Diploma Programme
Programme du diplôme
Programa del Diploma

Biology
Standard level
Paper 2

Monday 14 May 2018 (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.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is **[50 marks]**.

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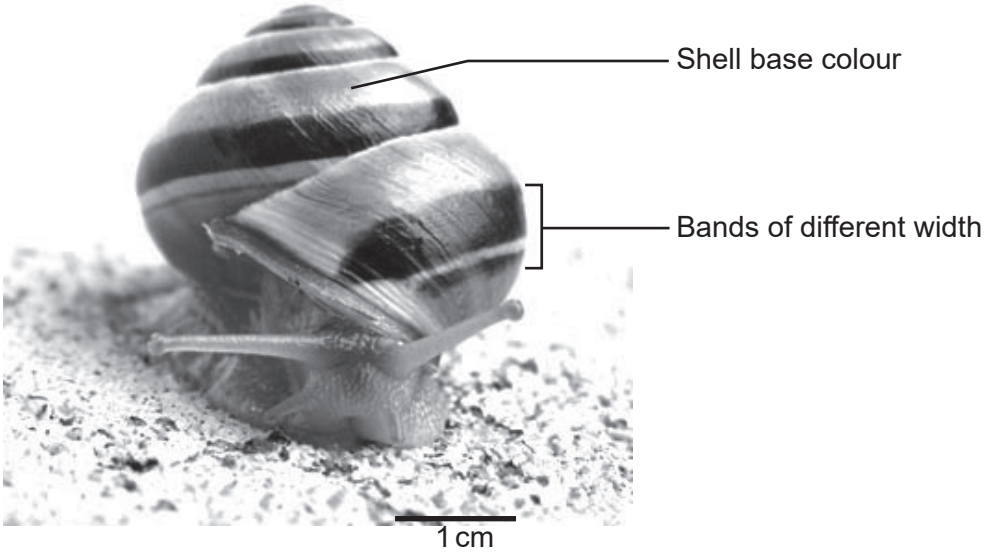
Answers written on this page
will not be marked.

Section A

Answer **all** questions. Answers must be written within the answer boxes provided.

1. The land snail *Cepaea nemoralis* is very common in North America and in Europe. The base colour of its shell varies between brown, pink and yellow, and also in its intensity. Some shells are unbanded, but most show one to five bands of different width on top of the shell base colour.



[Source: © International Baccalaureate Organization 2018]

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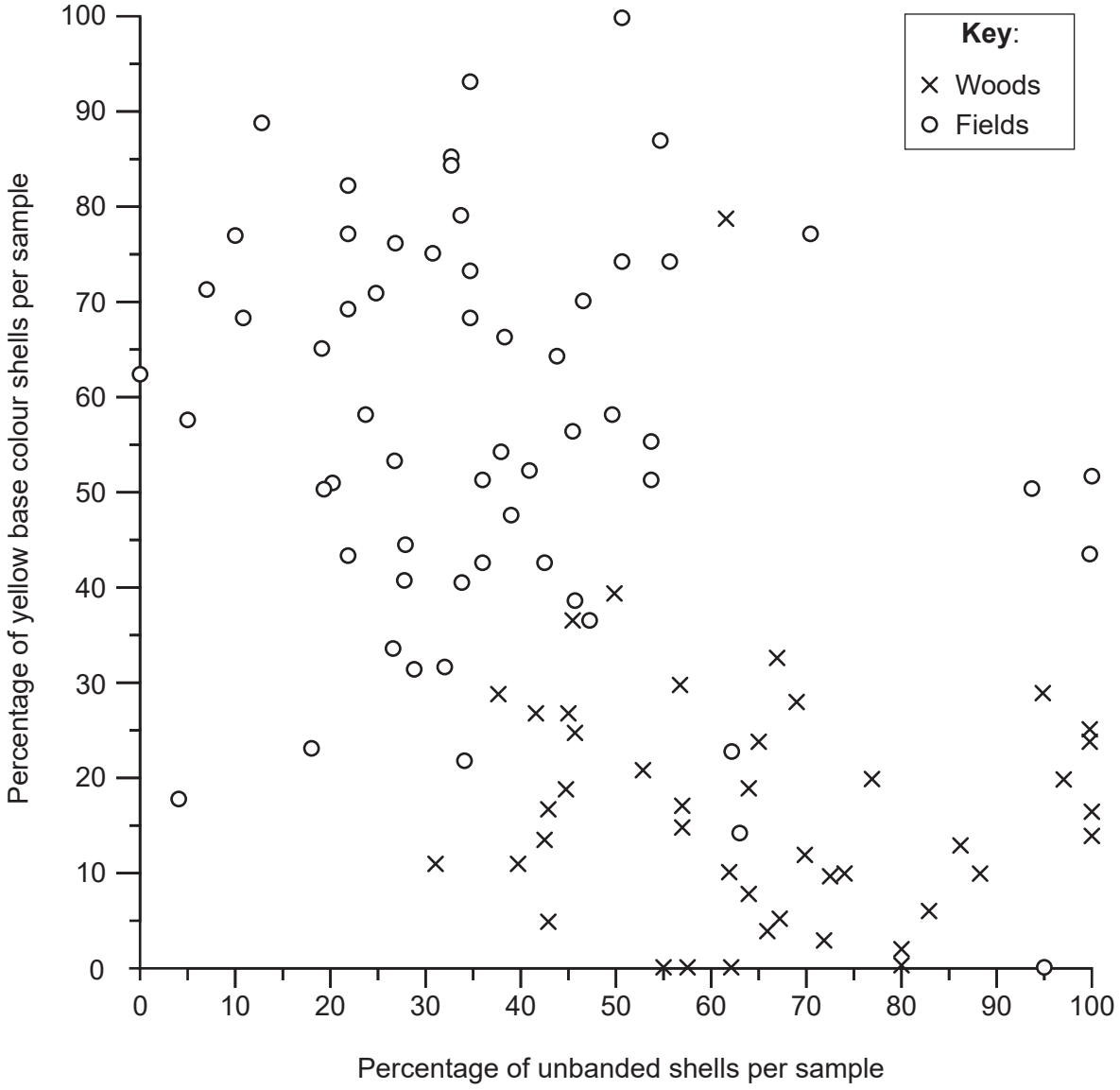
(Question 1 continued)

In the early 1950s, scientists studied the proportion of colours and banding of *C. nemoralis* in woods and fields near Oxford, UK, which differed in the type of plants and background colour. Each data point on the graph represents the percentage of yellow base colour shells and unbanded shells in a sample from either one type of wood or field, although other snail colours were present.



[Source: Adapted from Cain, A J and Sheppard, PM (1954), Natural Selection in Cepaea, *Genetics* 39 no. 1, p. 99.]

(a) Determine the maximum percentage of yellow base colour shells found in woods. [1]

. . . . . %

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(Question 1 continued)

(b) Suggest **either one** possible advantage **or one** disadvantage of having a banded shell, stating whether it is an advantage or disadvantage. [1]

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(c) Using the data in the graph, distinguish between the distribution of *C. nemoralis* shells in woods and fields. [2]

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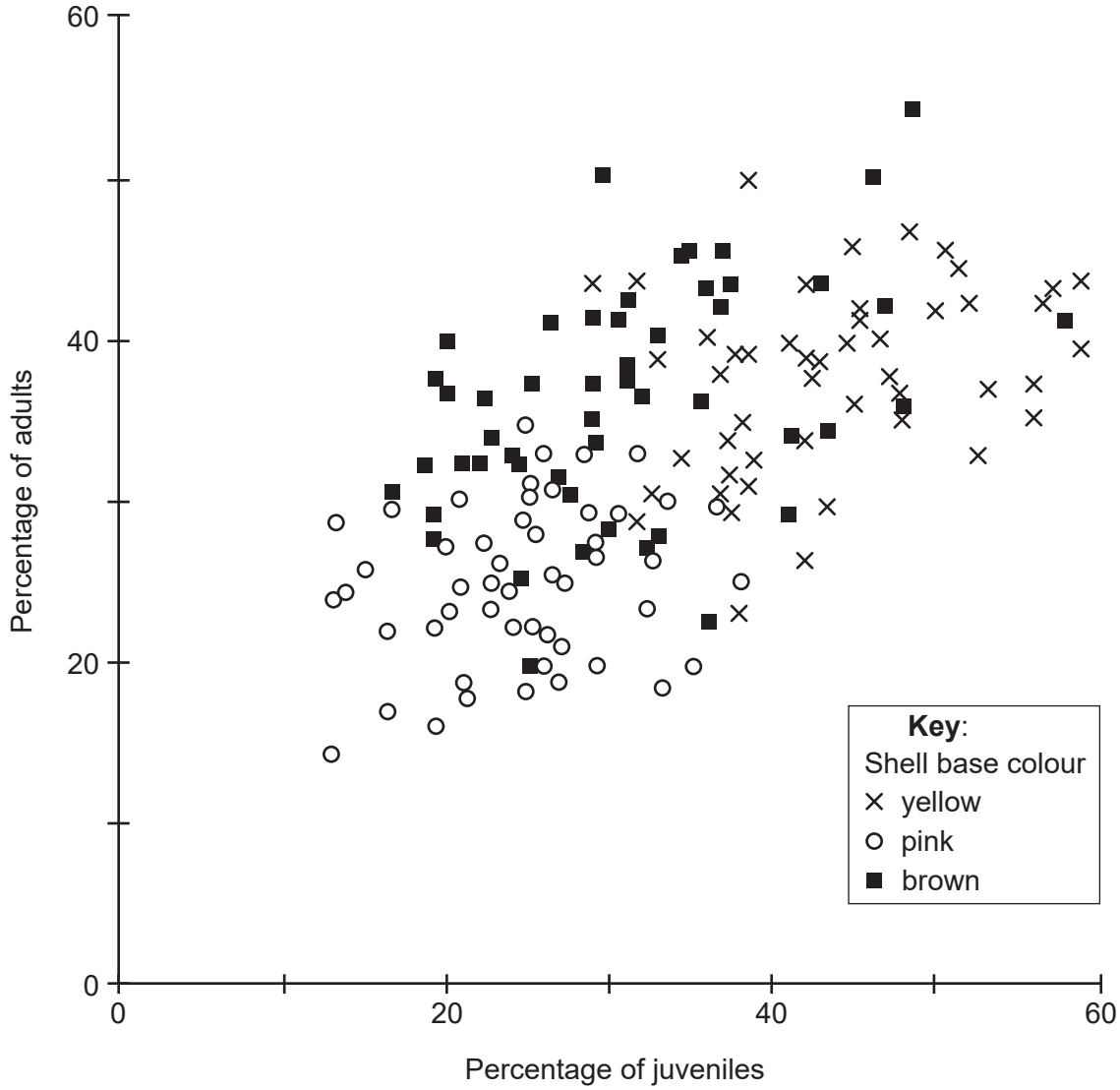
(Question 1 continued)

The population of *C. nemoralis* has been studied for many years in open fields in a similar area. In the graph, each data point represents the percentage of adults of a given base colour plotted against the percentage of juveniles of the same base colour collected each year.



[Source: Adapted from Cain, A J, *et al.*, Population size and morph frequency in a long-term study of Cepaea nemoralis (1990), *Proceedings of the Royal Society B*, 240, page 239, DOI: 10.1098/rspb.1990.0036, http://rspb.royalsocietypublishing.org/content/240/1298/231; permission conveyed through Copyright Clearance Center, Inc.]

(d) Deduce from the data in the graph which shell base colours are on average most and least frequent among adult snails. [2]

Most frequent: . . . . . .

Least frequent: . . . . . .

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(Question 1 continued)

(e) Discuss whether there is evidence in the data that colour plays a role in the survival of the snails. [3]

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(f) Using the theory of natural selection, explain the differences shown in the graph between the three colours of snail. [3]

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2. (a) (i) Distinguish between the structure of amylose and the structure of amylopectin. [1]

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(ii) Suggest the reason for cellulose passing undigested through the human gut. [1]

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(b) Draw an annotated diagram to show how a peptide bond is formed. [3]

(c) State **two** structural features that differ between RNA and DNA. [2]

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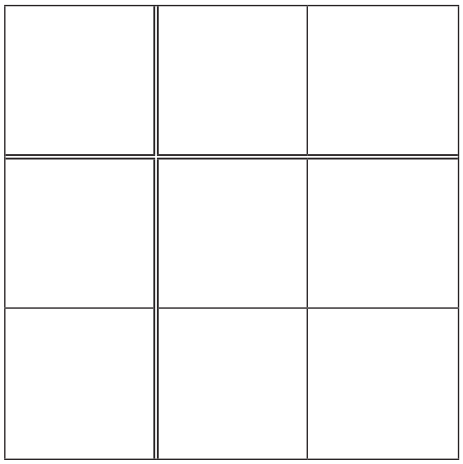
3. (a) Using the Punnett grid, explain how two parents can have children with any of the different ABO blood groups. [3]



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(b) Distinguish between the structure of arteries and the structure of veins. [3]

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(c) Explain how cuts in the skin are sealed by blood clotting. [2]

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4. (a) (i) State **one** reason that viruses are not classified as living organisms. [1]

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(ii) State the plant phylum which is characterised by the absence of vascular tissue. [1]

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(b) *C. nemoralis* (pictured in question 1) is a mollusc. Identify **two** external features that distinguish this snail from an arthropod. [2]

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(c) Outline the role of plant pigments in the process of photosynthesis. [3]

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Section B

Answer **one** question. Up to one additional mark is available for the construction of your answer. Answers must be written within the answer boxes provided.

5. (a) Draw a labelled diagram to show the fluid mosaic model of the plasma membrane. [4]

(b) Unicellular and multicellular organisms share the same functions of life. Outline **four** functions of life. [4]

(c) The structure of organisms is based on organic molecules containing carbon. Explain the cycling of carbon in an ecosystem. [7]

6. (a) Outline the role of the parts of an alveolus in a human lung. [4]

(b) Explain how antibiotic resistance can evolve in bacteria, such as those causing pneumonia. [4]

(c) Many diseases are caused by bacteria and other pathogens. Explain, using examples, how **other** factors can lead to disease in humans. [7]