**Pearson
Edexcel GCE**

Centre Number

Candidate Number

Biology

**Advanced
Unit 4: The Natural Environment and Species Survival**

Monday 8 June 2015 – Afternoon
Time: 1 hour 30 minutes

Paper Reference
6BI04/01

You must have:
Calculator, ruler, rubber and pencil.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name,
  centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 90.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*****) are ones where the quality of your
  written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as
  well as the clarity of expression, on these questions.*
- Candidates may use a calculator.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

PEARSON

Answer ALL questions.

Some questions must be answered with a cross in a box ⊠. If you change your mind about an answer, put a line through the box ⊠ and then mark your new answer with a cross ⊠.

1 One role of the skin is to protect the body from infection.

(a) (i) Explain how skin flora protect the body from infection.

(2)

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(ii) The skin produces lipids that protect the body from infection.

Place a cross ⊠ in the box next to the correct explanation of how these lipids protect the body from infection.

(1)

⊠ **A** they are alkalis that kill bacteria

⊠ **B** they have antimicrobial properties that inhibit the growth of bacteria

⊠ **C** they are enzymes that destroy viruses

⊠ **D** they are water soluble and prevent viruses from replicating

(b) The skin contains a fibrous protein. This protein forms a barrier to the entry of microorganisms.

(i) Place a cross ⊠ in the box next to the name of this protein.

(1)

⊠ **A** cytokine

⊠ **B** interferon

⊠ **C** keratin

⊠ **D** lysozyme

(ii) The primary structure of a protein is important in determining its final structure and properties.

Describe the structure and properties of fibrous proteins.

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(iii) Describe the roles of the template (antisense) DNA strand and mRNA in determining the primary structure of a protein.

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(Total for Question 1 = 12 marks)

2 The diagram below shows part of the carbon cycle. The processes A, B, C, D and E, transfer carbon.

forests

oceans

E

A

D

B

carbon dioxide in the air

C

fossil fuels
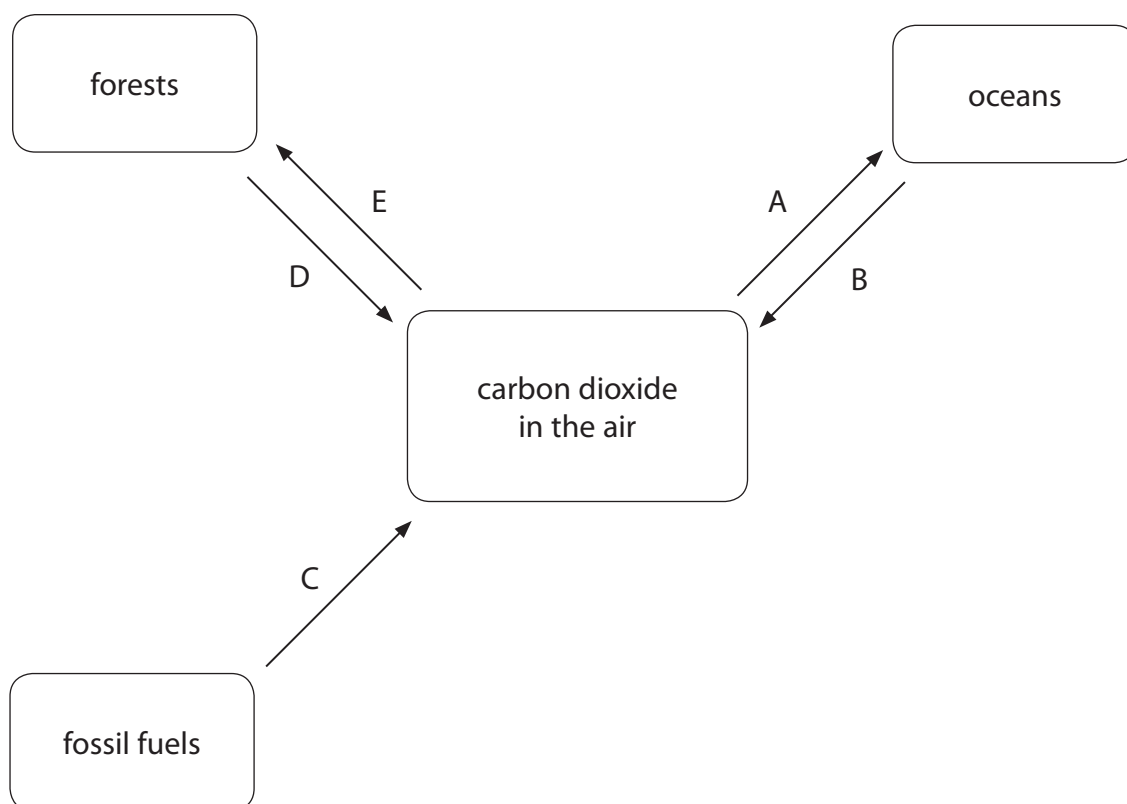
(a) Explain how carbon dioxide is removed from the air into the oceans by process A.

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(b) Suggest how carbon dioxide is returned to the air from the oceans by process B.

(1)

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(c) Place a cross ⊠ in the box next to the gases produced by process C.

(1)

⊠ **A** carbon dioxide and methane

⊠ **B** carbon dioxide and water vapour

⊠ **C** carbon dioxide, methane and water vapour

⊠ **D** carbon dioxide, oxygen and water vapour

(d) Describe the role of bacteria in process D in the diagram.

(3)

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(e) Place a cross ⊠ in the box next to the reaction in process E that uses carbon dioxide.

(1)

⊠ **A** light-dependent reaction

⊠ **B** light-independent reaction

⊠ **C** photolysis

⊠ **D** photophosphorylation

(f) The table below shows how much carbon is being transferred by each of the processes in the diagram.

Process	A	B	C	D	E
Mass of carbon transferred / au	338	332	23	444	450

(i) Calculate how much more carbon is entering the air than is leaving it.

Show your working.

(2)

Answer ....

(ii) Suggest why more carbon is entering the air than is leaving it.

(3)

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(Total for Question 2 = 13 marks)

3 Duckweed is a small plant that floats on the surface of water. It could be a source of animal feed as it grows very quickly. Duckweed absorbs dissolved inorganic ions and this decreases water pollution.

Duckweed grows by producing more fronds, which then separate into new plants.

The diagram below shows some duckweed growing in a beaker containing a solution of inorganic ions.

fronds — one duckweed plant

roots — solution of inorganic ions
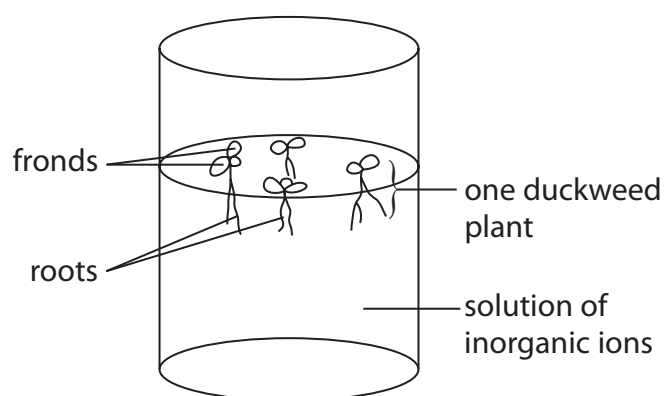
(a) The graph below shows the growth of duckweed over a four-day period.
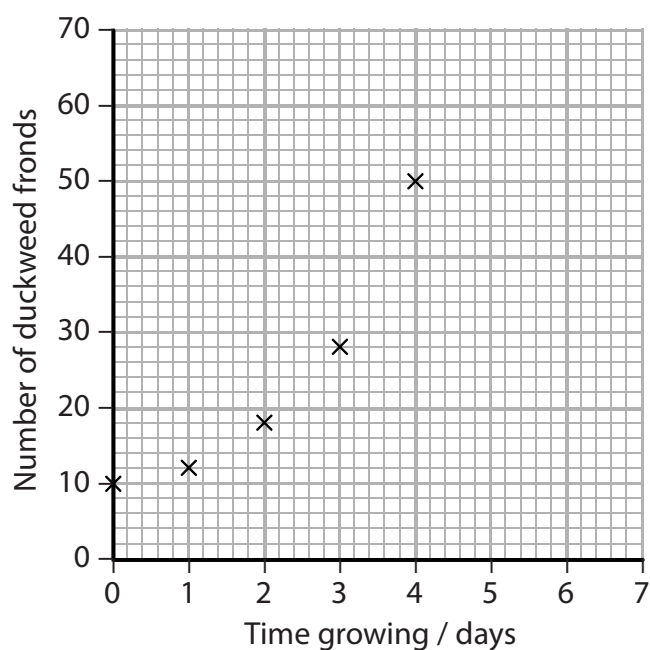
(i) Explain what the solution should contain for the optimum growth of duckweed.

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(ii) Explain how the information in this graph could be used to estimate the increase in growth after a further six days.

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*(b) Describe an experiment that could be carried out to investigate the effect of temperature on the growth of duckweed.

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(Total for Question 3 = 10 marks)

4 Phagocytosis is a non-specific response of the body to infection.

(a) Explain the meaning of each of the following terms.

(i) Phagocytosis

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(ii) Non-specific response

(2)

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(iii) Infection

(2)

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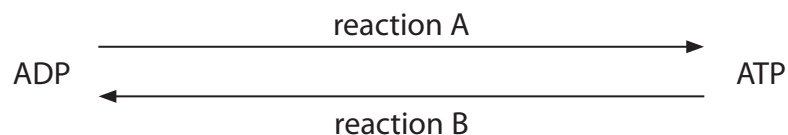
(b) Phagocytosis requires a source of energy in the form of ATP.

The diagram below shows the relationship between ATP and ADP.

reaction A

ADP ⟶ ATP

⟵

reaction B

Place a cross ⊠ in the box next to the name of reaction A and reaction B.

(2)

Reaction	Name of reaction				
	autolysis	decarboxylation	hydrolysis	phosphorylation	polymerisation
A	⊠	⊠	⊠	⊠	⊠
B	⊠	⊠	⊠	⊠	⊠

(c) ATP is synthesised in mitochondria.

(i) In the space below, draw and label a diagram to show the structure of a mitochondrion.

(4)

(ii) Name **one** other organelle that synthesises ATP.

(1)

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(Total for Question 4 = 13 marks)

Turn over ▶

**5** Infection of the lungs with *Mycobacterium tuberculosis* can result in a range of symptoms. These symptoms can include severe breathing problems, a persistent cough and coughing up blood.

(a) The photograph below shows a tubercle in part of a lung infected with *Mycobacterium tuberculosis,* as seen using a light microscope.

A tubercle is a solid mass of dead tissue, macrophages and bacteria.
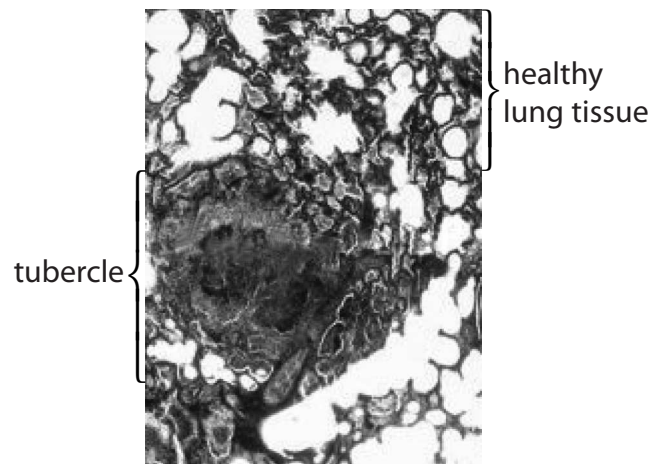
©John Burbidge/Science Photo Library

Magnification ×50

Using the information in the photograph and your knowledge of gas exchange surfaces, suggest why this infection can result in these symptoms.

(4)

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(b) Treating *Mycobacterium tuberculosis* infections can be a problem, as the bacteria are resistant to many antibiotics.

There are many strains of *Mycobacterium tuberculosis*. Different strains are resistant to different antibiotics or combinations of antibiotics.

The chart below shows the percentage of resistant strains of *Mycobacterium tuberculosis* to six different antibiotics, or combinations of antibiotics, in 2006, 2007 and 2008.
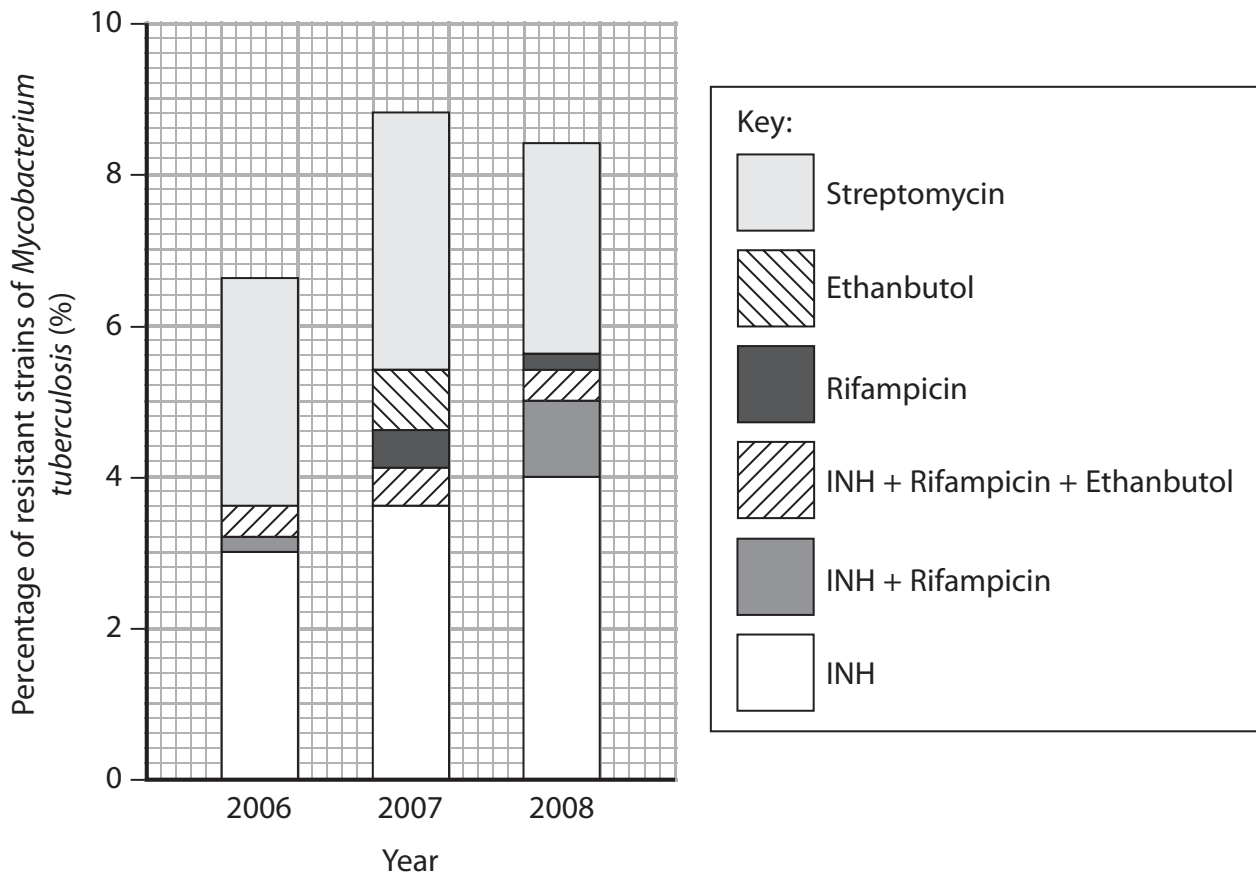
(i) Using the information in the graph, compare the types of antibiotics and combinations of antibiotics that the *Mycobacterium tuberculosis* are resistant to in 2006 with 2007.

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(ii) The percentage of strains of *Mycobacterium tuberculosis* resistant to the antibiotic INH has increased during these three years.

Suggest how natural selection could have resulted in this increase.

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(iii) Suggest how hospitals could prevent an increase in the percentage of strains of *Mycobacterium tuberculosis* resistant to antibiotics.

(2)

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(Total for Question 5 = 12 marks)

6 The time of death of a person can be estimated in a number of ways. One method is to use a Henssge nomogram.

The Henssge nomogram relates the time of death to the ambient (surrounding) temperature, the core temperature and the mass of the body.

(a) Explain why the ambient temperature and the core temperature of the body are used to determine the time of death of a person.

(3)

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(b) The chart shows a Henssge nomogram.

The steps below need to be followed to estimate the time of death using the Henssge nomogram:

Step 1

Draw a straight line between the core temperature of the body and the ambient temperature (= line 1)

Step 2

Draw a straight line that extends from the centre of the circle through the diagonal line, at the point where it crosses line 1 (= line 2)

Step 3

Read the time of death from the nomogram at the point line 2 crosses the appropriate semicircle for the mass of the body.

Henssge nomogram

core temperature of body / °C

mass of the body / kg

ambient temperature / °C

diagonal line

circle
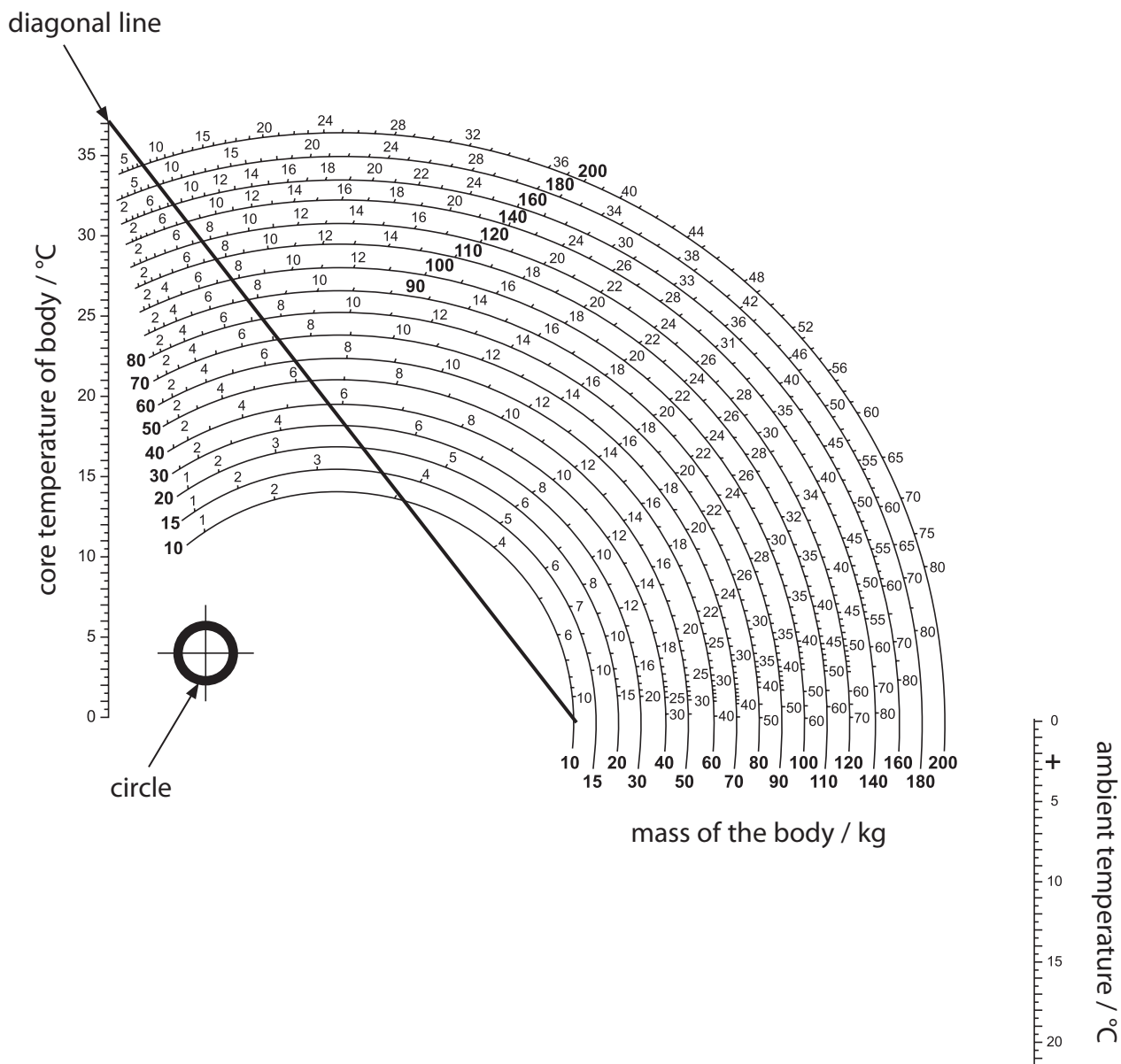
(i) A body was found. The mass of the body was 100 kg and the core temperature of the body was 25 °C. The ambient temperature was 15 °C.

Use the Henssge nomogram to estimate the time of death.

(3)

time of death = ... hours ago

*(ii) The Henssge nomogram is used to estimate the time of death of a naked body, lying stretched out and in still air.

Suggest how a change in each of these three factors could affect the estimated time of death. Give reasons for your answer.

(6)

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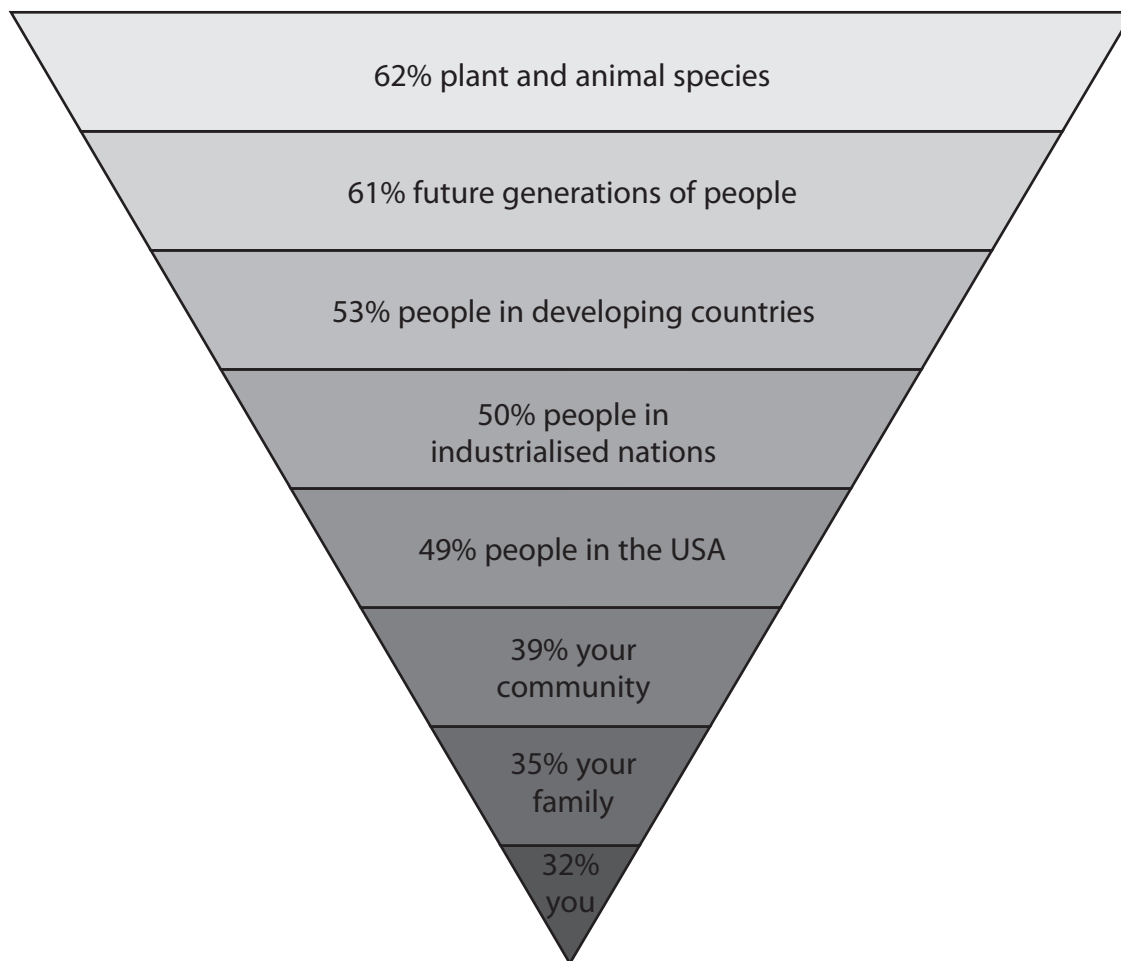
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(Total for Question 6 = 12 marks)

7 A survey was conducted in the USA to find out what harm people thought global warming could have.

The people were asked if they thought global warming could harm the eight groups shown in the diagram.

The diagram below shows the percentage of people who thought each group would be harmed.

62% plant and animal species

61% future generations of people

53% people in developing countries

50% people in industrialised nations

49% people in the USA

39% your community

35% your family

32% you

(a) Explain the meaning of the term **global warming**.

(2)

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(b) (i) Describe and explain how global warming could affect plant species.

(4)

(ii) Explain how the effects on plant species could affect animal species.

(3)

(c) This survey shows that 61% thought future generations of people could be harmed by global warming.
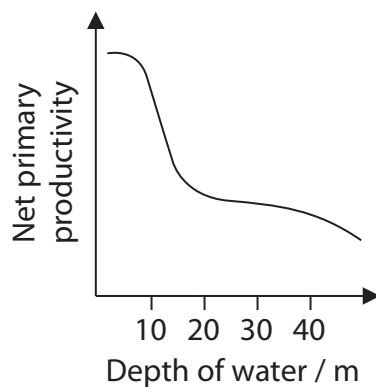
Suggest why the rest of the people surveyed thought that future generations of people would **not** be harmed by global warming.

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(Total for Question 7 = 12 marks)

8 The graph below shows how the depth of water in a freshwater lake affects the net primary productivity (NPP).

(a) Place a cross ⊠ in the box next to the units that should appear on the *y*-axis of this graph.

(1)

⊠ **A** kg

⊠ **B** kJ m^{-1}

⊠ **C** kJ m^{-2} year^{-1}

⊠ **D** kg m^{-1} year^{-1}

(b) Place a cross ⊠ in the box next to the equation that describes the relationship between NPP, gross primary productivity (GPP) and respiration (R).

(1)

⊠ **A** GPP = R − NPP

⊠ **B** NPP = GPP − R

⊠ **C** NPP = GPP + R

⊠ **D** R = GPP + NPP

(c) Suggest an explanation for the effect of depth of water on the NPP in this freshwater lake.

(4)

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(Total for Question 8 = 6 marks)

TOTAL FOR PAPER = 90 MARKS

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