

Biology
Higher level
Paper 2

Friday 4 November 2016 (morning)

Candidate session number

2 hours 15 minutes

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Instructions to candidates

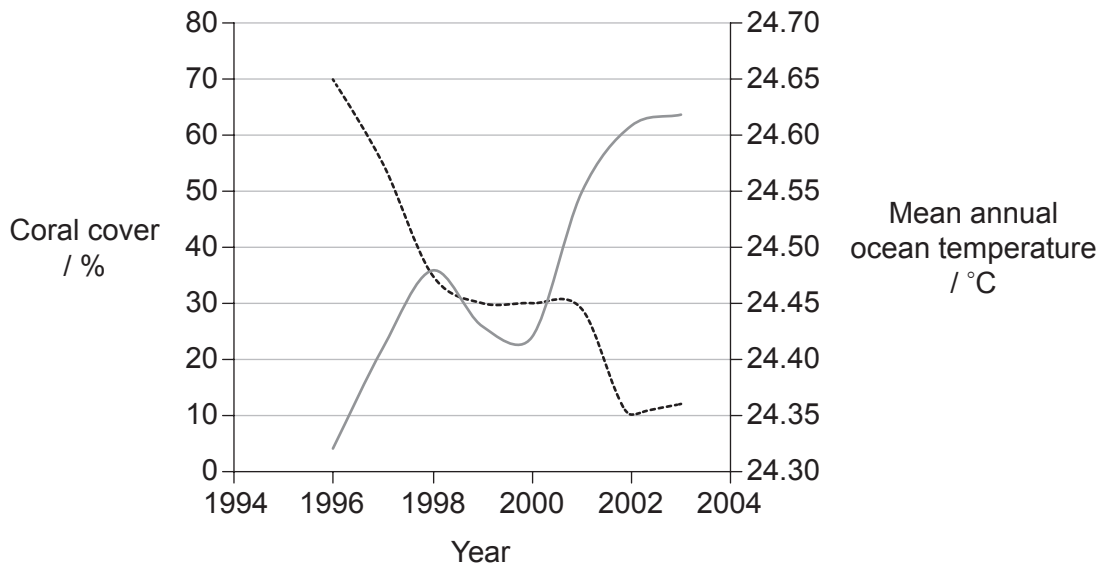
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer two questions.
- Write your answers in the boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[72 marks]**.



Section A

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

- 1. Coral reefs are among the most spectacular ecosystems on Earth. They support a rich diversity of life and provide economic benefits to the people who use them. In Papua New Guinea in the Pacific Ocean north of Australia the following data were collected. Coral cover is the percentage of the reef surface covered by live hard coral.



Key: ----- percentage coral cover — ocean temperature

[Source: adapted from Jones et al. (2004), The Encyclopedia of Earth, Patterns of Coral Loss]

- (a) Calculate the difference in coral cover in 1996 and 2002. No working required. [1]

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- (b) Describe the evidence that the ocean temperature has an effect on coral cover. [2]

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(Question 1 continued)

(c) Suggest causes for the changes in ocean temperature.

[2]

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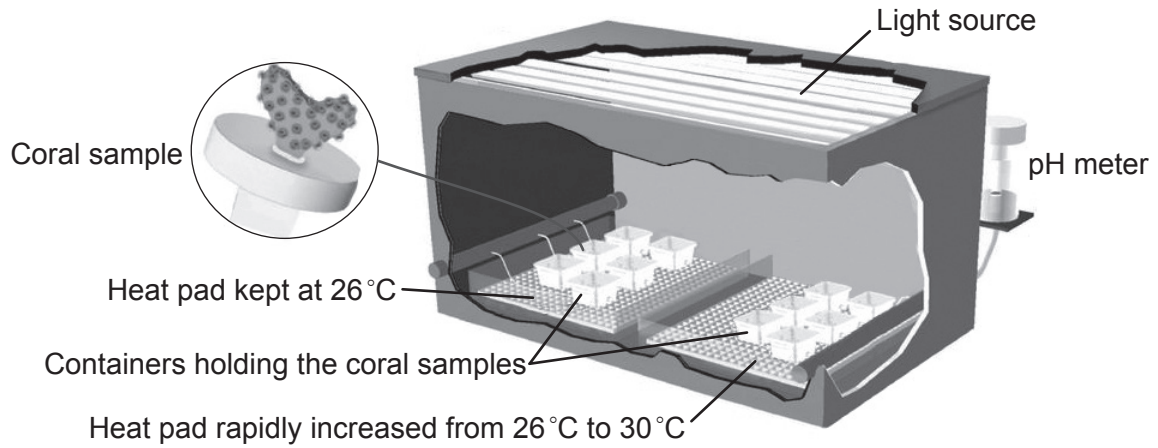
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Answers written on this page
will not be marked.

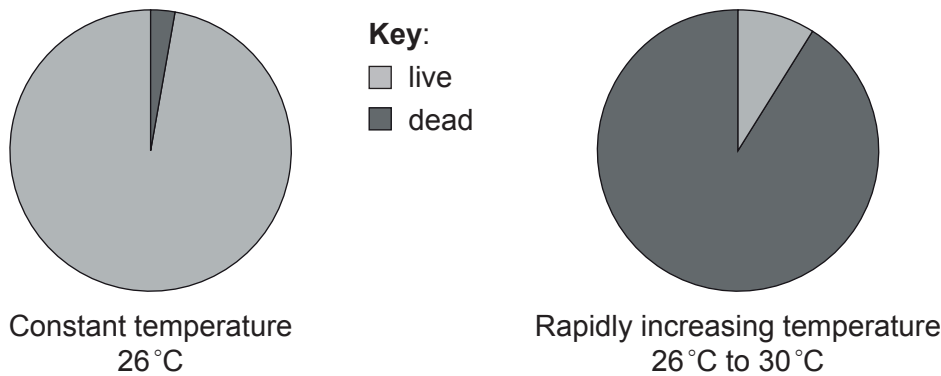


(Question 1 continued from page 3)

In order to test the effect of temperature, live samples of a species of coral, *Pocillopora damicornis*, were placed in an experimental chamber at a constant pH, water depth and low light. All the coral samples were started at 26 °C and half of them were rapidly increased to 30 °C.



The pie charts show the percentage of live and dead tissues at the end of the experiment.



[Source: Adapted from Mace G. Barron, Cheryl J. McGill, Lee A. Courtney, and Dragoslav T. Marcovich, "Experimental Bleaching of a Reef-Building Coral Using a Simplified Recirculating Laboratory Exposure System," *Journal of Marine Biology*, vol. 2010, Article ID 415167, 8 pages, 2010. doi:10.1155/2010/415167]

(d) Identify **one** advantage of conducting this experiment in the laboratory rather than in the ocean. [1]

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(e) Comment on whether the experimental data supports the observed data from the ocean. [1]

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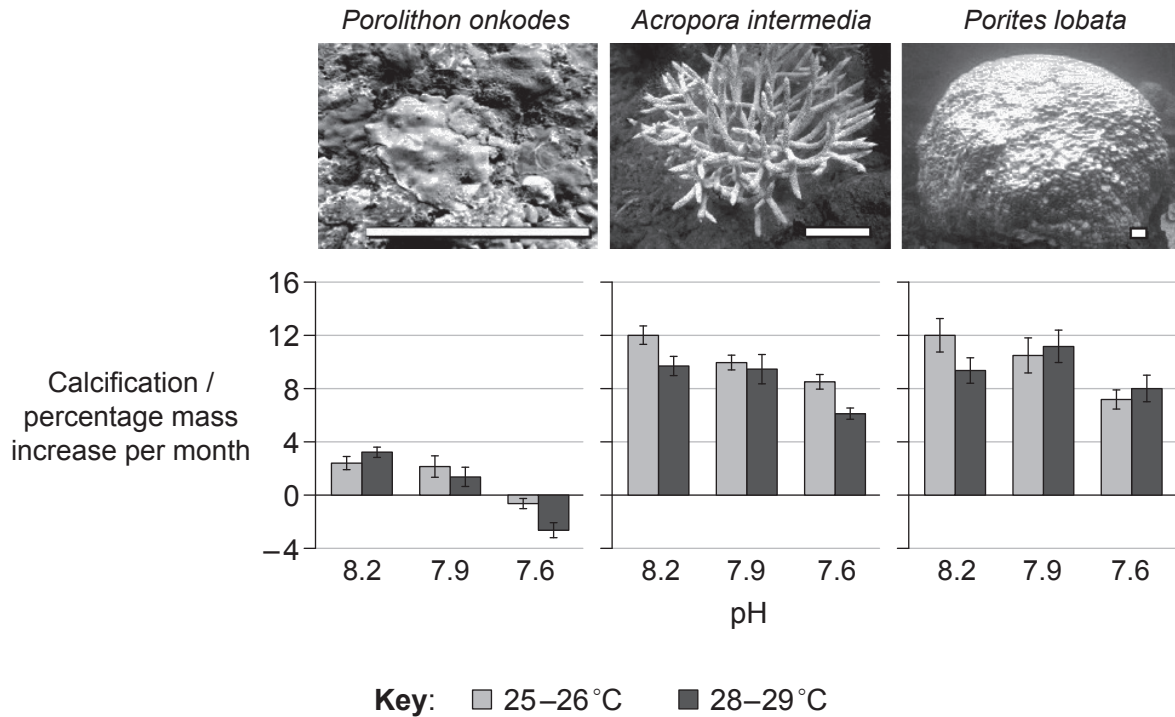
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(Question 1 continued)

Acidification of the world's oceans is an increasing threat to the health of oceanic life including coral reefs. Corals perform calcification to create their calcium carbonate exteriors. An experiment was conducted on Heron Island, Southern Great Barrier Reef, Australia. For the experiment the pH was altered by dissolving carbon dioxide in the water. Three different coral species were used, with each test group at two different temperature ranges and three different pH values. The white line in each photograph represents 5 cm.



[Source: Adapted from K. R. N. Anthony, D. I. Kline, G. Diaz-Pulido, S. Dove, and O. Hoegh-Guldberg, "Ocean acidification causes bleaching and productivity loss in coral reef builders," *PNAS*, vol. 105 no. 45, 17442–17446, Copyright 2008 National Academy of Sciences, U.S.A.]

(f) (i) Describe the trend in calcification when the pH is decreased at 25–26 °C. [1]

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(Question 1 continued)

- (ii) In environmental studies, a critical value is the level at which a population declines or shows signs of poor health. Suggest a critical pH for *P. onkodes*. [1]

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- (iii) Using all of the data, comment on the hypothesis that ocean acidification in warming seas will have the same effect on all species of coral. [1]

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- (g) Suggest another marine animal that has parts made of calcium carbonate and may therefore be damaged due to ocean acidification. [1]

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- (h) Outline causes of ocean acidification. [2]

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(Question 1 continued)

- (i) Discuss the need for international cooperation to solve the problems of declining coral populations.

[3]

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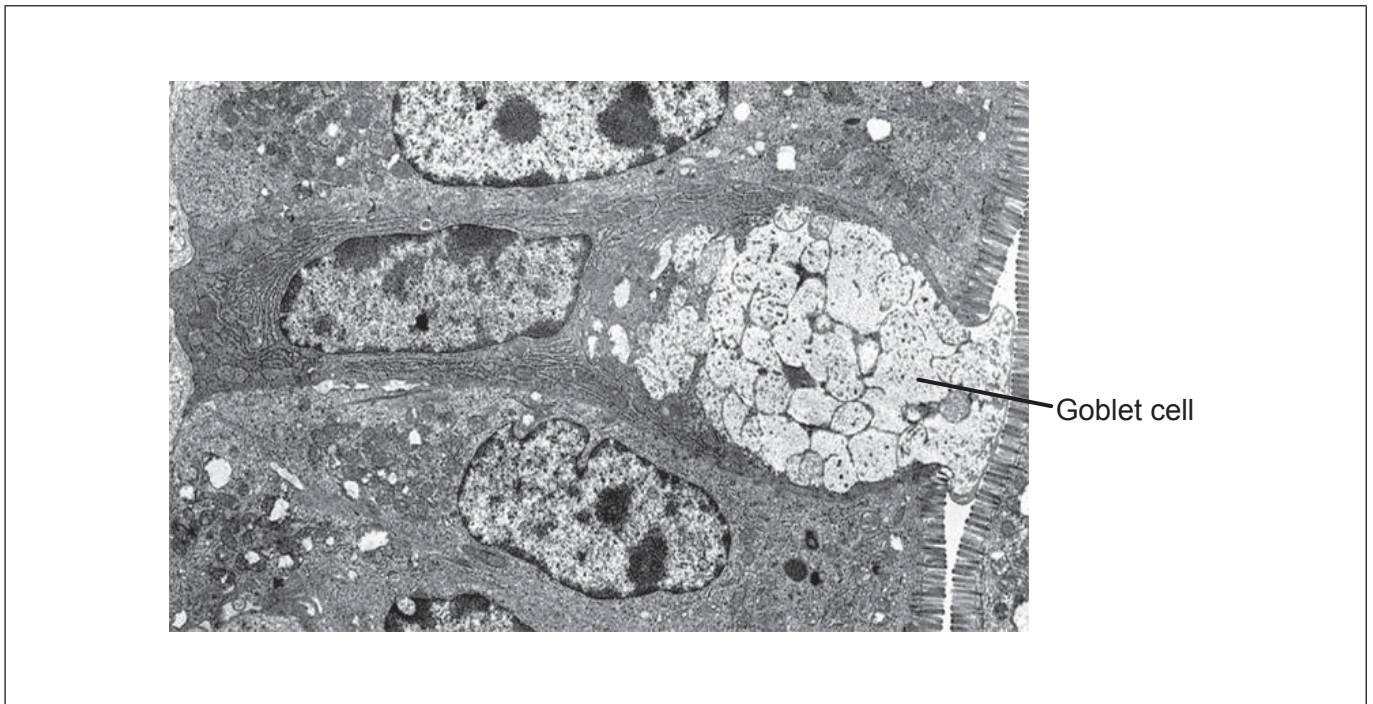
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- 2. (a) The image is an electron micrograph of the lining of the small intestine.



[Source: adapted from A. L. Mescher (2009), *Junqueira's Basic Histology: Text and Atlas*, 12th Edition, © 2009 McGraw-Hill Education]

- (i) Label the microvilli using the letter M and a nucleus using the letter N.

[1]

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(Question 2 continued)

(ii) State the function of the goblet cell. [1]

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(iii) Deduce, with a reason, whether or not the goblet cell is likely to divide. [1]

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(b) Explain how the cell cycle is controlled. [4]

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3. (a) Identify the following processes as **either** anabolism **or** catabolism by placing a tick (✓) in the correct box. [2]

Process	Anabolism	Catabolism
Light-independent reactions of photosynthesis	<input type="checkbox"/>	<input type="checkbox"/>
Glycolysis	<input type="checkbox"/>	<input type="checkbox"/>

- (b) Outline the importance of enzymes to metabolic processes. [4]

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4. (a) List **two** causes of variation within a gene pool. [2]

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(b) Describe how variation contributes to evolution by natural selection. [3]

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(c) Outline what is required for speciation to occur. [3]

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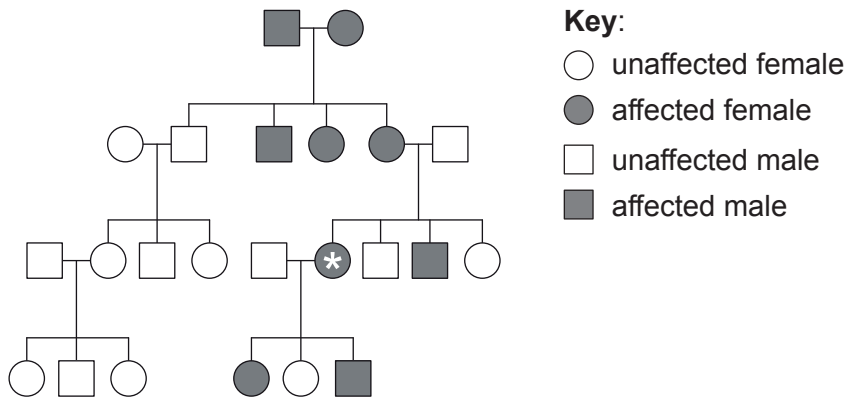
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5. This is a pedigree chart of a family with hypophosphatemia, an X-linked condition, in which bone deformities occur because of poor absorption of phosphates into the blood.



- (a) Using the pedigree chart, deduce the type of allele that causes hypophosphatemia. [2]

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- (b) Identify the genotype of the individual marked with a star in the pedigree chart, using appropriate symbols for your answer. [1]

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Section B

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

6. The human circulatory system is structured to serve the organs and tissues of the body efficiently.
- (a) Explain how circulation of the blood to the lungs and to other systems is separated in humans and what the advantages of this separation are. [8]
 - (b) Describe what happens in alveoli. [4]
 - (c) Distinguish between the composition of the blood of the renal artery and the blood of the renal vein. [3]
7. Angiospermophyta are vascular flowering plants.
- (a) Describe the transport of organic compounds in vascular plants. [4]
 - (b) The flowers of angiospermophyta are used for sexual reproduction. Outline **three** processes required for successful reproduction of angiospermophyta. [3]
 - (c) Growth in living organisms includes replication of DNA. Explain DNA replication. [8]
8. In ecosystems, energy is used to convert inorganic compounds into organic matter. Energy enters ecosystems through producers.
- (a) Explain the processes by which light energy is converted into chemical energy. [8]
 - (b) Producers extract phosphates and nitrates from soil. Outline how these ions are used in the synthesis of organic molecules. [3]
 - (c) Describe how energy flows through and is used by organisms in ecosystems. [4]



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20EP15

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20EP16

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20EP17

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A large rectangular area containing 28 horizontal dotted lines for writing.



20EP20