



BIOLOGY
STANDARD LEVEL
PAPER 2

Tuesday 10 November 2009 (afternoon)

1 hour 15 minutes

Candidate session number

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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 of Section A in the spaces provided.
- Section B: answer one question from Section B. Write your answers on answer sheets. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.
- At the end of the examination, indicate the numbers of the questions answered in the candidate box on your cover sheet and indicate the number of sheets used in the appropriate box on your cover sheet.



SECTION A

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

- 1. Limpets are small animals that feed on the green algae which grow on rocks on seashores. Oystercatchers (*Haematopus bachmani*) are birds that feed on limpets.

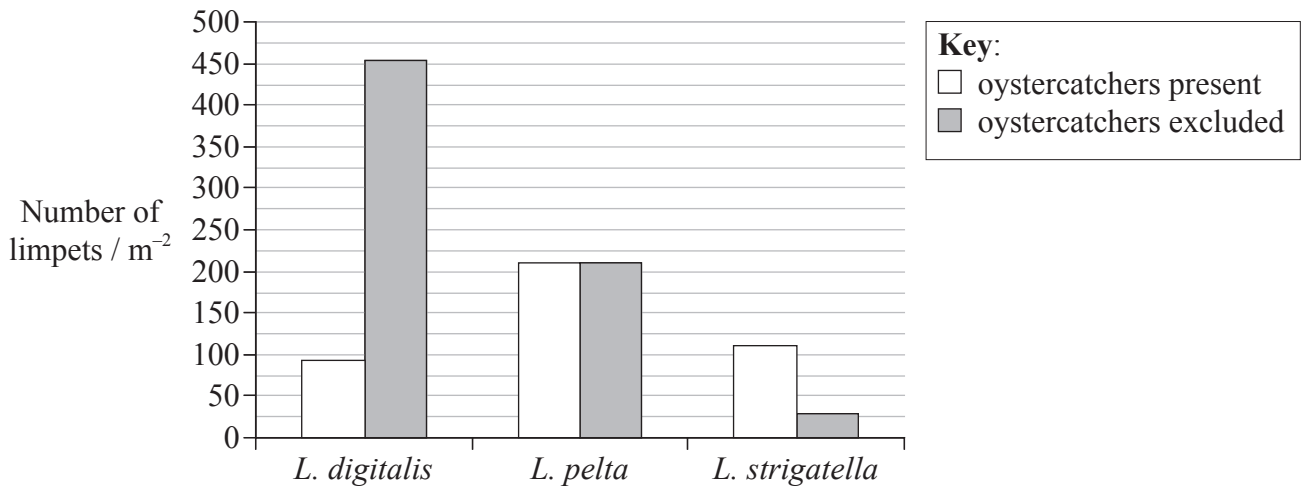
Limpet



Oystercatcher



In a study on the north-west coast of the USA, where three limpet species are common (*Lottia digitalis*, *Lottia pelta* and *Lottia strigatella*), the limpets were protected from the oystercatchers by large wire cages. After two years the number of limpets in this area was compared with the number of limpets in an area without cages, where oystercatchers were present.



[Source: *Ecology*, J T Wootton. © 1992 by ECOLOGICAL SOCIETY OF AMERICA. Reproduced with permission of ECOLOGICAL SOCIETY OF AMERICA in the format CD-ROM via Copyright Clearance Center.]

- (a) State the effect that the exclusion of the oystercatchers had on the total number of limpets per m².

[1]

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(Question 1 continued)

- (b) Construct a food web to show the feeding relationship between the three species of limpets, the oystercatchers and the green algae. [2]

- (c) Suggest reasons for the difference in numbers of *L. strigatella* between the areas where oystercatchers were present and where oystercatchers were excluded. [3]

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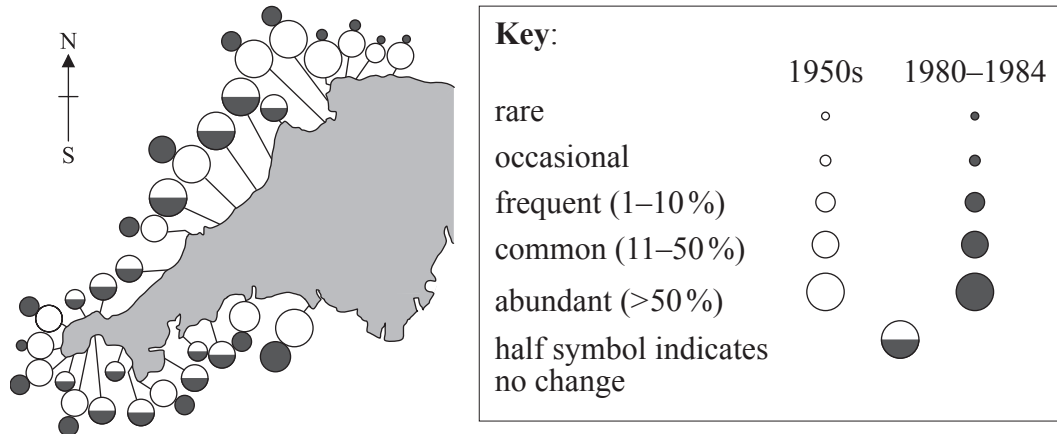
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(Question 1 continued)

There is evidence to show that both air and water temperatures have increased over a period of time. An investigation was undertaken to determine the effect this change in climate had on the populations of another species of limpet, *Patella depressa*, around south-west England. The population of the limpet was recorded in many locations and around 30 years later, this study was repeated. The chart below compares the population in each of the locations.



[M.T. & Southward, A.J. (2004). "Predicting the effects of marine climate change on the invertebrate prey of the birds of rocky shores", *IBIS (Special Edition)* 146:40-47. © John Wiley & Sons]

- (d) On the map above label **one** location,
 - (i) with the letter X, where the limpet population was abundant in the 1950s and occasional in the 1980s (1980–1984). [1]
 - (ii) with the letter Y, where the limpet population was abundant in both the 1950s and in the 1980s (1980–1984). [1]
- (e) Outline, using the data, the overall trend in the limpet population from the 1950s to the 1980s (1980–1984). [2]

- (f) Suggest **two** reasons for the change in limpet population between the 1950s and the 1980s (1980–1984). [2]



2. (a) State the type of bonds that

(i) connect base pairs in a DNA molecule. [1]

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(ii) link DNA nucleotides into a single strand. [1]

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(b) Distinguish between DNA and RNA nucleotides by giving **two** differences in the chemical structure of the molecules. [2]

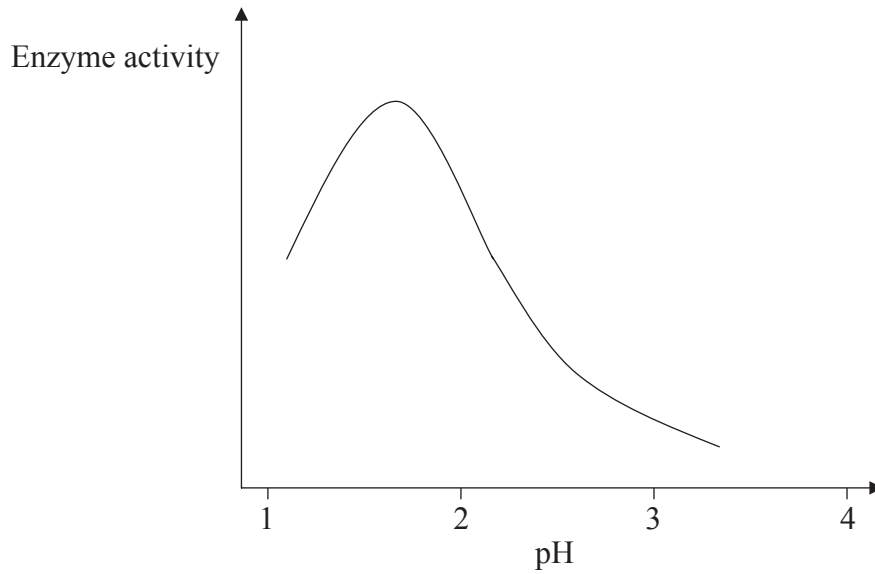
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(c) Explain the role of transfer RNA (tRNA) in the process of translation. [2]

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3. Researchers extracted an enzyme from the human digestive system and tested its activity at different pH values on proteins extracted from the blood of cows. The results are shown in the graph below.



- (a) Deduce from where in the human digestive system this enzyme was extracted. [1]

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- (b) Outline the need for enzymes in the digestive system. [2]

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- (c) State **one** function of the large intestine. [1]

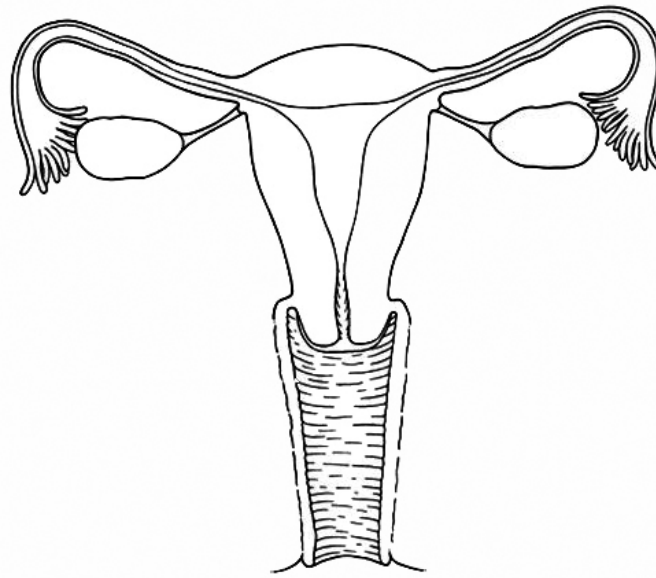
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- (d) Explain how the structure of the villus is adapted for absorption. [3]

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4. The diagram below shows the female reproductive system.



(a) Label the diagram above with the letter U to show the uterus. [1]

(b) Outline the role of luteinizing hormone (LH) **after** ovulation. [1]

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(c) Explain how sexual reproduction can lead to variation in a species. [3]

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SECTION B

Answer **one** question. Up to two additional marks are available for the construction of your answer. Write your answers on the answer sheets provided. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.

5. (a) Draw a labelled diagram to show the fluid mosaic structure of a plasma membrane, indicating the hydrophilic and hydrophobic regions. [5]
- (b) Distinguish between active and passive movements of materials across plasma membranes, using **named** examples. [4]
- (c) Explain how the properties of water are significant to living organisms. [9]
6. (a) Draw a labelled diagram to show the human ventilation system. [4]
- (b) Outline anaerobic cell respiration in plant cells. [5]
- (c) Explain the concept of homeostasis, using the control of blood sugar as an example. [9]
7. (a) Describe karyotyping and **one** application of its use. [4]
- (b) Describe a technique used for gene transfer. [5]
- (c) Using a **named** example, discuss the benefits and harmful effects of genetic modification. [9]
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