



BIOLOGY
STANDARD LEVEL
PAPER 2

Candidate number

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Tuesday 11 May 2004 (afternoon)

1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

- Write your candidate number in the box 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 candidate 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. Ecosystems require an input of energy, water and nutrients to maintain themselves. Nutrients may be reused through recycling within ecosystems.

Nutrient cycling within an ecosystem has been studied in many biomes. One factor studied is the mean residence time (MRT), which is the amount of time needed for one cycle of decomposition (from absorption by organism to release after death). The table below gives the mean residence time for certain nutrients in four different biomes. In addition, the plant productivity is also shown. (Plant productivity gives an indication of the quantity of biomass potentially available to consumers.)

Biome	Mean residence time / years						Plant productivity / g C m ⁻² yr ⁻¹
	Carbon	Nitrogen	Phosphorus	Potassium	Calcium	Magnesium	
Sub-arctic forest	353.0	230.0	324.0	94.0	149.0	455.0	360
Temperate forest	4.0	5.5	5.8	1.3	3.0	3.4	540
Chaparral	3.8	4.2	3.6	1.4	5.0	2.8	270
Tropical rainforest	0.4	2.0	1.6	0.7	1.5	1.1	900

[Source: W H Schlesinger (1991), in M Bush, *Ecology of a Changing Planet* (1997), Prentice Hall, page 67]

- (a) (i) State which nutrient shows the shortest mean residence time in a temperate forest. [1]

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- (ii) Identify the biome in which potassium has the longest mean residence time. [1]

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- (b) Compare the mean residence time for nutrients in the temperate forest and chaparral. [2]

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(Question 1 continued)

- (c) Evaluate the relationship between the mean residence time and plant productivity for the different biomes. [2]

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- (d) Suggest **one** reason for the difference in mean residence time of nutrients in the tropical rainforest and the sub-arctic forest. [1]

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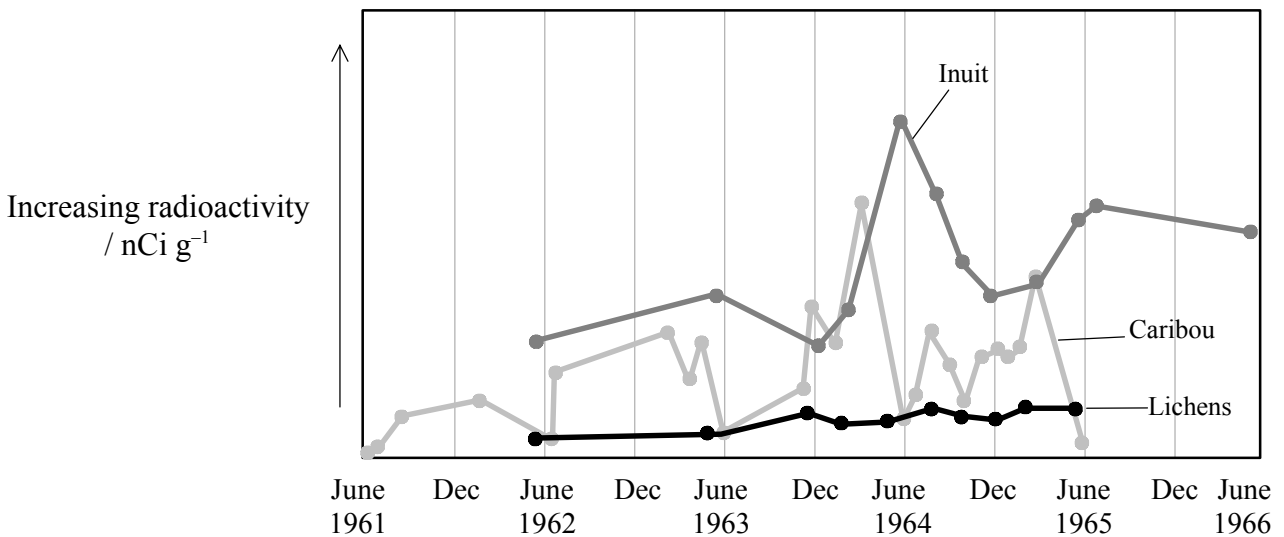
- (e) Define the term *ecosystem*. [1]

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(Question 1 continued)

In addition to nutrients, other atmospheric elements may also enter the ecosystem. Radioactive cesium-137 was released into the atmosphere by atomic bomb tests in 1961. The cesium-137 was deposited in the soil and on to plants. The graph shows the amount of radioactivity found in the tissues of lichens (an alga and a fungus growing together), caribou (a member of the deer family) and the Inuit (people of Alaska and Northern Canada) in the Anaktuvuk Pass of Alaska.



[Source: W G Hanson, "Cesium-137 in Alaska Lichens, Caribou and Inuit." *Health Physics*, (1967), 13, pages 383-389, Pergamon Press]

(f) Describe the level of cesium-137 in the Inuit from 1962 through to 1965. [2]

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(g) The three organisms form a food chain. Deduce the trophic level of [2]

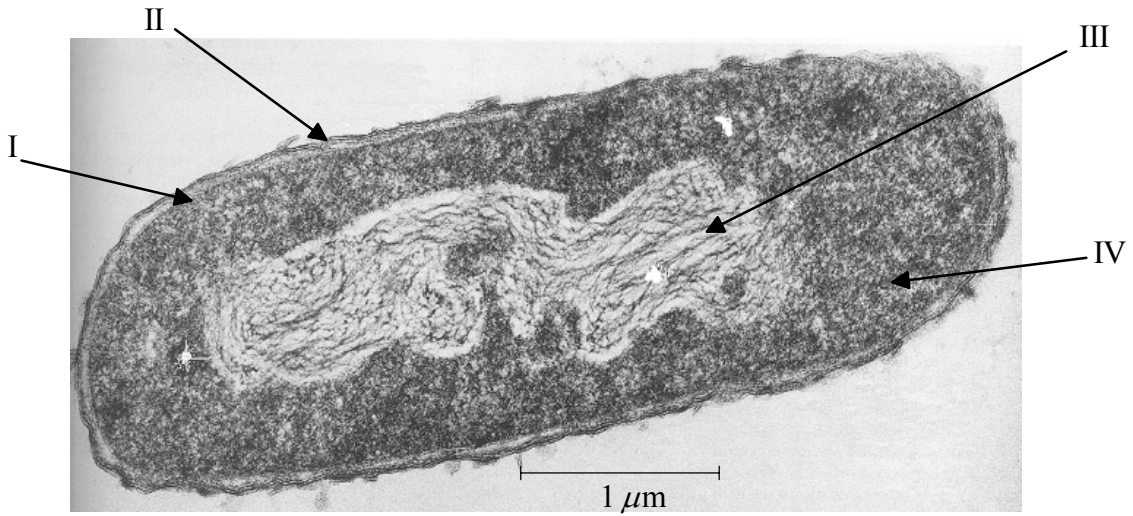
- (i) lichens.
- (ii) the Inuit.

(h) Suggest a reason for the difference in the amount of cesium-137 found in lichens, caribou and the Inuit. [1]

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2. (a) Label the following electron micrograph of a prokaryotic cell. [2]



[Source: Stephen Wolfe, *Biology of the Cell*, (1995), 2nd edition, Brooks Cole, page 5]

- I:
- II:
- III:
- IV:

(b) Calculate the magnification of the prokaryotic cell. [1]

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(c) State **two** advantages of using a light microscope over an electron microscope. [2]

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3. (a) Define the term *co-dominance*. [1]

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(b) A man of blood type AB and a woman of blood type B are expecting a baby. The woman's mother had blood type O. Deduce the possible phenotypes of the offspring from the cross shown below. [4]

Parent phenotypes		AB		B	
Parents genotypes		<input type="text"/>		<input type="text"/>	
Parent gametes	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
F ₁ genotypes	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
F ₁ phenotypes	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

4. (a) State the main photosynthetic pigment in plants. [1]

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(b) State the **two** materials used to convert carbon dioxide to organic molecules in plants. [2]

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(c) Explain **two** ways in which the rate of photosynthesis can be measured. [4]

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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 candidate 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 of an adult male reproductive system. [4]
- (b) Outline the process of in vitro fertilization (IVF). [6]
- (c) Discuss the advantages and disadvantages of genetic screening. [8]
6. (a) Draw a labelled diagram of the digestive system. [5]
- (b) State the sources, substrate, product, and optimum pH conditions for the enzyme amylase. [4]
- (c) Explain the control of blood glucose. [9]
7. (a) State **one** function of each of the following organelles. [5]
- Lysosome
 - Golgi apparatus
 - Rough endoplasmic reticulum
 - Nucleus
 - Mitochondrion
- (b) Explain the similarities and differences in anaerobic and aerobic cellular respiration. [8]
- (c) Describe the use of carbohydrates and lipids for energy storage in animals. [5]
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