Diploma Programme
Programme du diplôme
Programa del Diploma

Biology
Higher level
Paper 2

Wednesday 6 May 2015 (morning)

2 hours 15 minutes

Candidate session number

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]**.

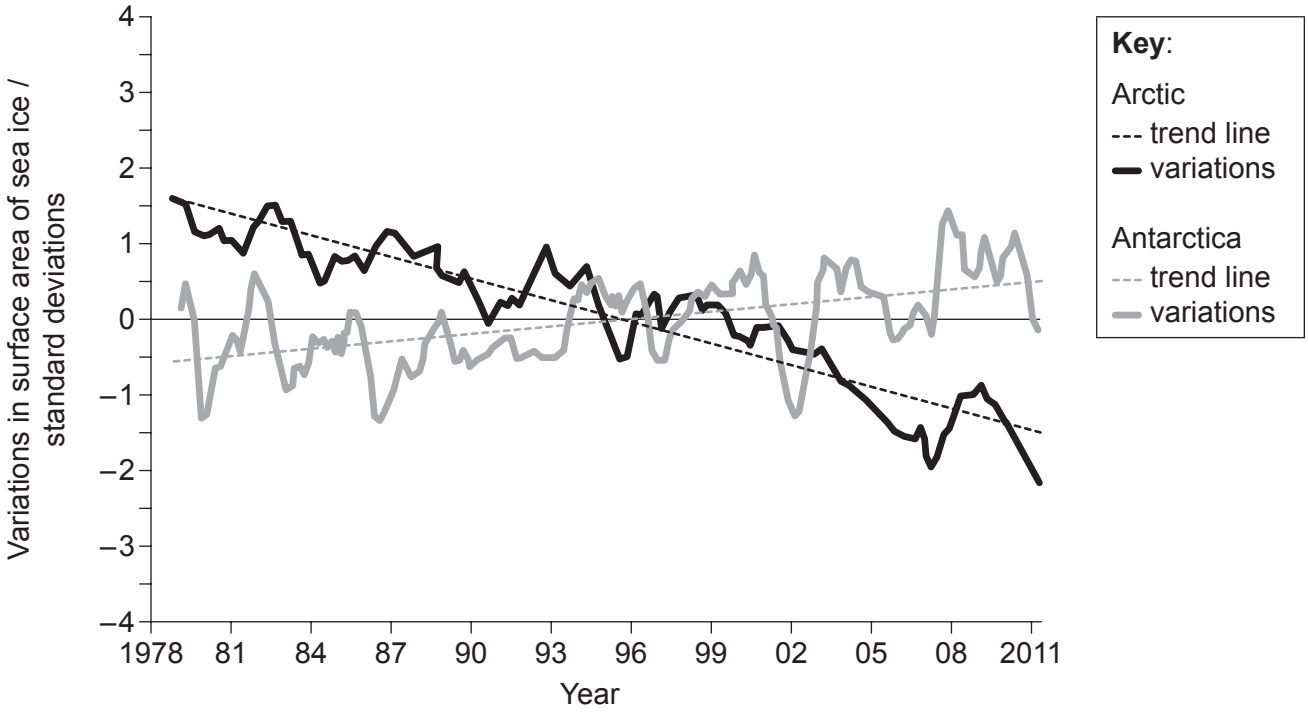
2215–6014

Section A

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

1. Global warming has changed both the thickness and surface area of sea ice of the Arctic Ocean as well as the Southern Ocean that surrounds Antarctica. Sea ice is highly sensitive to changes in temperature.

Scientists have calculated a long-term mean for the surface area of sea ice in the Arctic and in the Southern Ocean around Antarctica. This mean value is used as a reference to examine changes in ice extent. The graph shows the variations from this mean (zero line) over a period of time.



[Source: © International Baccalaureate Organization 2015]

(a) State the trend in the surface area of sea ice in the Southern Ocean around Antarctica. [1]

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(Question 1 continued)

(b) Distinguish between changes in the surface area of sea ice in the Arctic and Antarctica. [2]

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(c) Discuss the data as evidence of global warming. [3]

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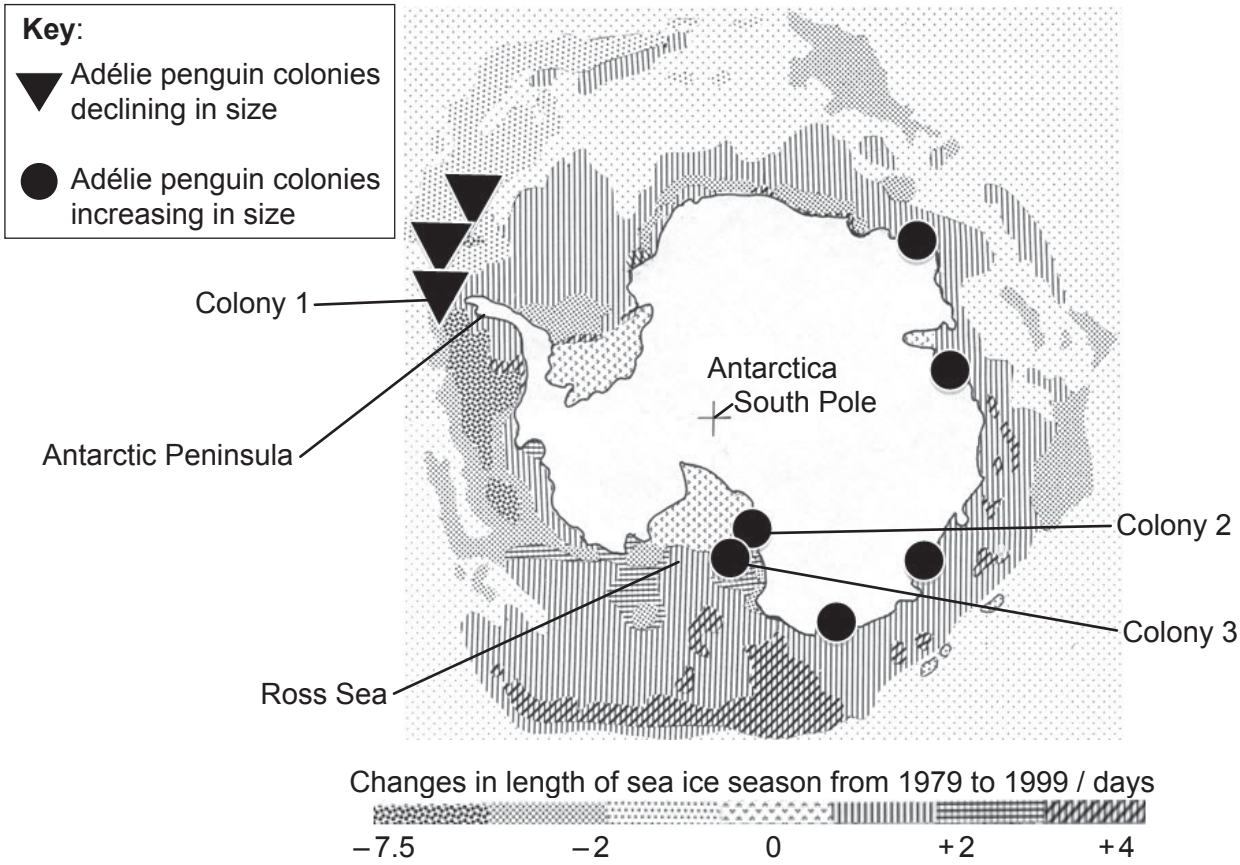
(Question 1 continued)

Adélie penguins (*Pygoscelis adeliae*) are only found in Antarctica and need sea ice for feeding and nesting. Biologists are able to deduce how these penguins have responded to changes in their environment for the last 35 000 years, as the Antarctic conditions have preserved their bones and their nests. The image is a map of Antarctica and the surrounding Southern Ocean. It shows the trends in the length of the sea ice season (days of the year when sea ice is increasing) and the sites of nine Adélie penguin colonies.



[Source: Data sourced from the penguinscience.com website]

(d) Describe the trends in the length of the sea ice season around the Antarctic Peninsula and in the Ross Sea. [2]

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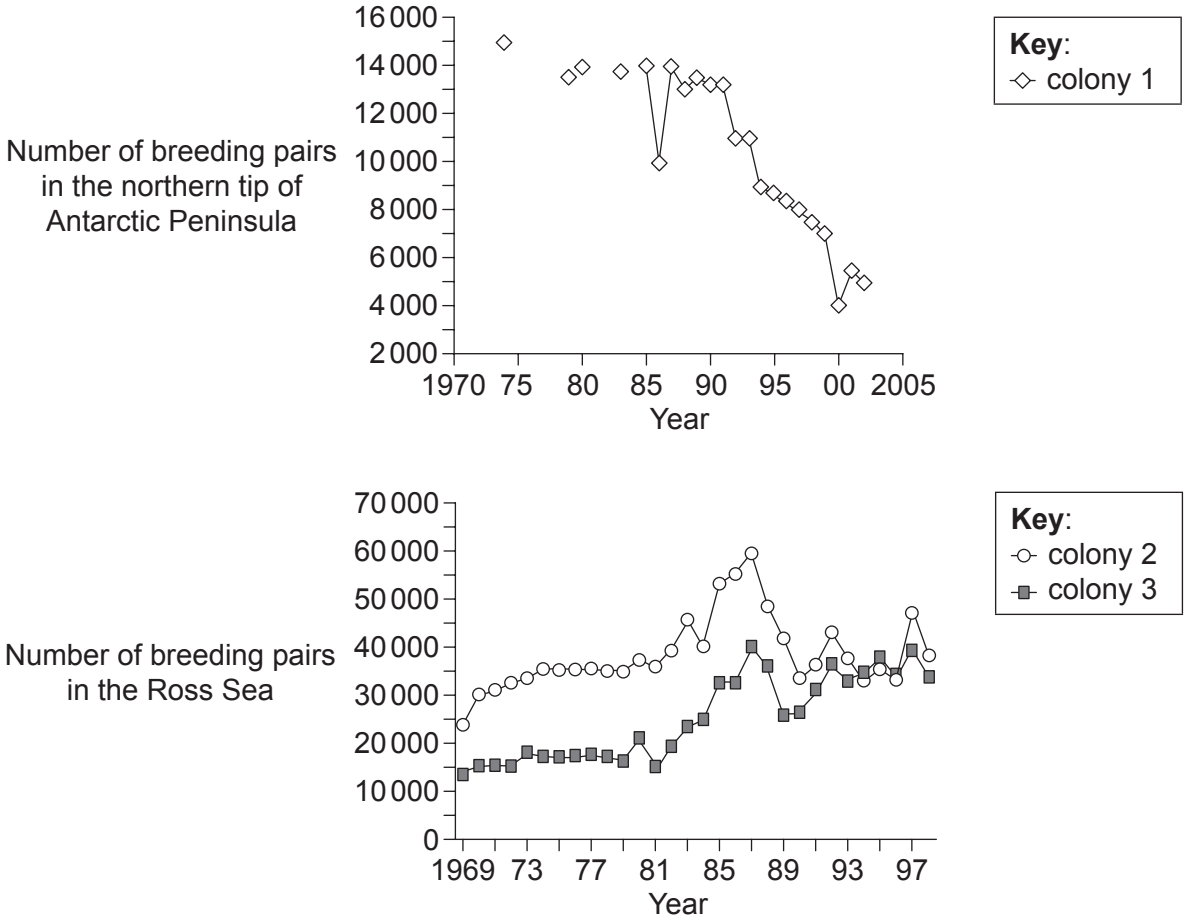
(Question 1 continued)

The graphs show the changes in penguin population in three of the colonies shown on the map.



[Source: Data sourced from: www.penguinscience.com/clim_change.php]

(e) Analyse the trends in colony size of the Adélie penguins in relation to the changes in the sea ice. [3]

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(Question 1 continued)

(f) Discuss the use of Adélie penguins in studying the effects of global warming. [3]

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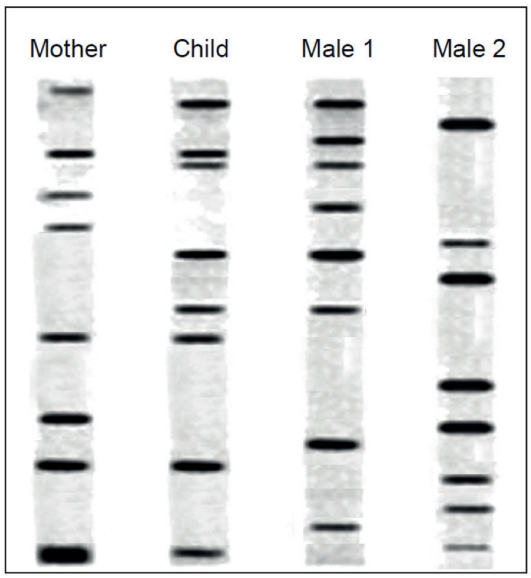
2. The image shows data collected in order to determine the paternity of a child.



[Source: © International Baccalaureate Organization 2015]

(a) State the name of the process used to produce the pattern of bands seen in the image. [1]

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(b) Determine, with a reason, which male is the father of the child. [1]

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3. (a) Outline the cell theory. [2]

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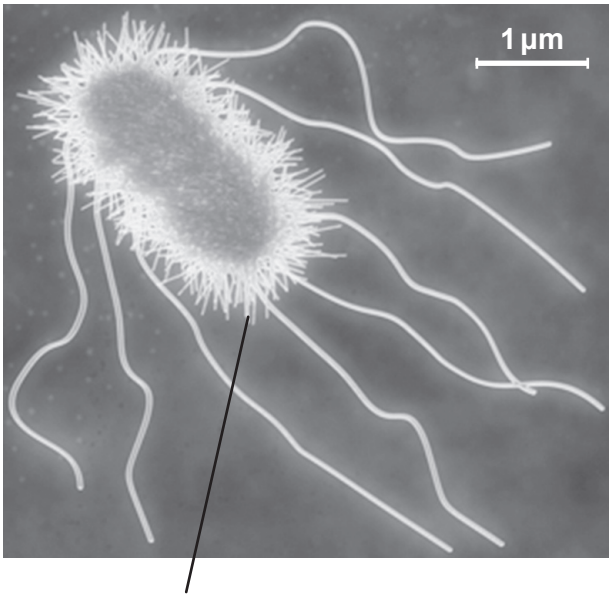
(b) (i) Annotate the electron micrograph of the *Escherichia coli* cell with the function of the indicated structure. [1]



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[Source: National Research Council, Canada]

(ii) Calculate the magnification of the electron micrograph. [1]

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(Question 3 continued)

(c) Explain the role of the following enzymes in DNA replication.

(i) Helicase [1]

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(ii) DNA polymerase III [1]

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(iii) RNA primase [1]

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(iv) DNA ligase [1]

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4. (a) Define *linked genes*. [1]

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(b) In cats, the allele for curled ears (C) is dominant over the allele for normal ears (c). The allele for black colour (B) is dominant over the allele for grey colour (b). A cross occurs between two cats that are both heterozygous for these unlinked traits.

Using a Punnett grid, predict the ratio of phenotypes of offspring in the next generation. [3]

(c) If a wild population of cats contained both curled ears and normal ears, explain how the proportion of these two phenotypes could change in the population. [4]

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Section B

Answer **two** questions. Up to two additional marks are available for the construction of your answers. Write your answers in the boxes provided.

5. (a) Outline the structure and functions of nucleosomes. [4]

(b) Explain how DNA is used to pass on genetic information to offspring accurately but also produce variation in species. [8]

(c) Accurate transmission of base sequences to offspring depends on successful gamete production. Describe how spermatogenesis occurs in humans. [6]

6. (a) Draw a labelled diagram of the human heart showing the attached blood vessels. [6]

(b) Describe the action of the heart in pumping blood. [5]

(c) All parts of the body change the composition of the blood. Explain how the nephron changes the composition of blood. [7]

7. (a) Explain chemiosmosis as it occurs in photophosphorylation. [8]

(b) Draw an annotated graph of the effects of light intensity on the rate of photosynthesis. [4]

(c) Using a **named** example of a genetically modified crop, discuss the specific ethical issues of its use. [6]

8. (a) Explain how minerals move into plants. [8]

(b) Outline the conditions needed for the germination of a typical seed. [3]

(c) Following germination of seeds, plants undergo a rapid increase in the number of cells. Describe stages in the cell cycle that result in this increase of cells. [7]