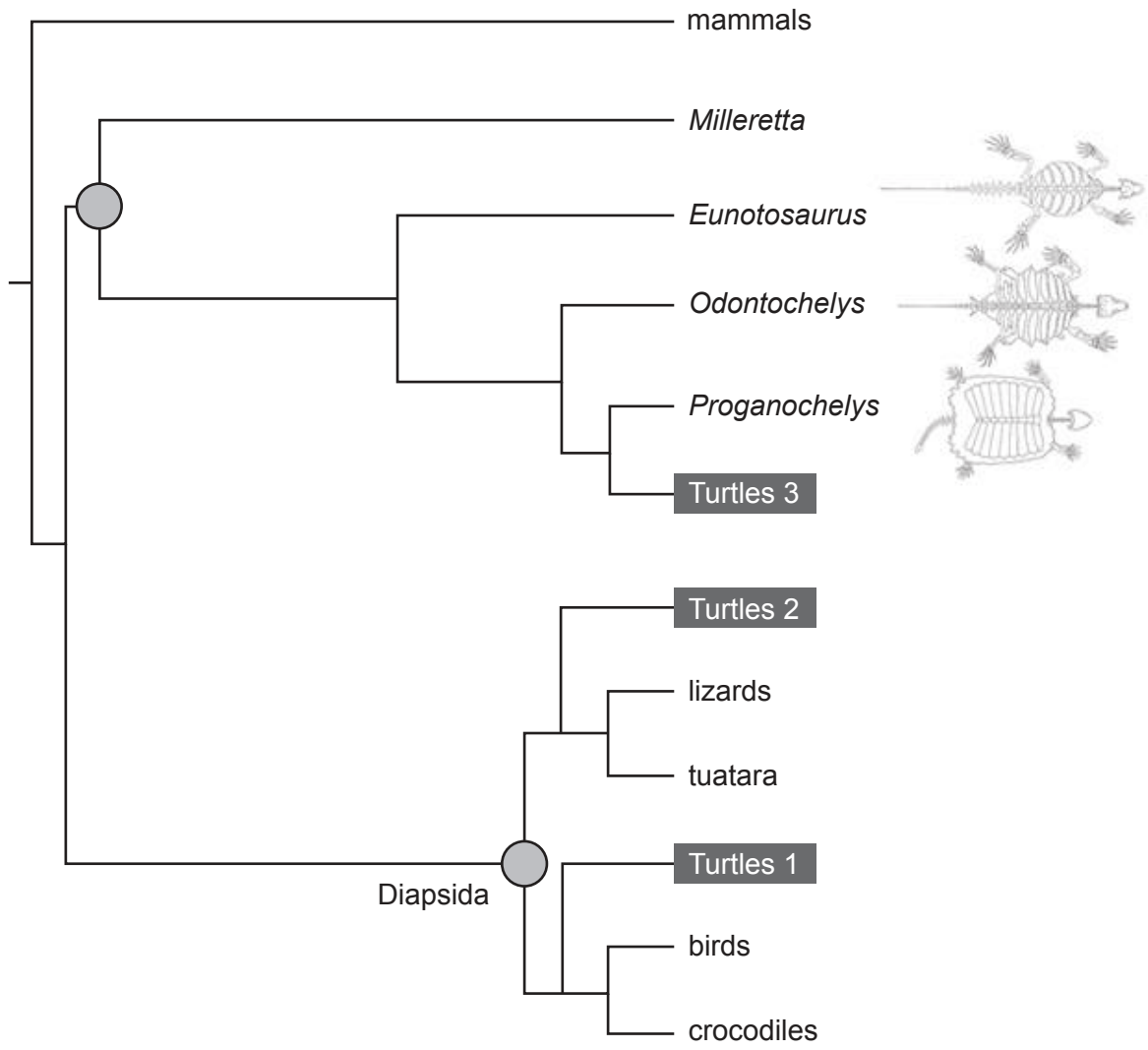
4. The following cladogram shows three possible evolutionary routes for the turtle (Turtles 1, Turtles 2 and Turtles 3). The taxa in italics are extinct.



[Source: Tyler R. *et al*., Transitional fossils and the origin of turtles, *Biology Letters* 6, Dec 23, 2010, pages 830–833, by permission of the Royal Society.]

(a) (i) State the organism most closely related to the lizards. [1]

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(Question 4 continued)

(ii) Based on the taxa shown, deduce a difficulty in gathering data to study turtle ancestry. [1]

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(b) (i) Molecular evidence is often used to construct a cladogram. Describe **one** type of molecular-based evidence to identify members of a clade. [2]

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(ii) Suggest **one** type of additional evidence that could provide strong support for Turtles 3 as the evolutionary route for turtles rather than Turtles 1 or Turtles 2. [1]

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(c) Taxonomists aim to place species into genera, families and higher taxa according to their evolutionary origins. This is known as natural classification.

Explain the usefulness of natural classification in biodiversity research. [2]

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Section B

Answer **one** question. Up to one additional mark is available for the construction of your answer. Write your answers in the boxes provided.

5. DNA research, involving biotechnology, has led to benefits for society but has given rise to some controversy.

(a) Outline how translation depends on complementary base pairing. [3]

(b) Describe the polymerase chain reaction (PCR), including the role of Taq DNA polymerase. [4]

(c) Explain benefits and risks of using genetically modified crops for the environment and also for human health. [8]

6. James Beard, a famous chef, once said “Food is our common ground, a universal experience.”

(a) Explain how the small intestine moves, digests and absorbs food. [8]

(b) Distinguish between the structures of the different types of fatty acids in food. [4]

(c) Outline how leptin controls appetite. [3]