Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

For Examiner's Use

General Certificate of Education
June 2008
Advanced Level Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

BIOLOGY/HUMAN BIOLOGY (SPECIFICATION A) BYA5
Unit 5 Inheritance, Evolution and Ecosystems

Friday 13 June 2008 1.30 pm to 3.00 pm

For this paper you must have:
- a ruler with millimetre measurements.

You may use a calculator.

Time allowed: 1 hour 30 minutes

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. **Answers written in margins or on blank pages will not be marked**.
- Do all rough work in this book. Cross through any work you do not want to be marked.

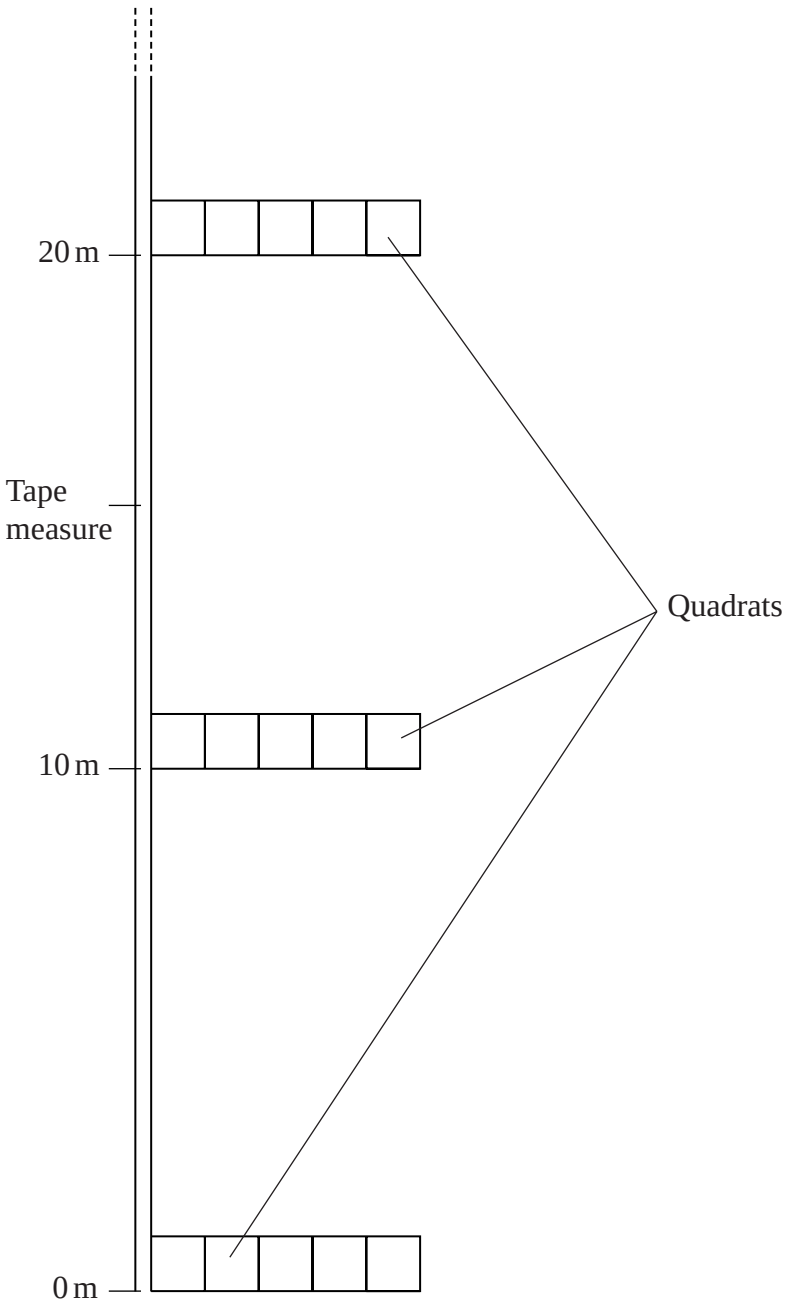
Information

- The maximum mark for this paper is 75.
- The marks for questions are shown in brackets.
- You will be marked on your ability to use good English, to organise information clearly and to use accurate scientific terminology where appropriate.

For Examiner's Use			
Question	Mark	Question	Mark
1		9	
2			
3			
4			
5			
6			
7			
8			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

Answer **all** questions **in the spaces provided**.

1 Some students investigated the succession of plants in sand dunes at different distances from the high tide mark. They produced a belt transect by laying out a tape measure and placing five $1m^2$ quadrats every 10 metres along the measure.



1 (a) They decided to lay quadrats every 10 metres rather than use random sampling. Explain the advantage of this.

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(2 marks)

1 (b) Suggest an explanation for placing five quadrats, rather than just one, at each sampling point.

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(2 marks)

4

Turn over for the next question

2 (a) Explain what is meant by the following ecological terms.

2 (a) (i) Habitat .....

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2 (a) (ii) Population .....

.....

2 (a) (iii) Community .....

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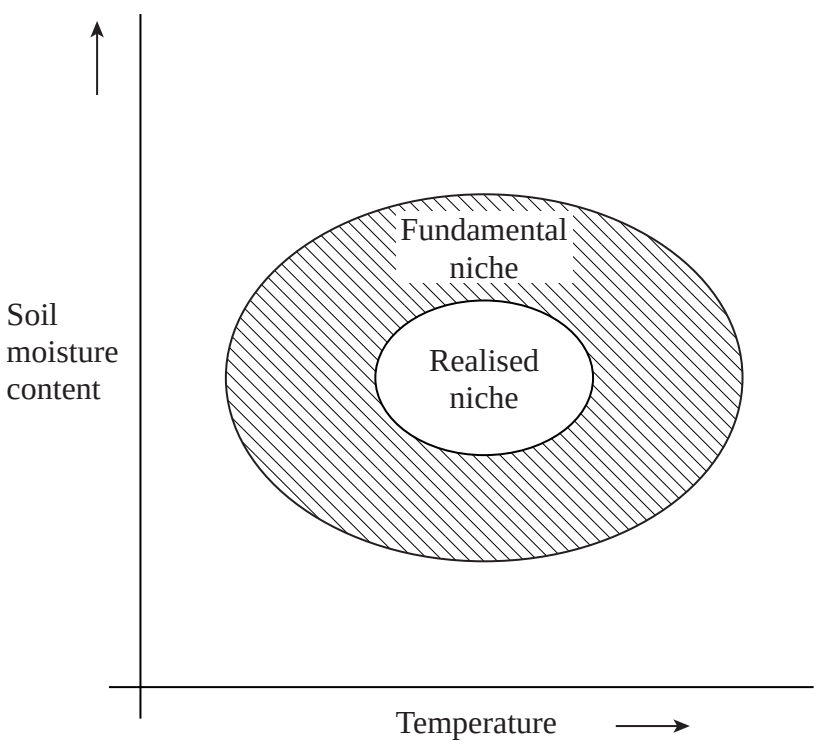
(3 marks)

2 (b) The fundamental niche of a species is the range of environmental conditions in which individuals of that species could survive.

The realised niche is the range of environmental conditions in which the species is actually found.

The diagram shows the fundamental niche and realised niche of a species of plant with respect to temperature and soil moisture content.



2 (b) Suggest an explanation for the difference between the fundamental niche and the realised niche.

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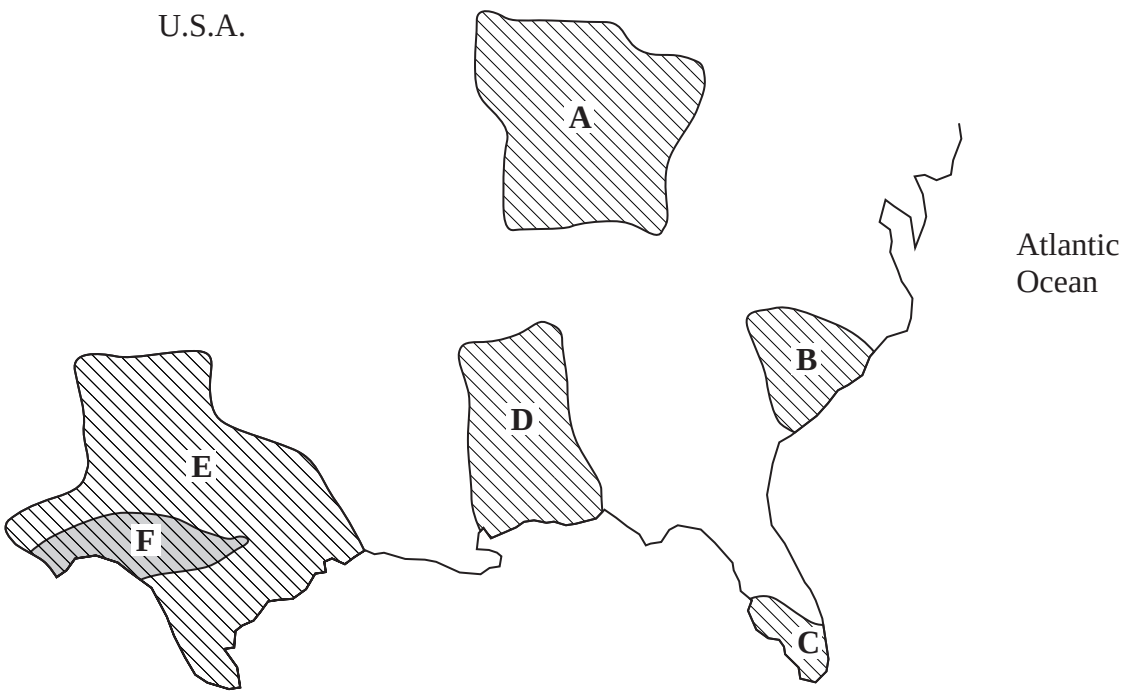
(2 marks)

5

Turn over for the next question

3 The rat snake has six distinct populations in the USA. The distribution of these populations is shown in the diagram.



3 (a) Individuals of population **E** do not breed with individuals of population **F**. Suggest **two** reasons why not.

1 .....

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2 .....

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(2 marks)

3 (b) Scientists believe that population **A** is evolving into a different species from population **B**. Explain how this might be happening.

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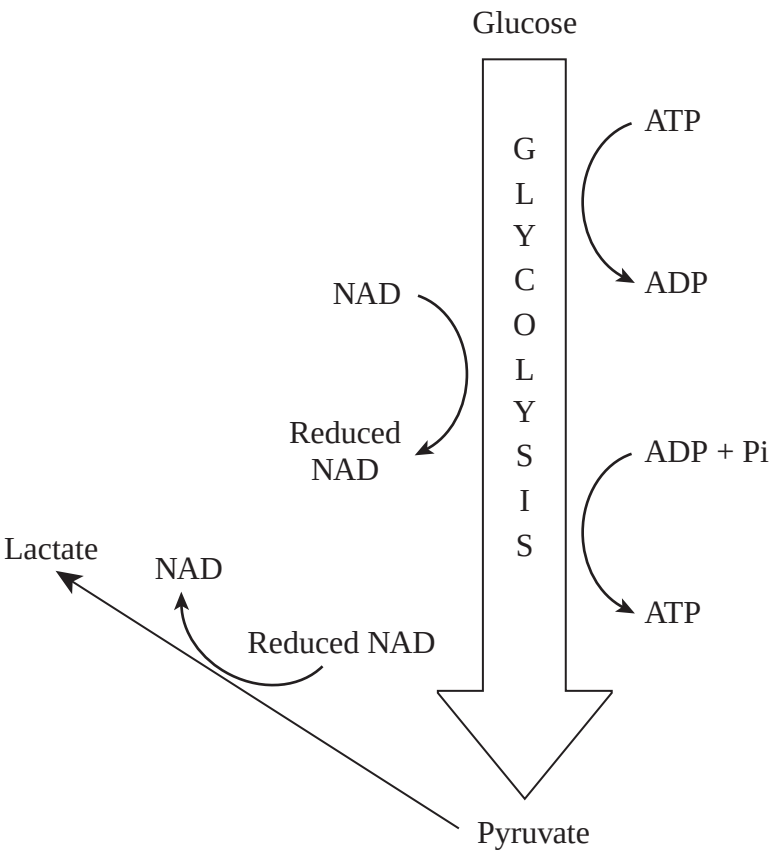
(3 marks)

5

Turn over for the next question

4 (a) The diagram summarises anaerobic respiration in a muscle cell.



The production of lactate allows glycolysis to continue in the absence of oxygen. Explain how.

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(2 marks)

4 (b) Respiration produces less ATP from a molecule of glucose in the absence of oxygen than it does when oxygen is present. Explain why.

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(3 marks)

5

Turn over for the next question

5 Sickle cell anaemia is an inherited condition. The condition is determined by the allele Hb^S. This allele causes one amino acid in the haemoglobin molecule to be replaced with a different amino acid. The allele Hb^A causes the production of normal haemoglobin.

5 (a) The Hb^S allele arose as a result of a gene mutation. What type of gene mutation could have caused this change? Explain your answer.

Type of mutation .....

Explanation .....

.....

(Extra space) .....

(2 marks)

5 (b) The table shows the frequency of the Hb^S allele in five populations.

Population	Frequency of Hb^S
R	0.150
S	0.001
T	0.003
U	0.133
V	0.011

5 (b) (i) Populations **R** and **U** are found in regions where malaria is common. Explain how the table provides evidence for this statement.

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(2 marks)

5 (b) (ii) Use the Hardy–Weinberg equation to predict the frequency of babies homozygous for the Hb^A allele in the next generation of population **R**. Show your working.

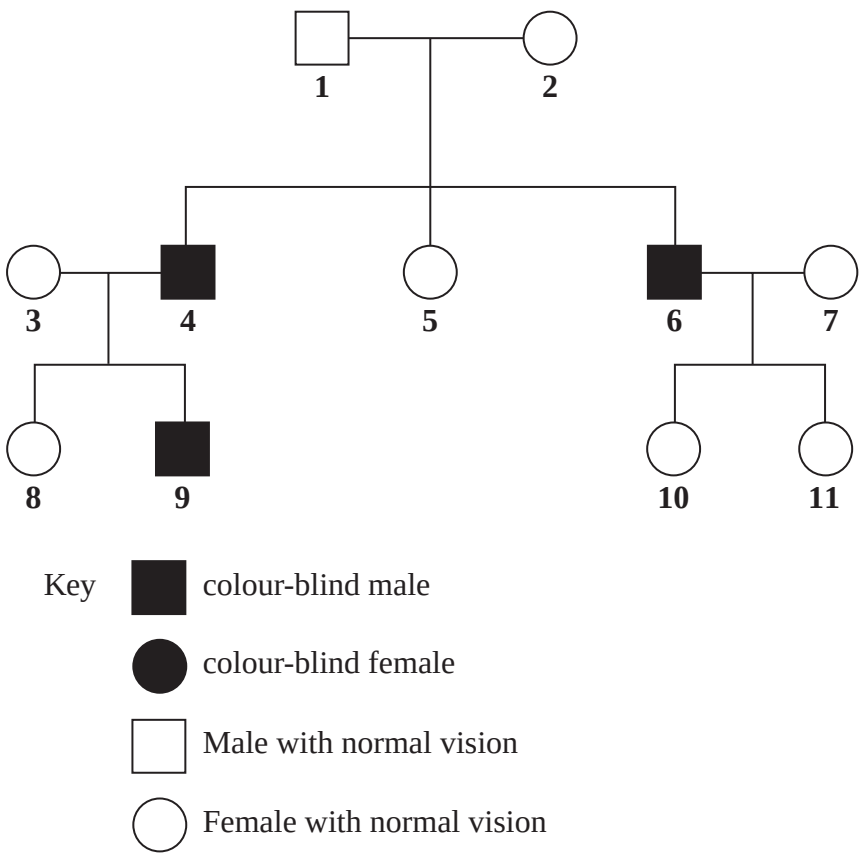
Frequency of babies in the next generation homozygous for Hb^A .....

(2 marks)

6

Turn over for the next question

6 The diagram shows the inheritance of red-green colour blindness in a family. This condition is controlled by a single gene with two alleles.



6 (a) Give **one** piece of evidence that suggests the allele causing red-green colour blindness is

6 (a) (i) sex-linked

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(1 mark)

6 (a) (ii) recessive.

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(1 mark)

6 (b) Using appropriate symbols from $\mathbf{X}^{B}$, $\mathbf{X}^{b}$ and **Y**, give the genotype of individual **2**. Explain your answer.

Genotype .....

Explanation .....

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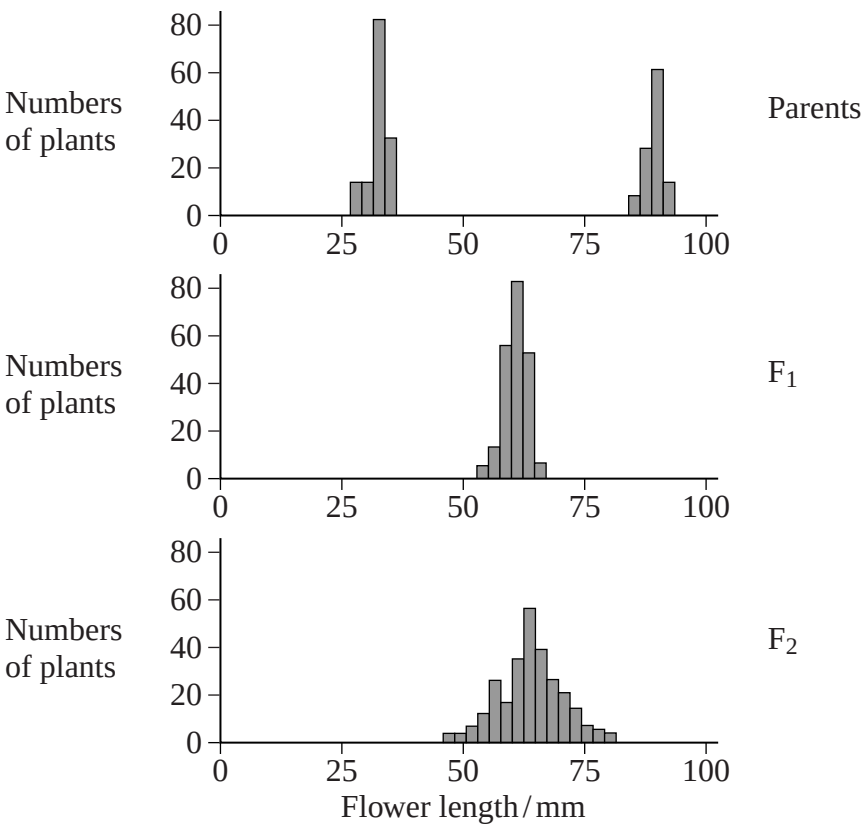
(3 marks)

5

Turn over for the next question

7 (a) The inheritance of flower length in tobacco plants is an example of polygenic inheritance. Plants from a group homozygous for all the short-flower alleles were crossed with plants from a group homozygous for all the long-flower alleles. The offspring from this cross (the F_1) were then self-fertilised to produce the next generation (F_2). **Figure 1** shows the flower lengths in each of these groups of plants.

Figure 1



7 (a) (i) Polygenic inheritance and multiple allele inheritance are different.
Explain what is meant by

polygenic inheritance

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multiple allele inheritance.

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(2 marks)

7 (a) (ii) What caused the variation in flower length of the long-flowered parent plants? Explain your answer.

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(2 marks)

7 (a) (iii) How was the genotype of the F_1 plants different from the genotypes of the parent plants? Explain your answer.

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(2 marks)

7 (a) (iv) There was variation in the flower length of the F_2 plants. What caused this variation? Explain your answer.

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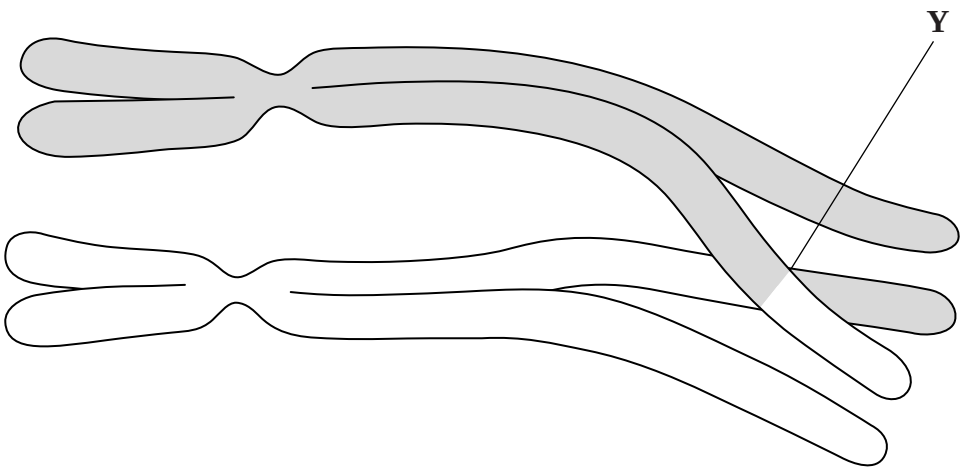
(3 marks)

Question 7 continues on the next page

7 (b) **Figure 2** shows one pair of homologous chromosomes from a tobacco plant at a stage of meiosis.

Figure 2



7 (b) (i) Give **one** way in which the chromosomes of one homologous pair are

similar .....

.....

different. .....

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(2 marks)

7 (b) (ii) What has happened at **Y**?

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(1 mark)

7 (b) (iii) Name the stage of meiosis during which this event happened.

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(1 mark)

7 (b) (iv) Explain the biological importance of this event.

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(2 marks)

8 (a) The light-dependent reactions of photosynthesis produce ATP and reduced NADP. Describe how.

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(Extra space) .....

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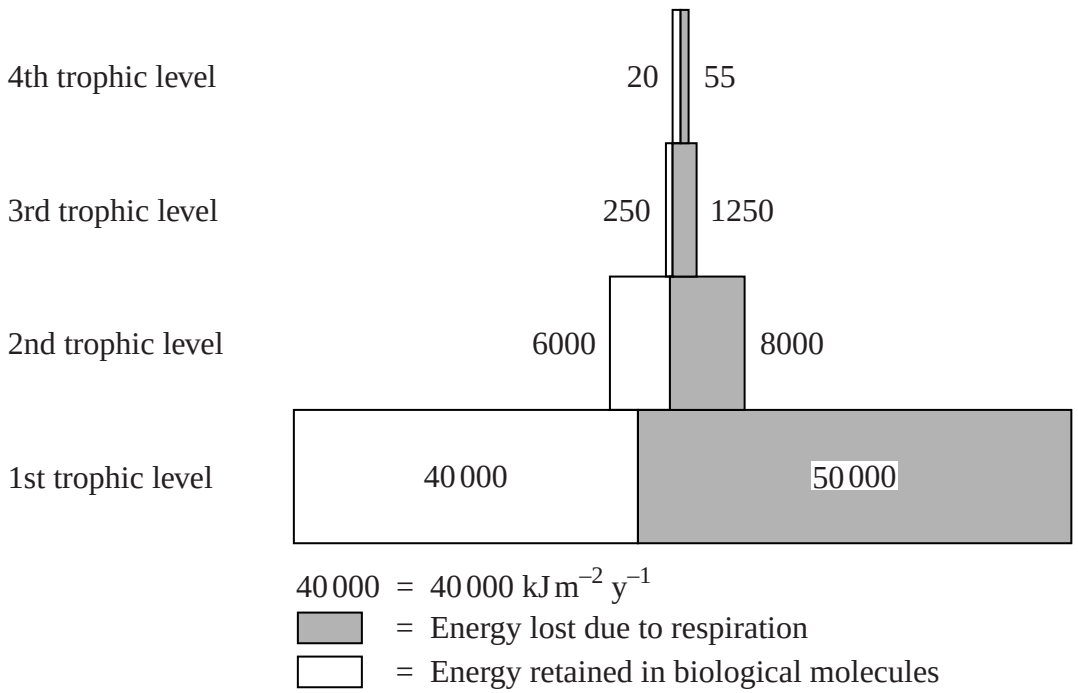
(5 marks)

Question 8 continues on the next page

8 (b) The energy entering a trophic level will either be lost as heat in respiration, or will be retained in biological molecules and eventually be passed to another organism.
Figure 3 shows the energy lost due to respiration and retained in biological molecules for a food chain with four trophic levels.

Figure 3



8 (b) (i) In this food chain, how much energy (in kJ m^{-2} y^{-1}) is harnessed by photosynthesis?

..... kJ m^{-2} y^{-1} *(1 mark)*

8 (b) (ii) The proportion of energy lost in respiration by individuals in the 2nd trophic level is different from that for individuals in the 3rd trophic level. Calculate the ratio of the proportion of energy lost in the 2nd trophic level to the proportion lost in the 3rd trophic level. Show your working.

Ratio ..... *(2 marks)*

8 (b) (iii) Individuals in the 3rd trophic level lose a greater proportion of their energy in respiration than individuals in the 2nd trophic level. Explain why.

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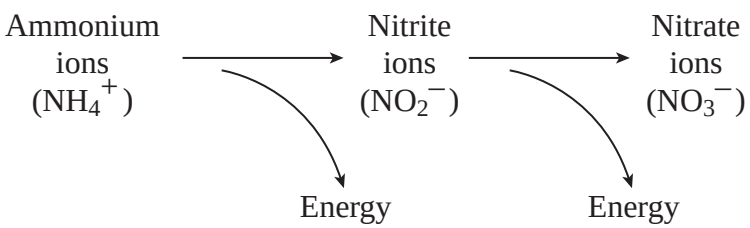
(3 marks)

Question 8 continues on the next page

8 (c) **Figure 4** shows the stages in biological nitrification.

Figure 4



8 (c) (i) Give **two** ways in which ammonium ions can be produced.

1 .....

2 .....

(2 marks)

8 (c) (ii) Using information in the diagram, describe **two** ways in which biological nitrification is similar to the aerobic respiration of carbohydrates in mammalian cells.

1 .....

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2 .....

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(2 marks)

15

9 (a) Carbon dioxide is produced during aerobic respiration. Explain how.

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(Extra space) .....

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(4 marks)

Question 9 continues on the next page

9 (b) Plants use carbon dioxide in the light-independent reactions of photosynthesis to make useful carbohydrates. Describe how.

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(Extra space) .....

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(6 marks)

9 (c) The felling of tropical rain forests may affect the concentration of carbon dioxide in the atmosphere. Research shows that, when rain forest is felled, phosphate ions become more available to soil microorganisms. This increases the rate of their metabolism.

Explain **two** ways in which felling of rain forests could lead to an increase in the concentration of carbon dioxide in the atmosphere.

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(Extra space) .....

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(5 marks)

15

END OF QUESTIONS

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