



22136301



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

Monday 6 May 2013 (morning)

1 hour

Candidate session number

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Examination code

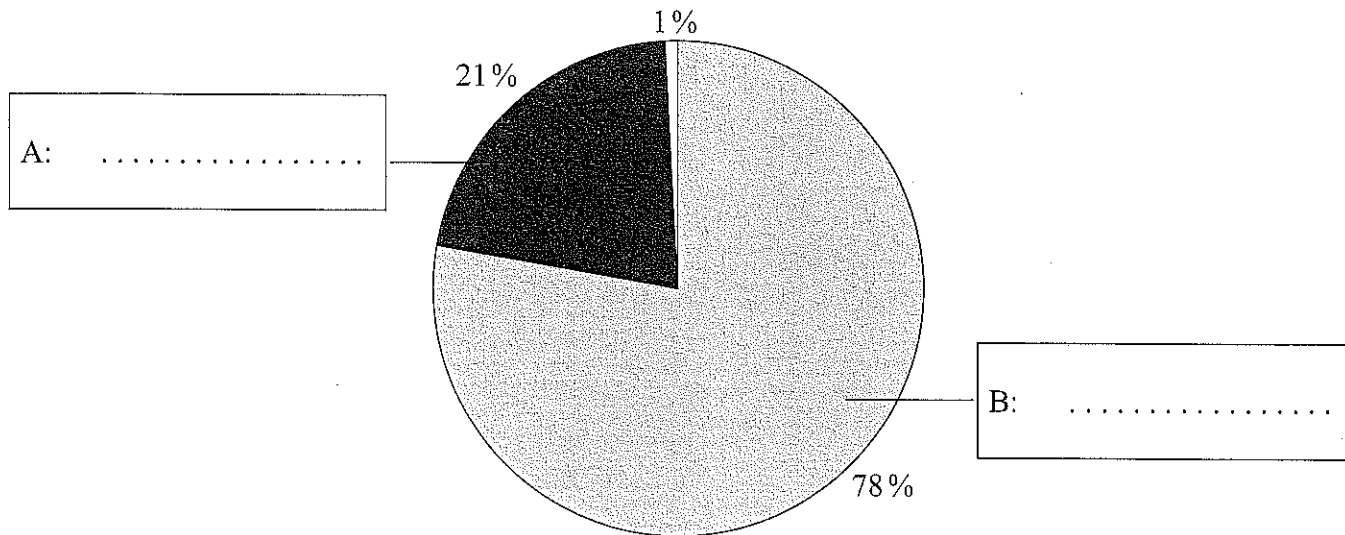
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**INSTRUCTIONS TO CANDIDATES**

- 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]*.

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]

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

1. ....

2. ....

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*(Question 1 continued)*

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

[2]

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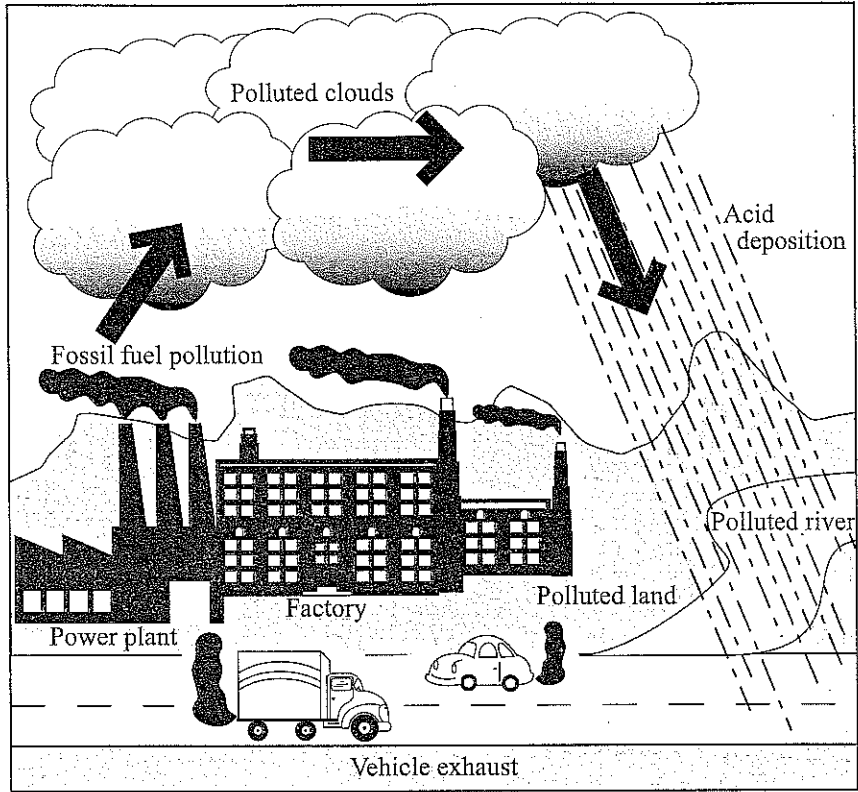
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2. Figure 2 below shows some of the sources and processes that lead to acid deposition.

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](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  $\text{SO}_x$  and  $\text{NO}_x$ . State the names of the **two** acids usually produced when  $\text{SO}_x$  and  $\text{NO}_x$  dissolve in water. [1]

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

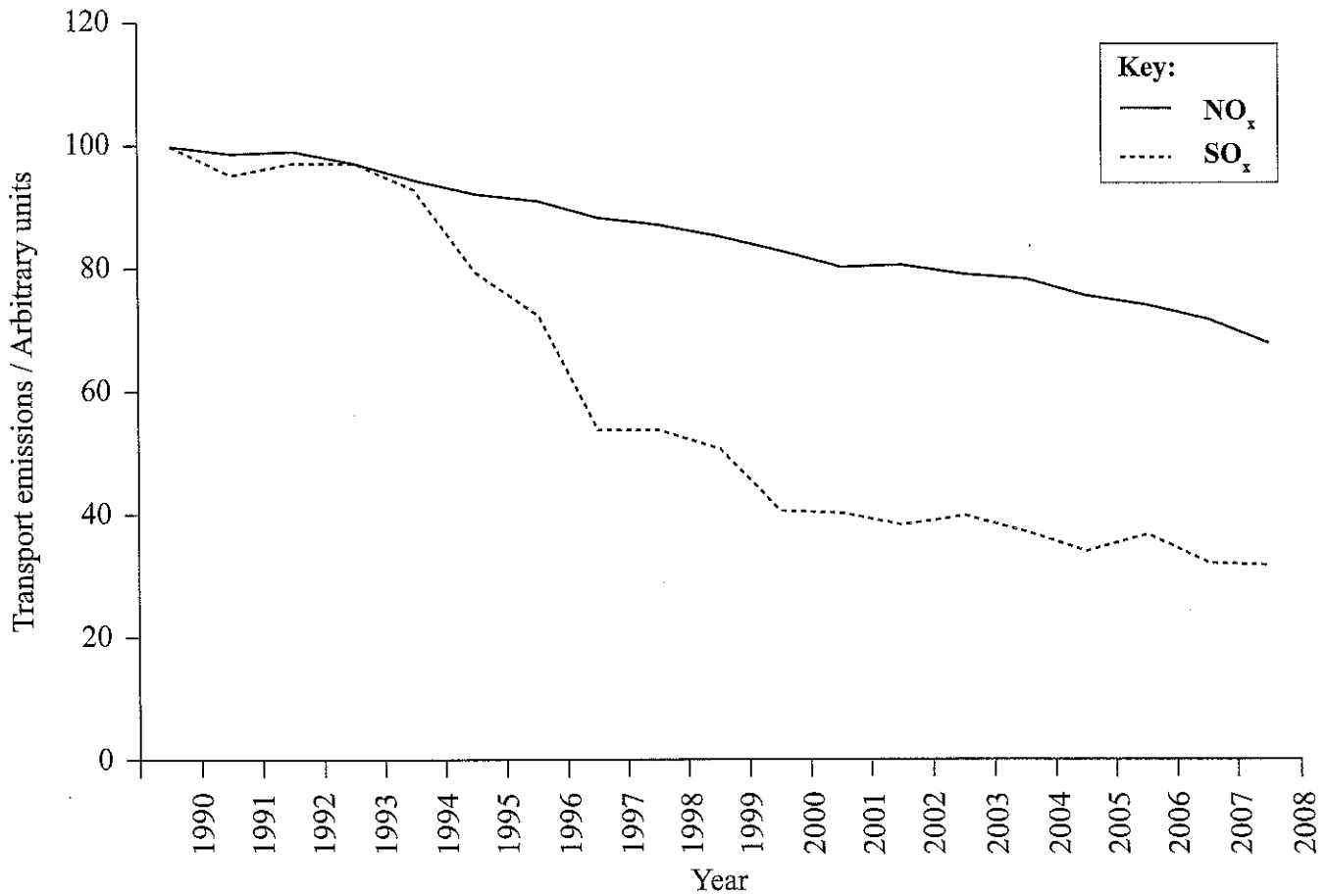
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(Question 2 continued)

Figure 3 below shows the changes in European transport emissions of  $\text{SO}_x$  and  $\text{NO}_x$  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  $\text{SO}_x$  and  $\text{NO}_x$ , shown in Figure 3. [2]

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*(Question 2 continued)*

- (ii) Outline how both an advance in technology and a change in human activity have reduced transport emissions of  $\text{SO}_x$  and  $\text{NO}_x$ .

[2]

Advance in technology:

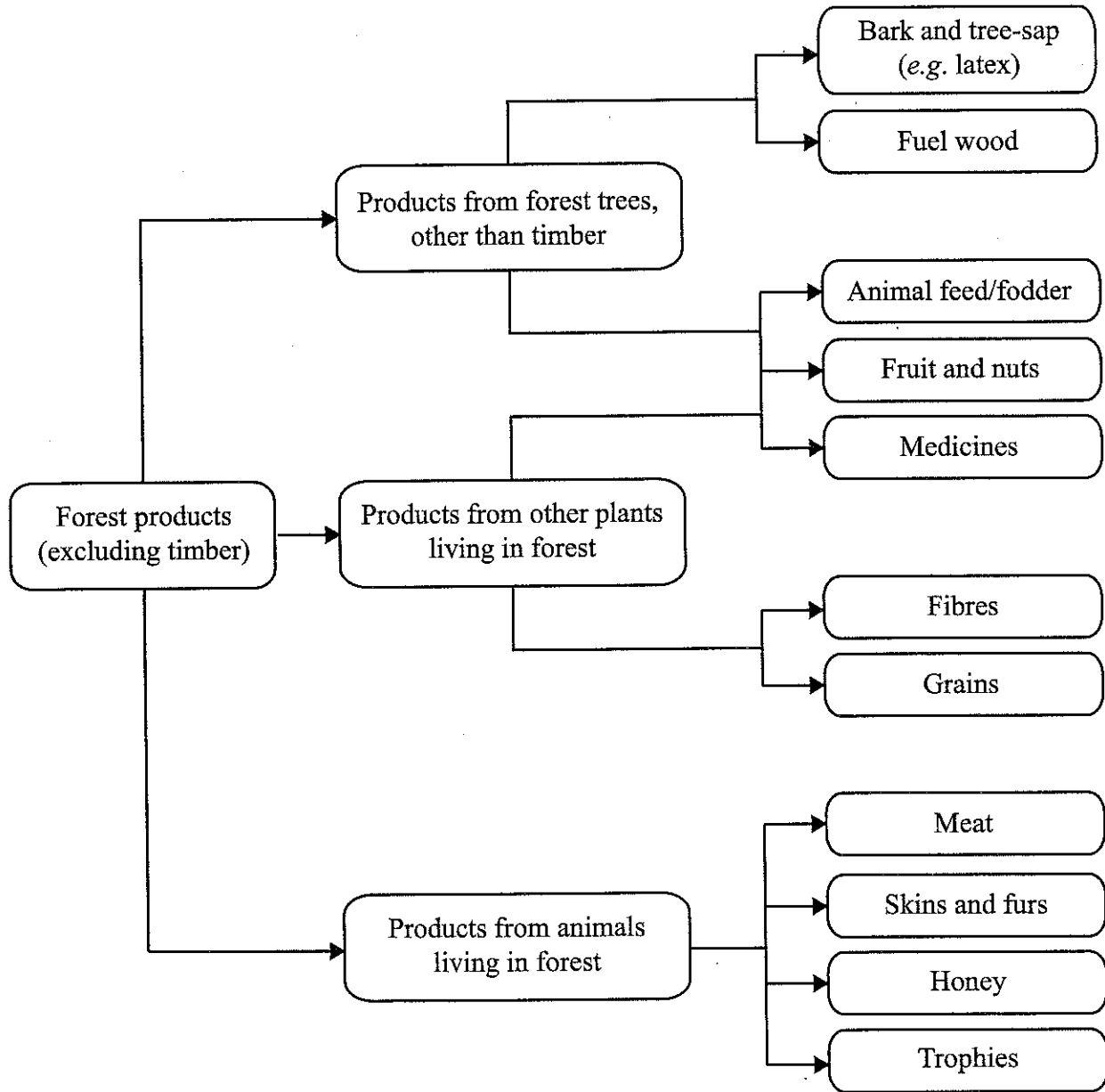
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Changes in human activity:

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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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.....



*(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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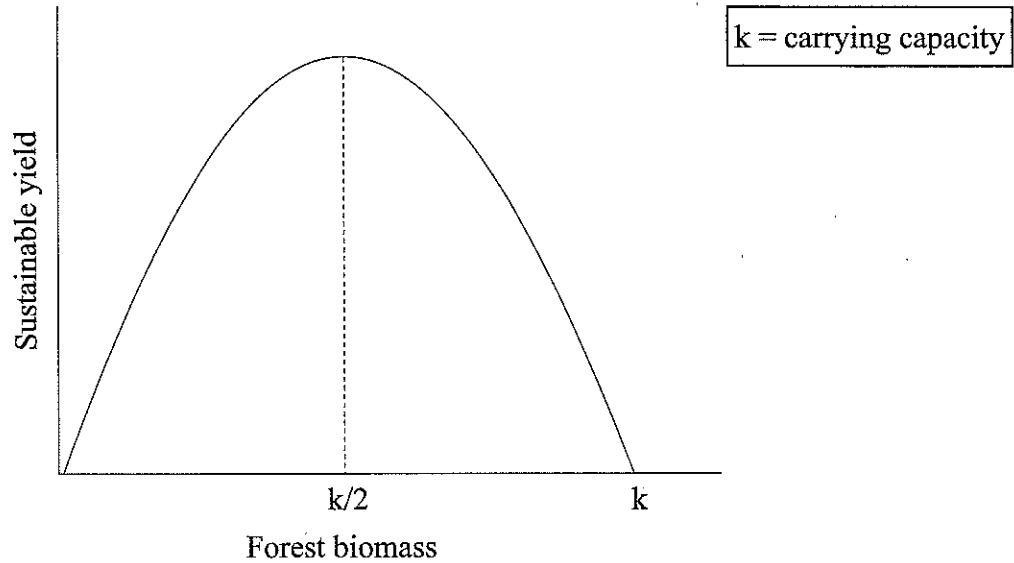
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(Question 3 continued)

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]

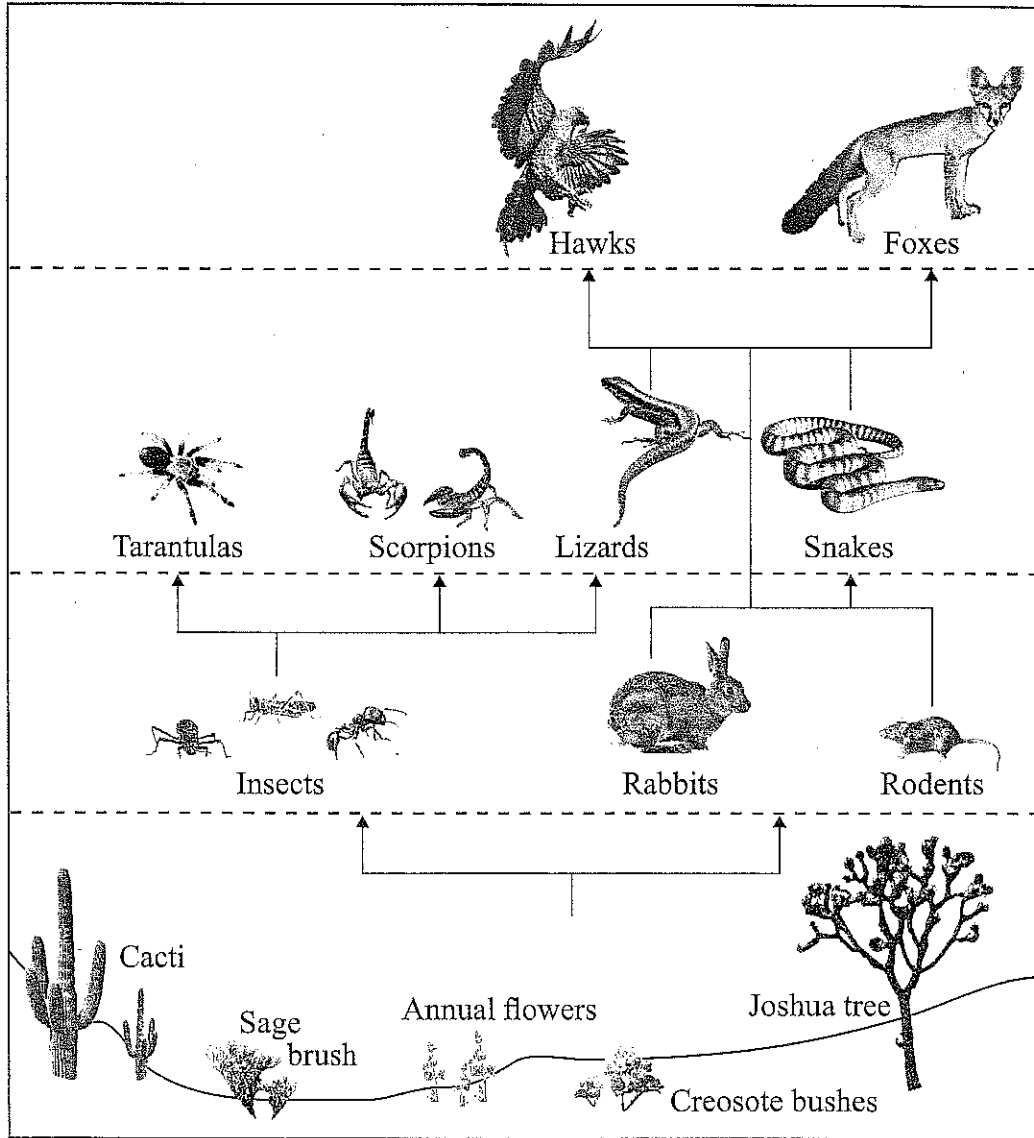
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4. Figure 6 below shows a desert food web.

Figure 6



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

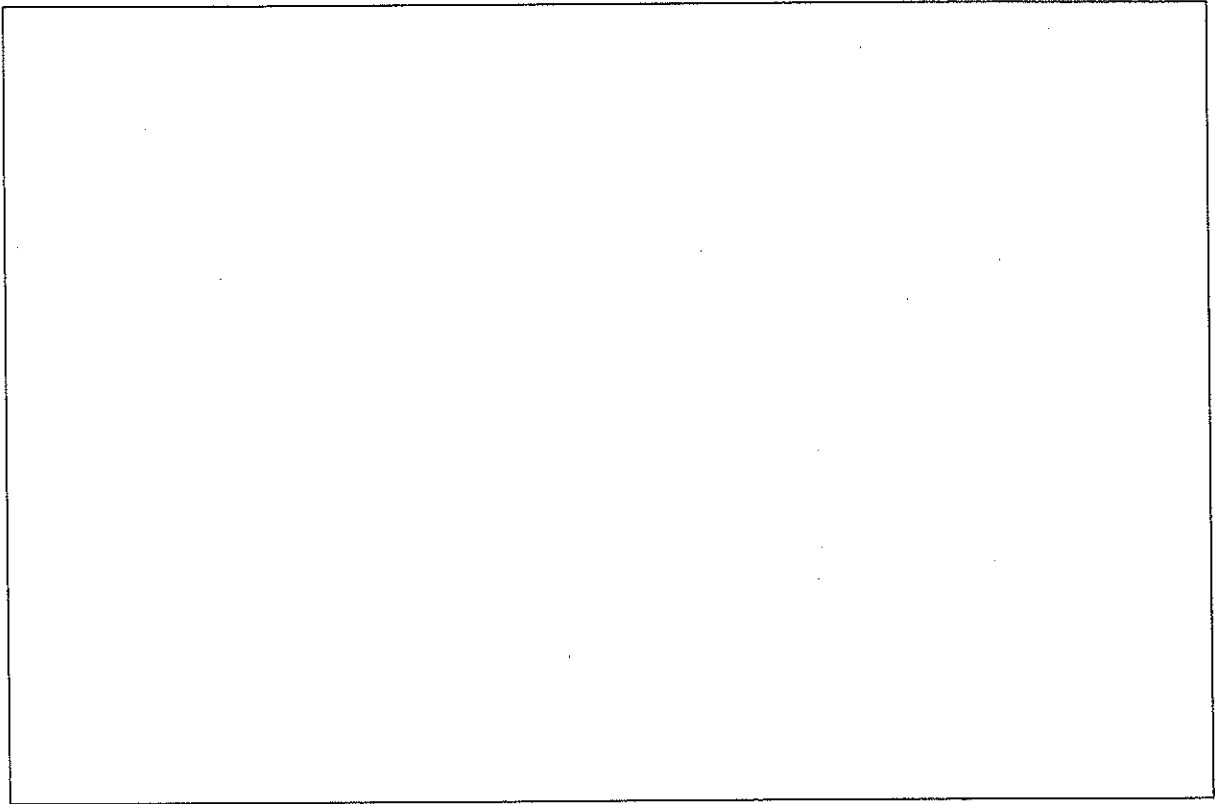
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(Question 4 continued)

(a) Using Figure 6,

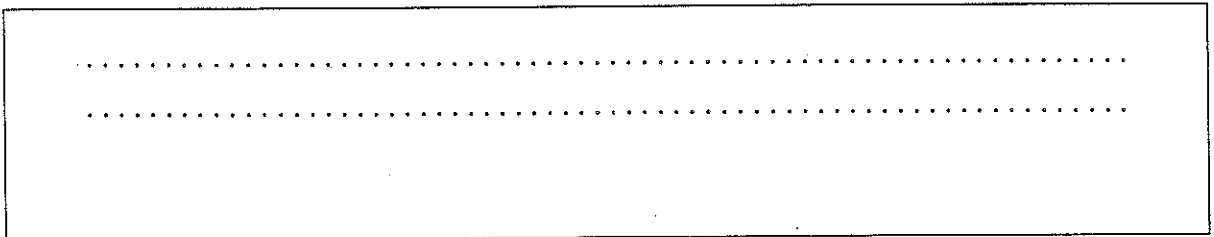
(i) Construct a food chain with **four** trophic levels.

[2]



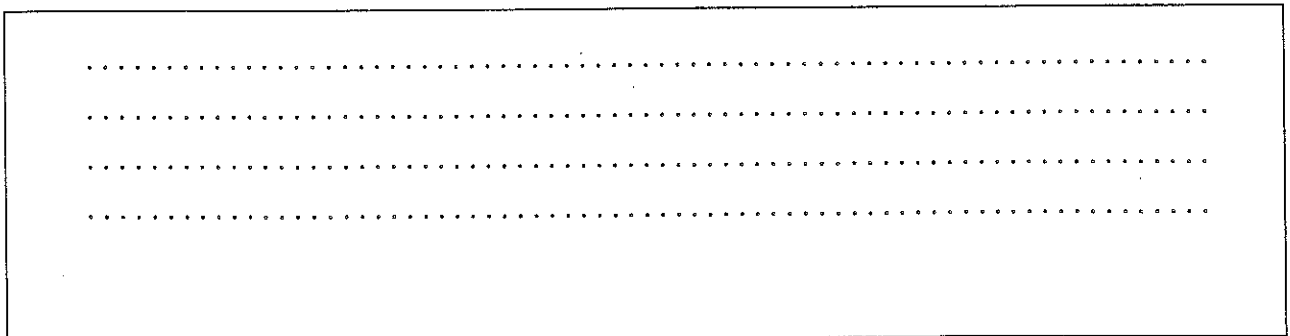
(ii) Suggest why the population of snakes might increase if all the foxes were killed.

[1]



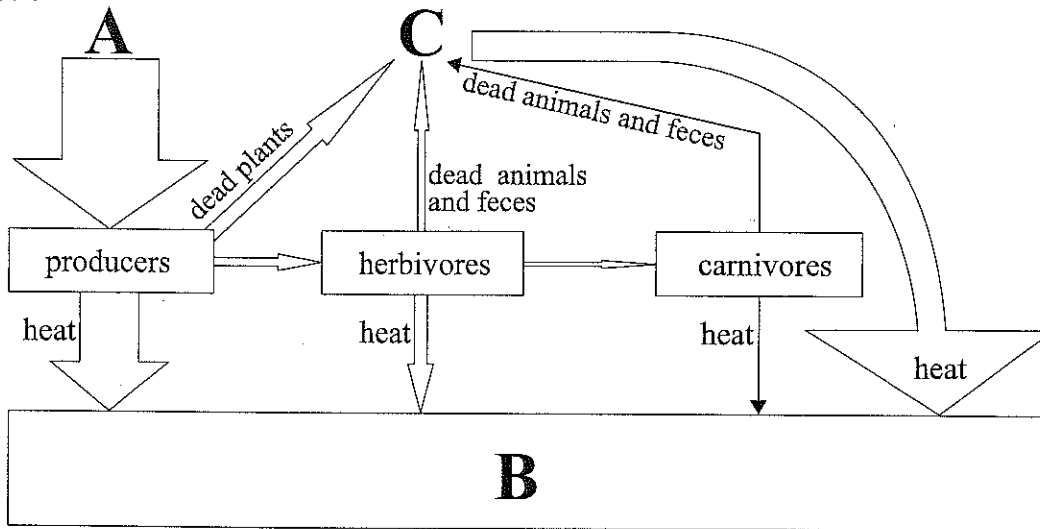
(b) Explain, giving **two** reasons, why biodiversity is lower in a desert ecosystem than in a tropical rainforest.

[2]



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]

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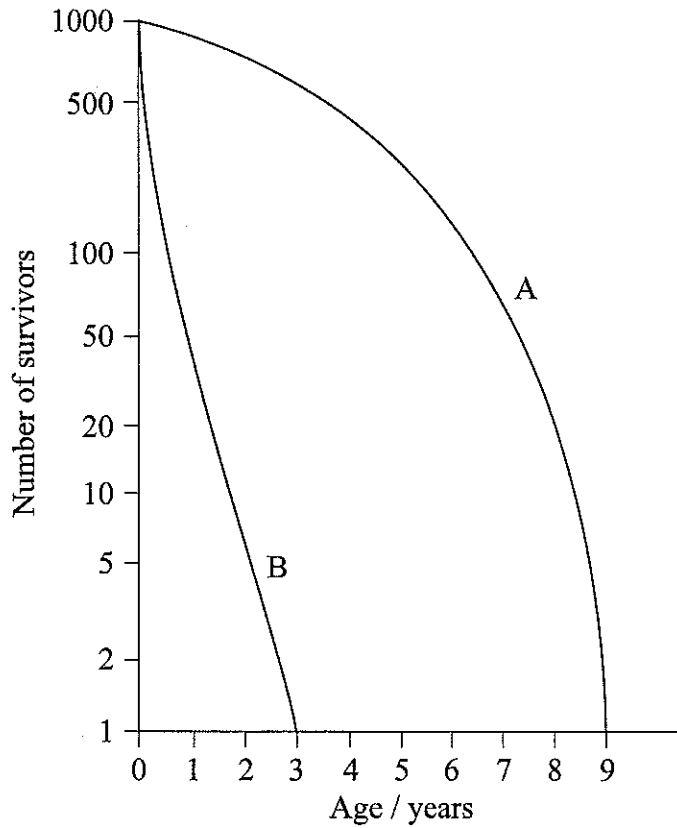
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6. Figure 8 below shows survivorship curves for two different species, A and B.

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]

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(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](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:

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Reason for decrease in death rate:

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- (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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