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**ENVIRONMENTAL SYSTEMS AND SOCIETIES**
**STANDARD LEVEL**
**PAPER 1**

Candidate session number

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Monday 6 May 2013 (morning)

1 hour

Examination code

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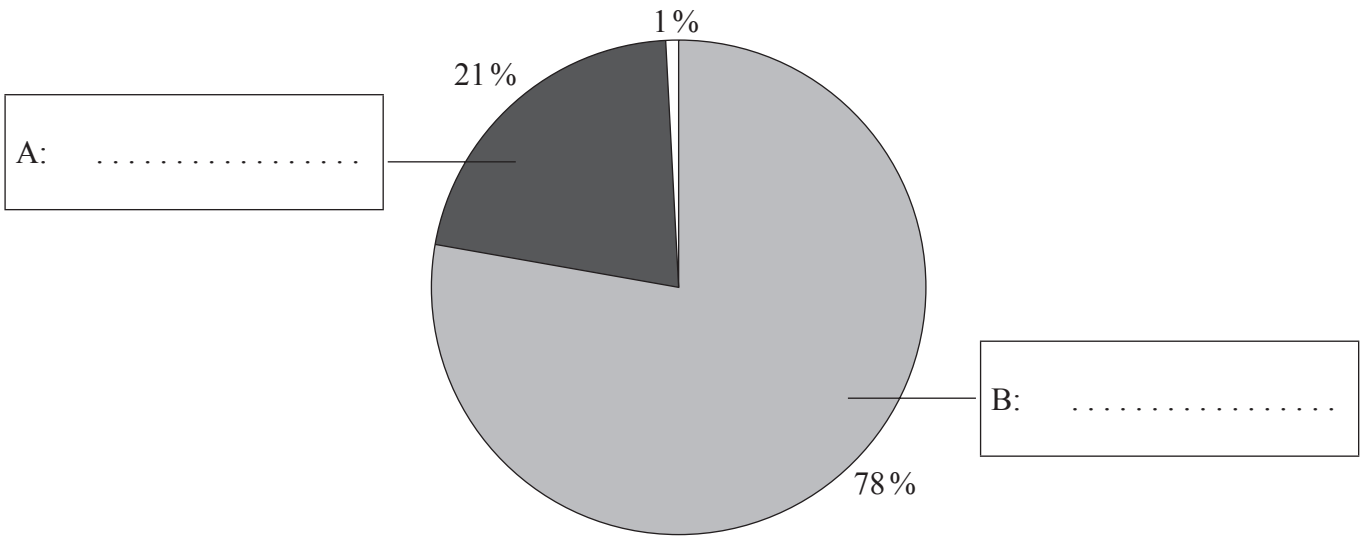
INSTRUCTIONS TO CANDIDATES

- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all questions.
- Write your answers in the boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is *[45 marks]*.

0120

**1.** Figure 1 below is a pie chart showing the percentages (by volume) of gases in the troposphere.

**Figure 1**




[Source: http://www.chem.shef.ac.uk/chm131-2002/cha02ncm/comp.html]

(a) Label gases A and B on Figure 1 above. *[1]*

(b) (i) State the name of the solar radiation absorbed by the protective layer of ozone found in the stratosphere. *[1]*

. . . . . .

(ii) Refrigerators are sometimes a source of ozone-depleting substances. List **two** other sources of ozone-depleting substances (ODS). *[1]*

1. . . . . .

2. . . . . .

*(This question continues on the following page)*

*(Question 1 continued)*

(iii) Evaluate the success of the Montreal Protocol in reducing emissions of ozone-depleting substances. *[2]*

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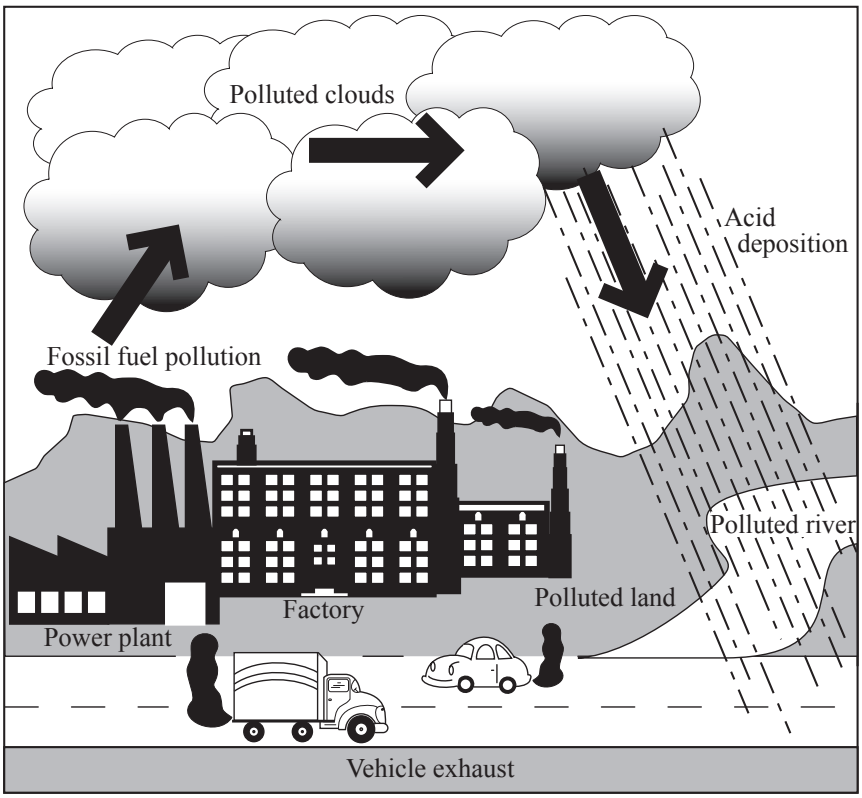
**2.** Figure 2 below shows some of the sources and processes that lead to acid deposition.

**Figure 2**




[Source: Adapted from http://www.teachengineering.com/view_lesson.php?url=http://www.teachengineering.com/collection/cub_/lessons/cub_air/cub_air_lesson01.xml&rights=true#fig3.jpg]

(a) (i) Burning fossil fuels produces gases often called $SO_x$ and $NO_x$. State the names of the **two** acids usually produced when $SO_x$ and $NO_x$ dissolve in water. *[1]*

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*(This question continues on the following page)*

*(Question 2 continued)*

(ii) Outline **one** example of a transformation process and **one** example of a transfer process shown in Figure 2. *[2]*

Transformation process:

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. . . . . .

Transfer process:

. . . . . .

. . . . . .

(iii) Discuss why acid deposition has been controlled mainly by regional agreements rather than by global agreements. *[2]*

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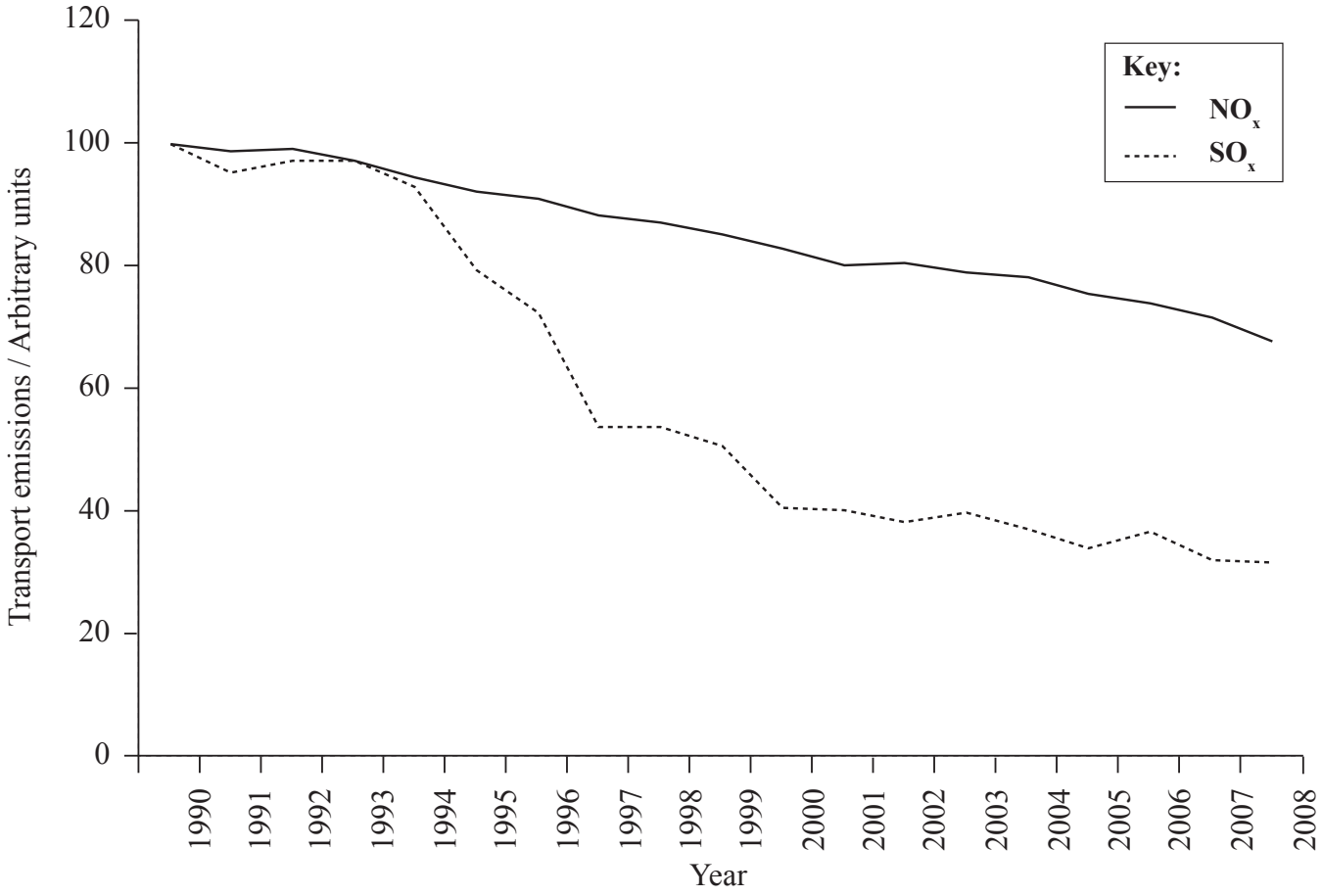
*(Question 2 continued)*

Figure 3 below shows the changes in European transport emissions of $SO_x$ and $NO_x$ between 1990 and 2007.

**Figure 3**




[Source: adapted from http://www.eea.europa.eu/data-and-maps/figures/trend-in-emissions-of-air]

(b) (i) Compare and contrast the trends in transport emissions for $SO_x$ and $NO_x$, shown in Figure 3. *[2]*

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*(This question continues on the following page)*

*(Question 2 continued)*

(ii) Outline how both an advance in technology and a change in human activity have reduced transport emissions of $SO_x$ and $NO_x$. *[2]*

Advance in technology:

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. . . . . .

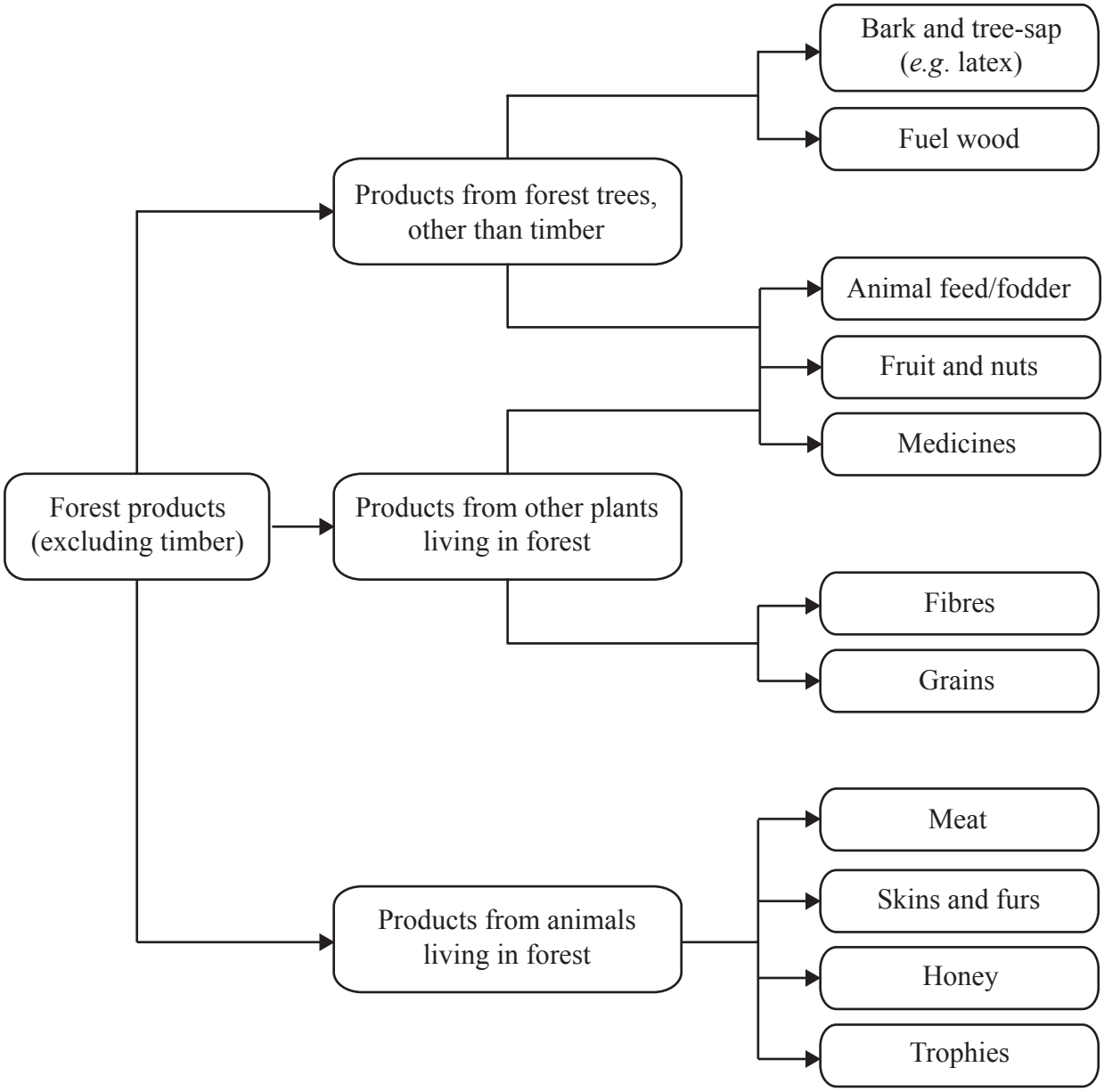
Changes in human activity:

. . . . . .

. . . . . .

**3.** Figure 4 below shows some of the products that can be harvested from a forest.

**Figure 4**




(a) (i) State the terms used for the three classes of natural capital. *[1]*

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*(This question continues on the following page)*

*(Question 3 continued)*

(ii) Using a **named** example from Figure 4, explain how natural capital may provide a sustainable natural income. *[2]*

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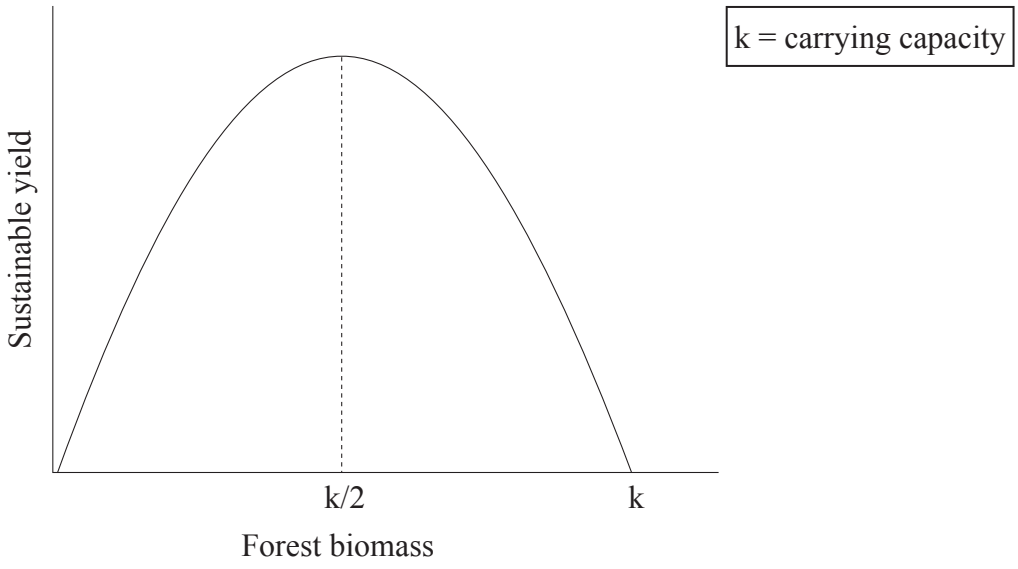
*(Question 3 continued)*

Figure 5 below is a theoretical model of the relationship between forest biomass and its sustainable yield.

**Figure 5**




[Source:http://www.fao.org/docrep/006/y5027e/y5027eli.gif]

(b) (i) Define *carrying capacity*. *[1]*

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(ii) Explain the term *sustainable yield* for a forest. *[1]*

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*(This question continues on the following page)*

*(Question 3 continued)*

(iii) At carrying capacity the total biomass of the forest is 300 tonnes. Using the model in Figure 5, determine the value of total forest biomass which would theoretically give the highest sustainable yield for the forest. Use appropriate units in your answer. *[1]*

. . . . . .

(iv) Suggest **one** reason why harvesting the maximum sustainable yield of biomass calculated from this model might not be sustainable in the long term. *[1]*

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(c) Identify **one** method of reducing soil loss where bare soil is exposed after forest clearance. *[1]*

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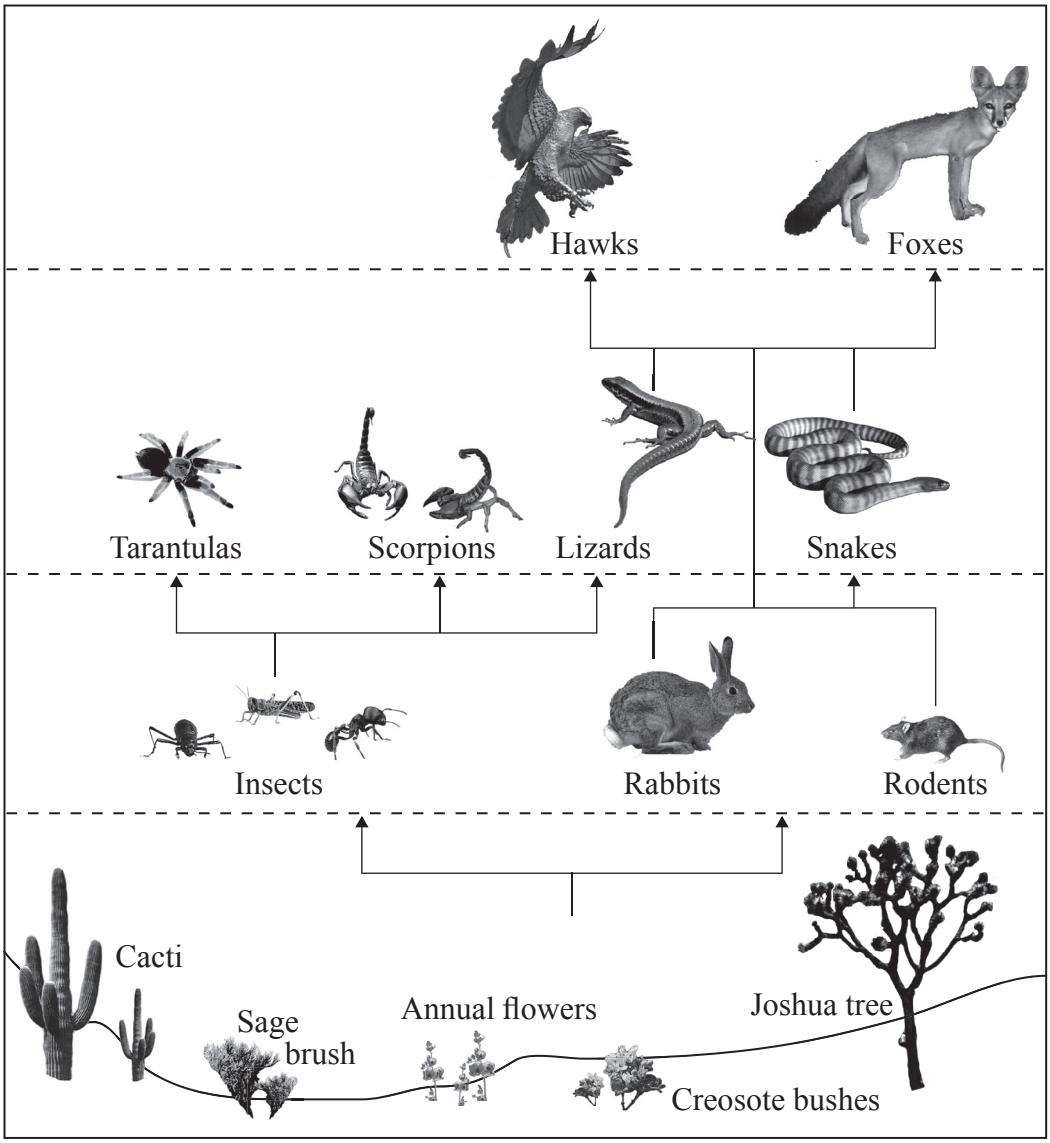
**4.** Figure 6 below shows a desert food web.

**Figure 6**




[Source: adapted from http://image.wistatutor.com/content/feed/tvcs/Screen20shot202010-09-1520at209.13.5520AM.png]

*(This question continues on the following page)*

*(Question 4 continued)*

(a) Using Figure 6,

(i) Construct a food chain with **four** trophic levels. *[2]*

(ii) Suggest why the population of snakes might increase if all the foxes were killed. *[1]*

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(b) Explain, giving **two** reasons, why biodiversity is lower in a desert ecosystem than in a tropical rainforest. *[2]*

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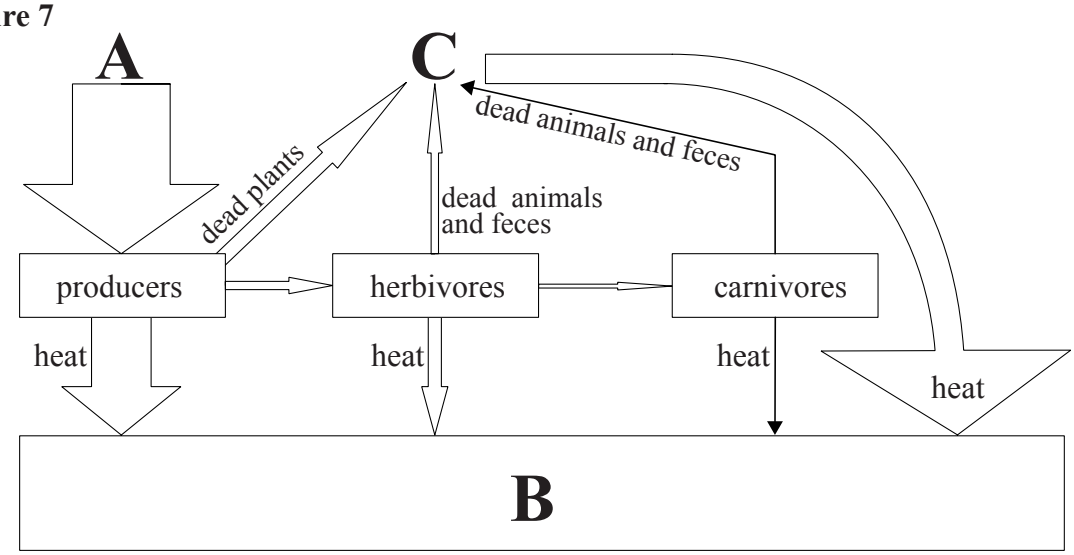
**5.** Figure 7 below shows the energy flow in an ecosystem. The width of the arrows is proportional to the quantity of energy transferred.

**Figure 7**




(a) With reference to Figure 7,

(i) Identify energy source **A**. *[1]*

. . . . . .

(ii) State the process in living organisms that releases heat energy to **B**. *[1]*

. . . . . .

(iii) State the group of organisms at **C** that feed on dead plants, animals and feces. *[1]*

. . . . . .

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*(Question 5 continued)*

(b) Suggest why the quantity of energy transferred decreases along the food chain. *[1]*

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(c) Explain how entropy is increased by each energy transformation that takes place in the food chain. *[2]*

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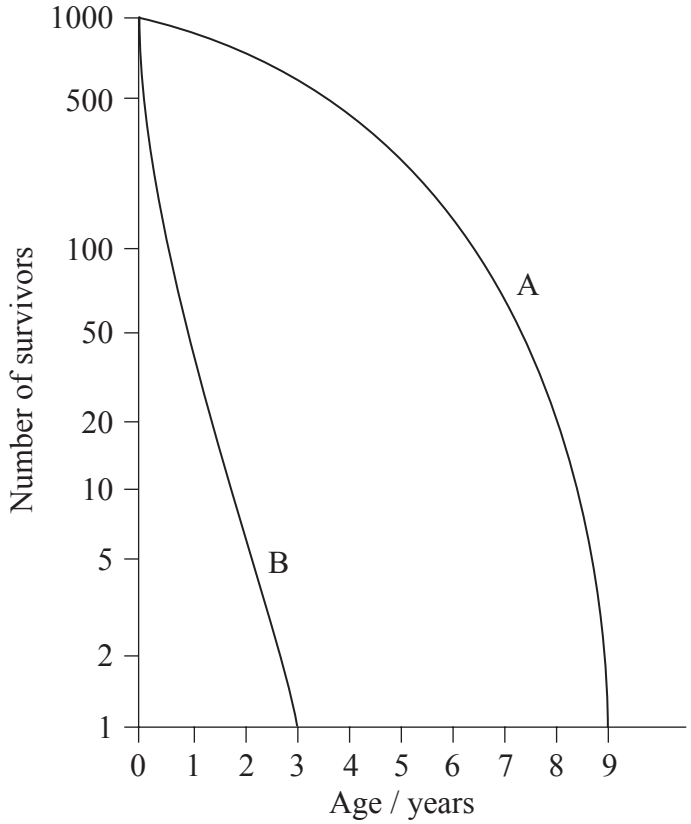
**6.** Figure 8 below shows survivorship curves for two different species, A and B.

**Figure 8**




[Source: Adapted from http://uts.cc.utexas.edu/~varanus/lizsurv.gif]

(a) With reference to Figure 8,

(i) State the type of scale used on the vertical (*y*) axis. *[1]*

. . . . . .

*(This question continues on the following page)*

*(Question 6 continued)*

(ii) Identify **two** reasons why species A is probably a *K*-strategist but species B is more likely to be an *r*-strategist. *[2]*

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(b) (i) State a density-dependent factor that might affect the size of a **named** animal population. *[1]*

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(ii) Explain, with the aid of a sketch graph, how the size of the **named** animal population in (b) (i) may eventually reach a steady-state equilibrium. *[3]*

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**7.** Figure 9 below shows the crude birth rate and the crude death rate per thousand of the global human population between 2003 and 2011.

**Figure 9**

| Year | Crude birth rate / 1000 | Crude death rate / 1000 |
|---|---|---|
| 2003 | 20.43 | 8.83 |
| 2004 | 20.24 | 8.86 |
| 2005 | 20.15 | 8.78 |
| 2006 | 20.05 | 8.67 |
| 2007 | 20.09 | 8.37 |
| 2008 | 20.18 | 8.23 |
| 2009 | 19.86 | 8.37 |
| 2010 | 19.56 | 8.20 |
| 2011 | 19.15 | 8.12 |

[Source: http://www.indexmundi.com/world/death_rate.html]

(a) (i) Using the data in Figure 9, calculate the percentage natural increase rate in the year 2011 for the global human population. *[1]*

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(ii) The percentage natural increase rate in global population in the year 2000 was 1.3 %. Calculate the estimated doubling time in the year 2000 for the global human population. *[1]*

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*(Question 7 continued)*

(b) Suggest **one** reason for the general decrease in birth rate and **one** reason for the general decrease in death rate between 2003 and 2011. *[2]*

Reason for decrease in birth rate:

. . . . . .

. . . . . .

Reason for decrease in death rate:

. . . . . .

. . . . . .

(c) Outline **one** way in which a larger world population may cause an increase in the rate of global warming. *[1]*

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Please **do not** write on this page.

Answers written on this page
will not be marked.