Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	1	0	5	/	0	1	Signature	

Paper Reference(s)

6105/01

Edexcel GCE

Biology

Advanced

Unit 5B

Tuesday 20 June 2006 – Morning

Time: 1 hour 30 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
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6	
7	
Total	

Materials required for examination
Ruler

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
Check that you have the correct question paper.
Answer ALL questions in the spaces provided in this booklet.
Show all the steps in any calculations and state the units. Calculators may be used.
Include diagrams in your answers where these are helpful.

Information for Candidates

The marks for individual questions and parts of questions are shown in round brackets: e.g. **(2)**.
The total mark for this question paper is 70.

Advice to Candidates

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The Synoptic section (Questions 4 to 7) is designed to give you the opportunity to make connections between different areas of biology and to use skills and ideas developed throughout the course in new contexts. You should include in your answers any relevant information from the whole of your course.

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Answer ALL questions in the spaces provided.

1. The table below refers to the five kingdoms and some of their characteristic features. Complete the table by writing the name of the kingdom in the blank spaces.

Characteristic features	Kingdom
• Eukaryotic organisms • Single-celled, or consists of groups of similar cells	Proctoctista
• Eukaryotic organisms • Photosynthetic • Cell walls that contain cellulose	
• Unicellular • No nucleus within a membrane • No membrane-bound organelles	
• Eukaryotic organisms • Non-photosynthetic • Non-cellulose cell wall	
• Eukaryotic organisms • Cannot carry out photosynthesis • Have nervous co-ordination	

Q1

(Total 4 marks)

Leave blank

2. (a) Distinguish between the terms **gene** and **allele.**

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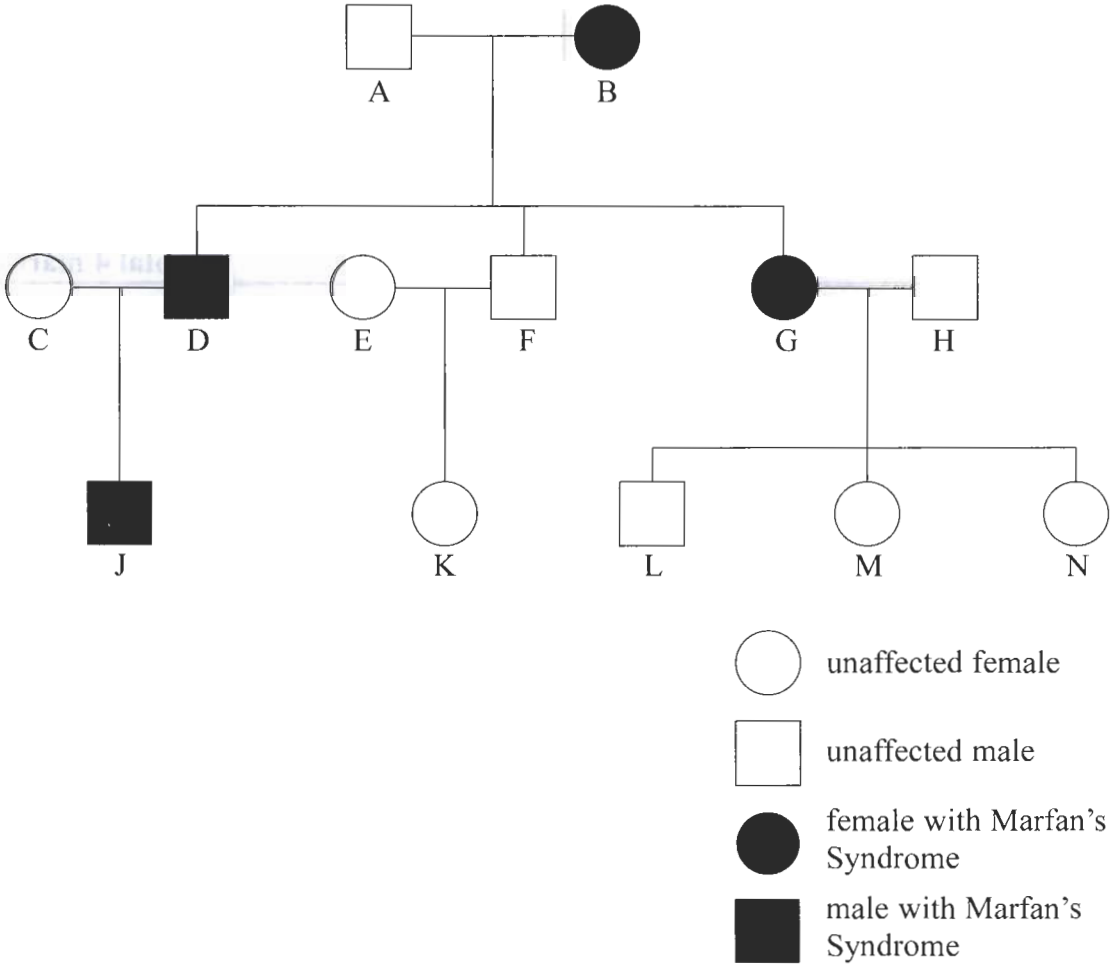
(2)

(b) Marfan's Syndrome is a rare genetic disease which affects the eyes, heart and bones. The family tree below shows how this disease was inherited through three generations of a family.



Leave blank

(i) Male A is an unaffected homozygous individual. State whether the allele for Marfan's Syndrome is dominant or recessive. Explain your answer.

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(2)

(ii) Using the symbols of **D** for dominant allele and **d** for recessive allele, show the genotype for the following individuals.

B .....

F .....

J .....

(2)

(iii) Individuals C and D have one affected child. Use a genetic diagram to determine the probability of their next child being affected.

(3)

Leave blank

(c) A genetic disease can suddenly appear in a family with no previous history of the disease. Suggest how this could be possible.

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(2)

Q2

(Total 11 marks)

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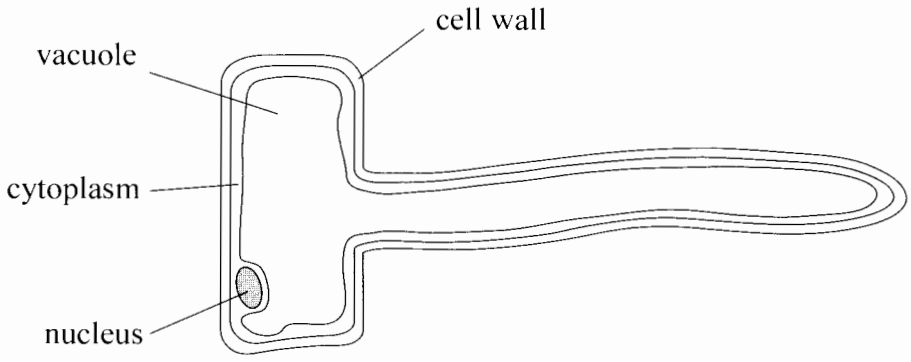
3. The diagram below shows a root hair cell.



(a) Describe how the shape of a root hair cell increases the efficiency of absorption of water and mineral ions from the soil solution.

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(1)

(b) Mineral ions can be taken up by root hair cells and may accumulate at higher concentrations than in the soil solution. Explain how mineral ions are taken up by root hair cells.

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(c) Phosphate ions are required for the synthesis of many important molecules in plants. Name **two** products of the light-dependent stage of photosynthesis that require phosphate ions in their molecular structure.

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(1)

(d) Describe a simple procedure by which you could use mineral culture solutions to find the effect of a lack of phosphate ions on plant growth.

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(3) **Q3**

(Total 9 marks)

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Synoptic Section.

The questions in this section are designed to give you the opportunity to make connections between different areas of biology and to use skills and ideas developed throughout the course in new contexts. You should include in your answers any relevant information from the whole of your course.

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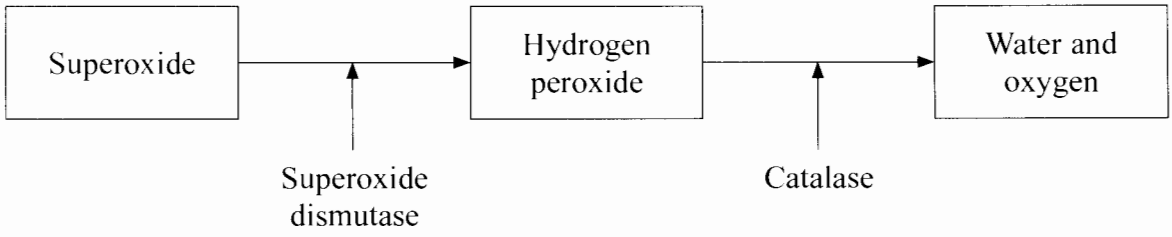
4. Oxidative phosphorylation is an important process that increases the output of ATP from respiratory metabolism. This process is dependent upon the electron transport chain in mitochondria.

The electron transport chain produces free radicals, known as Reactive Oxygen Species (ROS), as by-products. Two examples of ROS are superoxide and hydrogen peroxide.

ROS react with fatty acids causing damage to membranes within cells. In order to prevent the accumulation of damaging levels of ROS, certain enzymes must be produced by the cell. The action of two of these enzymes, superoxide dismutase and catalase, is shown in the diagram below.



(a) Explain why the term **oxidative phosphorylation** is used to describe the synthesis of ATP as a result of electron transport chain activity.

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(b) Suggest why the reaction of ROS with fatty acids might lead to a reduction in the efficiency of oxidative phosphorylation in mitochondria.

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(c) Explain how a point mutation in the gene for superoxide dismutase synthesis might result in damaging levels of ROS accumulating in mitochondria.

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(4)

Q4

(Total 9 marks)

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5. The fox (*Vulpes vulpes*) is a common mammal living in both rural (country) and urban (town) areas of the United Kingdom. Foxes eat a variety of foods including berries, rabbits, small birds and rodents such as rats and mice.

(a) The photograph below shows the skull of the fox. Describe **two** features of the teeth of this fox that are an adaptation for feeding on small mammals.

Magnification ×0.5
Source: www.nhc.ed.ac.uk

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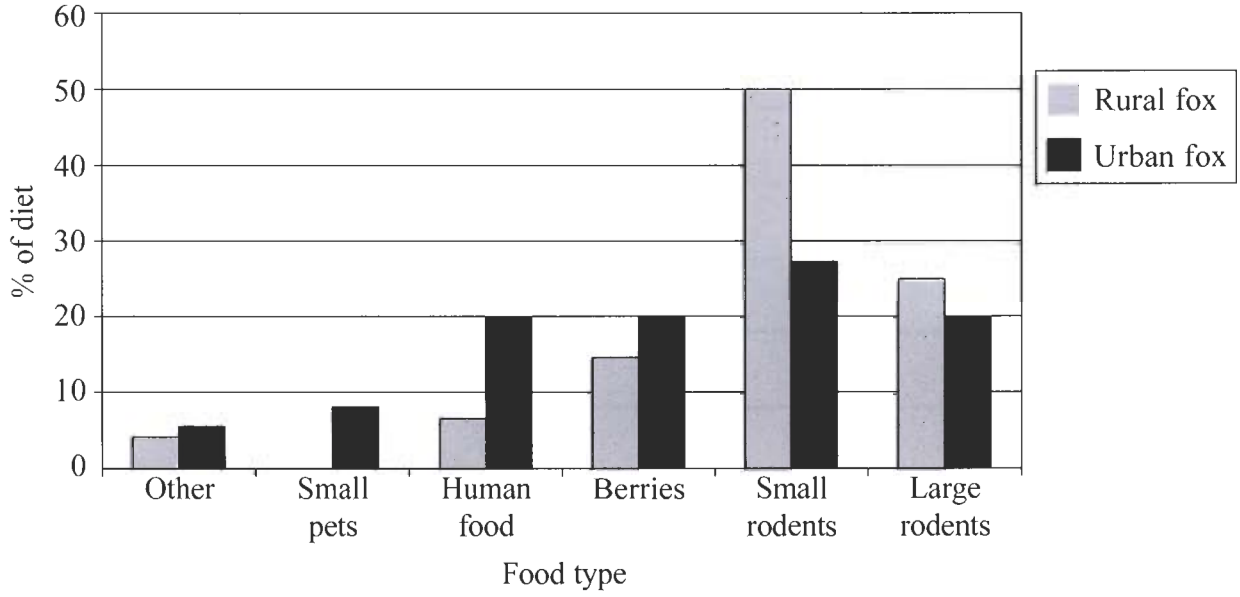
Leave blank

(b) A number of studies have investigated the differences between the diets of rural foxes and foxes living in urban areas. The results of one study are shown below.



(i) Compare the diet of the rural fox with the diet of the urban fox.

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(ii) Human food was found to have a high content of carbohydrates and fats. Suggest how this could affect the time spent looking for food and the quantity of food eaten by the urban foxes.

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(c) (i) Foxes are territorial animals. Rural foxes commonly have territories between two and six km^2 (200 to 600 hectares) in size. Urban foxes have a much smaller territory of less than $0.6\,km^2$. Explain how this could affect the population of foxes in urban areas.

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(ii) Suggest **one** factor, other than food and territory size, that could affect the population size of the urban fox.

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(d) It has been suggested that the teeth of the urban fox are changing as their diet changes. Describe how the rural and urban foxes could evolve into separate species.

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Q5

(Total 13 marks)

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6. Biodegradable organophosphate pesticides, such as malathion, are used to reduce insect damage to fruits, vegetables and grains during storage.

The chemical structure of malathion resembles the intermediate stage in the hydrolysis of the transmitter substance, acetylcholine, found at synapses in the nervous system. Malathion is able to bind irreversibly to the enzyme, acetylcholinesterase, at its active site. This enzyme catalyses the rapid hydrolysis of acetylcholine in the synapse. Insects coming into contact with relatively small quantities of malathion suffer from a severe disruption of the functioning of their nervous system which leads to their death.

(a) Malathion is an active site-directed enzyme inhibitor. Explain what is meant by the term **active site-directed enzyme inhibitor**.

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(2)

(b) With reference to the function of acetylcholine, explain why malathion can lead to severe disruption of the functioning of an insect's nervous system.

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Leave blank

(c) Suggest why it is easier to control insects in fruit, vegetable and grain stores by chemical means rather than by using biological control.

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(d) The table below shows the percentage of fruits, vegetables and grains with detectable organophosphate residues in the USA from 1994 to 2001.

Year	Percentage of fruits, vegetables and grains with detectable organophosphate residues
1994	21
1995	24
1996	29
1997	28
1998	23
1999	24
2000	23
2001	19

[Data adapted from *US Department of Agriculture*, Pesticide Data Program]

Leave blank

Suggest how the data might have differed if non-biodegradable pesticides, such as DDT, had been used instead of organophosphates. Explain your answer.

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(3) **Q6**

(Total 12 marks)

Leave blank

7. (a) Explain what is meant by the term **gross primary production** (GPP).

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(2)

(b) The table below shows the flow of energy in a tropical rainforest.

Trophic level	Energy entering trophic level / kJ m^{-2} $year^{-1}$
Producers	180.0×10^3
Primary consumers	5.0×10^3
Secondary consumers	4.5×10^3
Tertiary consumers	3.4×10^3
Decomposers	28.4×10^3

(i) Energy is transferred between trophic levels. If the producers lose 145×10^3 kJ m^{-2} $year^{-1}$ in respiration, calculate the percentage of net primary production (NPP) which is passed to the primary consumers. Show your working.

Answer ..... %

(3)

Leave blank

(ii) Explain the role of decomposers in a food chain.

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(2)

(iii) The productivity of a temperate forest in Europe is much lower than that of a tropical rainforest. Suggest reasons for this difference.

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(c) Describe how a forest could be managed sustainably in order to ensure a continual supply of timber for the future.

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(3) **Q7**

(Total 12 marks)

TOTAL FOR PAPER: 70 MARKS

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Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	1	1	5	/	0	1	Signature	

Paper Reference(s)

6115/01

Edexcel GCE

Biology (Human)

Advanced

Unit 5H

Tuesday 20 June 2006 – Morning

Time: 1 hour 30 minutes

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Examiner's use only		

Team Leader's use only		

Question Number	Leave Blank
1	
2	
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Total	

Materials required for examination
Ruler

Items included with question papers
Nil

Instructions to Candidates

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Include diagrams in your answers where these are helpful.

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Answer ALL questions in the spaces provided.

1. The table below lists some of the characteristic features of the four superfamilies that make up the order of Primates. Complete the table by writing the name of the superfamily in the blank spaces.

Characteristic features	Superfamily
• No tail • Free-swinging arm movements • Nails	
• Prehensile tail • Flat nose with separate nostrils	
• Non-prehensile tail • Most have claws	
• All limbs similar length • Walk on all fours • Non-prehensile tail • Downward-facing nostrils	

Q1

(Total 4 marks)

Leave blank

2. (a) Distinguish between the terms **gene** and **allele**.

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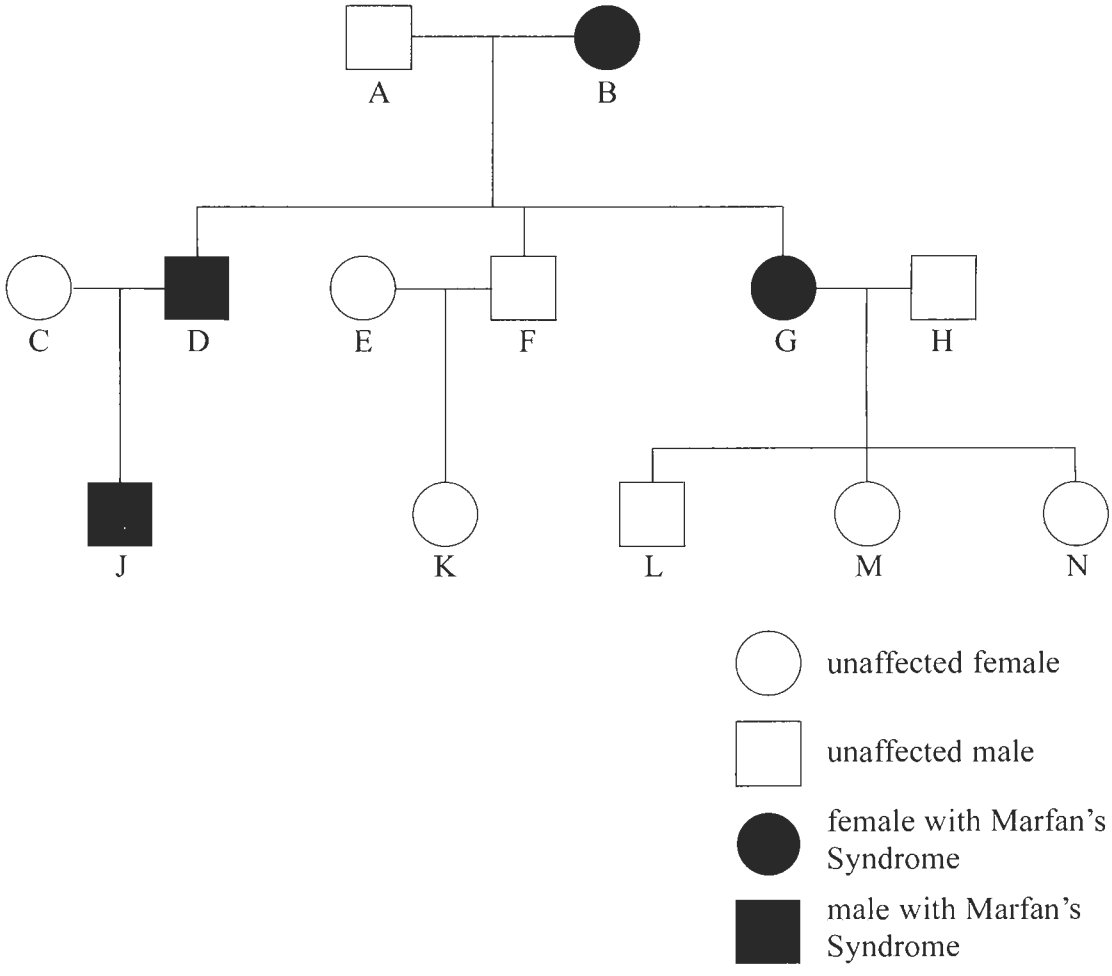
(2)

(b) Marfan's Syndrome is a rare genetic disease which affects the eyes, heart and bones. The family tree below shows how this disease was inherited through three generations of a family.



Leave blank

(i) Male A is an unaffected homozygous individual. State whether the allele for Marfan's Syndrome is dominant or recessive. Explain your answer.

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(2)

(ii) Using the symbols of **D** for dominant allele and **d** for recessive allele, show the genotype for the following individuals.

B .....

F .....

J .....

(2)

(iii) Individuals C and D have one affected child. Use a genetic diagram to determine the probability of their next child being affected.

(3)

Leave blank

(c) A genetic disease can suddenly appear in a family with no previous history of the disease. Suggest how this could be possible.

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(2)

Q2

(Total 11 marks)

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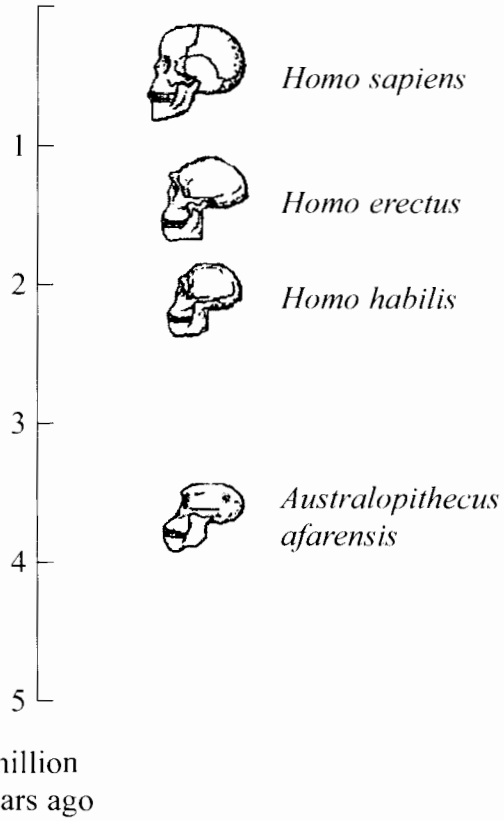
3. The diagram below shows a time scale and the skull of a modern human, *Homo sapiens*, together with those of some possible ancestors.



(a) State **one** structural feature that would be visible on the cranium of the skull of *Australopithecus afarensis* that would not be visible on any of the species of *Homo*.

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(b) State **two** pieces of fossil evidence that might be used to indicate whether an ancestral hominid species was capable of bipedal walking.

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(c) Explain how climate changes may have had an influence on the evolution of hominid features.

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(d) Explain how the technique of **DNA hybridisation** could be used to give evidence for the evolutionary relationships between primates.

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(4)

Q3

(Total 10 marks)

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Synoptic Section.

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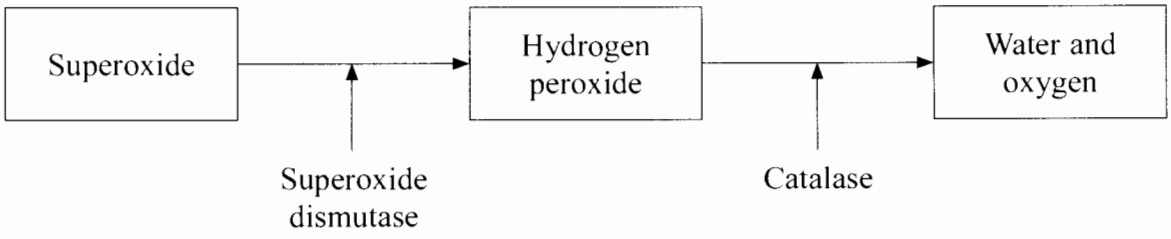
4. Oxidative phosphorylation is an important process that increases the output of ATP from respiratory metabolism. This process is dependent upon the electron transport chain in mitochondria.

The electron transport chain produces free radicals, known as Reactive Oxygen Species (ROS), as by-products. Two examples of ROS are superoxide and hydrogen peroxide.

ROS react with fatty acids causing damage to membranes within cells. In order to prevent the accumulation of damaging levels of ROS, certain enzymes must be produced by the cell. The action of two of these enzymes, superoxide dismutase and catalase, is shown in the diagram below.



(a) Explain why the term **oxidative phosphorylation** is used to describe the synthesis of ATP as a result of electron transport chain activity.

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(b) Suggest why the reaction of ROS with fatty acids might lead to a reduction in the efficiency of oxidative phosphorylation in mitochondria.

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(c) Explain how a point mutation in the gene for superoxide dismutase synthesis might result in damaging levels of ROS accumulating in mitochondria.

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(4)

Q4

(Total 9 marks)

Leave blank

5. The fox (*Vulpes vulpes*) is a common mammal living in both rural (country) and urban (town) areas of the United Kingdom. Foxes eat a variety of foods including berries, rabbits, small birds and rodents such as rats and mice.

(a) The photograph below shows the skull of the fox. Describe **two** features of the teeth of this fox that are an adaptation for feeding on small mammals.

Magnification ×0.5
Source: www.nhc.ed.ac.uk

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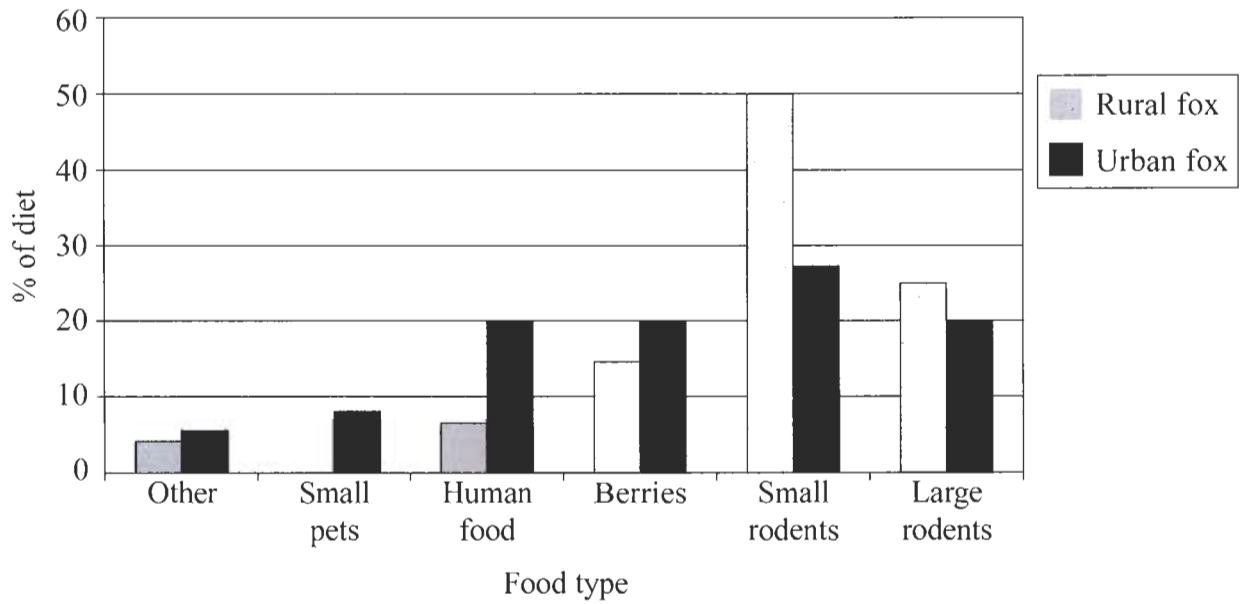
(2)

Leave blank

(b) A number of studies have investigated the differences between the diets of rural foxes and foxes living in urban areas. The results of one study are shown below.



(i) Compare the diet of the rural fox with the diet of the urban fox.

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(2)

(ii) Human food was found to have a high content of carbohydrates and fats. Suggest how this could affect the time spent looking for food and the quantity of food eaten by the urban foxes.

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(c) It has been suggested that the teeth of the urban fox are changing as their diet changes. Describe how the rural and urban foxes could evolve into separate species.

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(4)

(d) The fox is closely related to the dog, a domesticated animal. Describe the characteristics of an animal that make it suitable for domestication.

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Q5

(Total 12 marks)

Leave blank

6. Biodegradable organophosphate pesticides, such as malathion, are used to reduce insect damage to fruits, vegetables and grains during storage.

The chemical structure of malathion resembles the intermediate stage in the hydrolysis of the transmitter substance, acetylcholine, found at synapses in the nervous system. Malathion is able to bind irreversibly to the enzyme, acetylcholinesterase, at its active site. This enzyme catalyses the rapid hydrolysis of acetylcholine in the synapse. Insects coming into contact with relatively small quantities of malathion suffer from a severe disruption of the functioning of their nervous system which leads to their death.

(a) Malathion is an active site-directed enzyme inhibitor. Explain what is meant by the term **active site-directed enzyme inhibitor**.

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(2)

(b) With reference to the function of acetylcholine, explain why malathion can lead to severe disruption of the functioning of an insect's nervous system.

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Leave blank

(c) Suggest why it is easier to control insects in fruit, vegetable and grain stores by chemical means rather than by using biological control.

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(2)

(d) The table below shows the percentage of fruits, vegetables and grains with detectable organophosphate residues in the USA from 1994 to 2001.

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1996	29
1997	28
1998	23
1999	24
2000	23
2001	19

[Data adapted from *US Department of Agriculture*, Pesticide Data Program]

Leave blank

Suggest how the data might have differed if non-biodegradable pesticides, such as DDT, had been used instead of organophosphates. Explain your answer.

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(3) **Q6**

(Total 12 marks)

Leave blank

7. (a) Explain what is meant by the term **gross primary production** (GPP).

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(2)

(b) The table below shows the flow of energy in a tropical rainforest.

Trophic level	Energy entering trophic level/kJ m $^{-2}$ year^{-1}
Producers	180.0×10^3
Primary consumers	5.0×10^3
Secondary consumers	4.5×10^3
Tertiary consumers	3.4×10^3
Decomposers	28.4×10^3

(i) Energy is transferred between trophic levels. If the producers lose 145×10^3 kJ m^{-2} year^{-1} in respiration, calculate the percentage of net primary production (NPP) which is passed to the primary consumers. Show your working.

Answer ..... %

(3)

Leave blank

(ii) Explain the role of decomposers in a food chain.

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(2)

(iii) The productivity of a temperate forest in Europe is much lower than that of a tropical rainforest. Suggest reasons for this difference.

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(2)

Leave blank

(c) Describe how a forest could be managed sustainably in order to ensure a continual supply of timber for the future.

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(3)

Q7

(Total 12 marks)

TOTAL FOR PAPER: 70 MARKS

END