James Ruse Agricultural High School

2004

HIGHER SCHOOL CERTIFICATE

TRIAL EXAMINATION

BIOLOGY

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black or blue pen

- Draw diagrams using pencil
- Board-approved calculators may be used
- *Write your Student Number at the top of the pages*

Total marks - 100

Section I Pages 2 – 27

75 marks
This section has two parts, Part A and Part B

Part A – 15 marks
- Attempt Questions 1- 15
- Allow about 30 minutes for this part

Part B – 60 marks
- Attempt Questions 16 - 29
- Allow about 1 hour and 45 minutes for this part

Section II Pages 28 – 29

25 marks
- Attempt all parts of this question
- Allow about 45 minutes for this section

Section I

75 marks

Part A – 15 marks

Attempt Questions 1 – 15

Allow about 30 minutes for this part

Use the multiple choice answer sheet.

Select the alternative A, B, C or D that best answers the question. Fill in the response circle completely.

Sample 2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9

A ○ B ○ C ○ D ○

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ○ B ○ C ○ D ○

If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and drawing an arrow as follows:

correct

A ○ B ○ C ○ D ○

1. In an organism, pink spots is a sex-linked recessive trait, white colour being the sex-linked dominant trait. If a white heterozygote female were mated with a white male what would be the phenotypic ratio of the male offspring?

   (A) 1:1 pink spots to white colour

   (B) all pink spots

   (C) all white

   (D) 3:1 white colour to pink spots

2. Which set of system components would be required for the process of homeostasis to occur in a mammal?

   (A) detector, receptor, effector

   (B) detector, receptor, effector, control centre

   (C) receptor, effector

   (D) control centre, effector

3. What is the name of the scientist who proved that micro-organisms are responsible for the souring of alcoholic drinks such as wine?

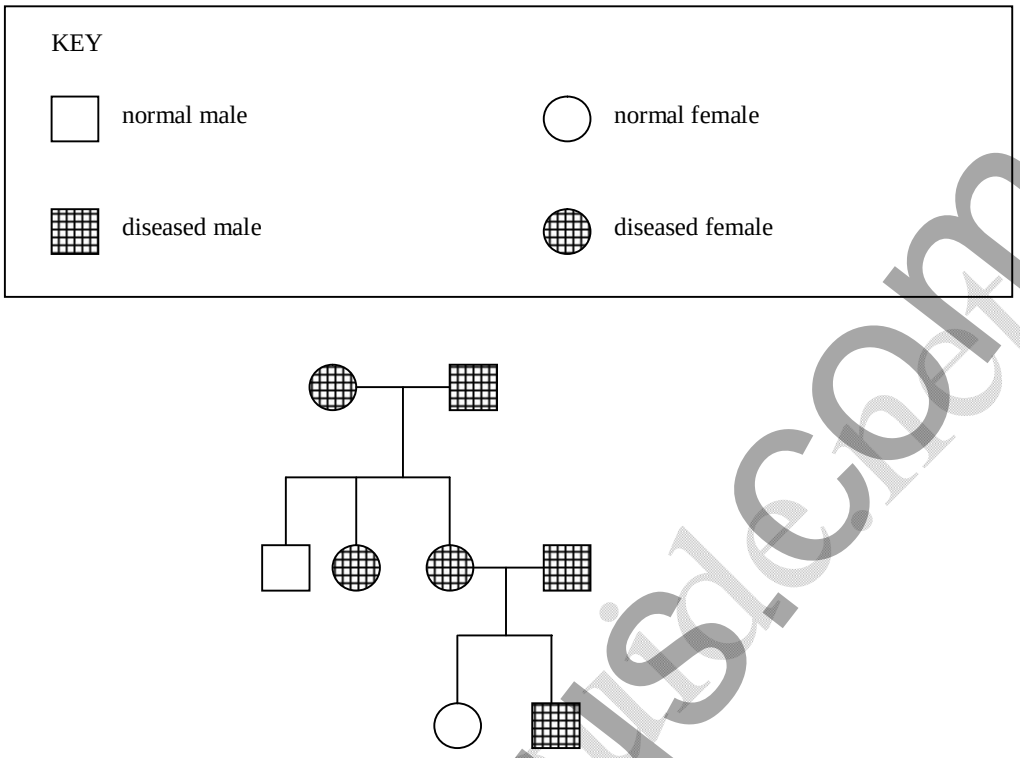
   (A) Robert Koch

   (B) Louis Pasteur

   (C) Gregor Mendel

   (D) Thomas Morgan

4. The pedigree for a bone disease in chickens is shown.



What type of inheritance is chicken bone disease according to the pedigree?

(A) recessive

(B) sex-linked dominant

(C) co-dominance

(D) sex-linked recessive

5. What factors are essential for an infectious disease to occur throughout a population?

(A) host, vector, air , water, contact between members of the population

(B) host, vector, parasite

(C) host, vector, pathogen

(D) vector, pathogen

6. A fungus called *Neurospora*, found on stale bread, was treated with X-rays. The growth requirements of the three types of *Neurospora* that resulted from the treatment with X-rays are shown in the diagram. A dark band on top of the medium represents growth of the fungus.

These results suggested the following sequence of steps occurring in *Neurospora* for the synthesis of one amino acid essential for the growth of the mould, arginine:

What is the genetic basis for these results?

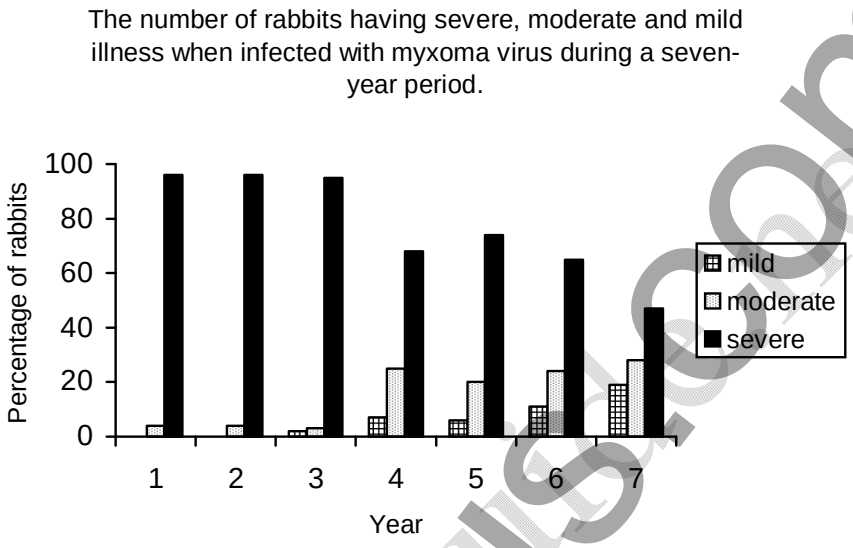
(A) One gene is responsible for all the enzymes A, B and C.

(B) One gene is responsible for enzymes A and B only.

(C) Each enzyme has its own gene.

(D) The enzymes do not result from genes.

7. The graph displays the percentage of rabbits having severe (death), moderate (illness) and mild reactions (minor illness) when infected with myxoma virus during a seven-year period.



What is the scientific explanation for these results?

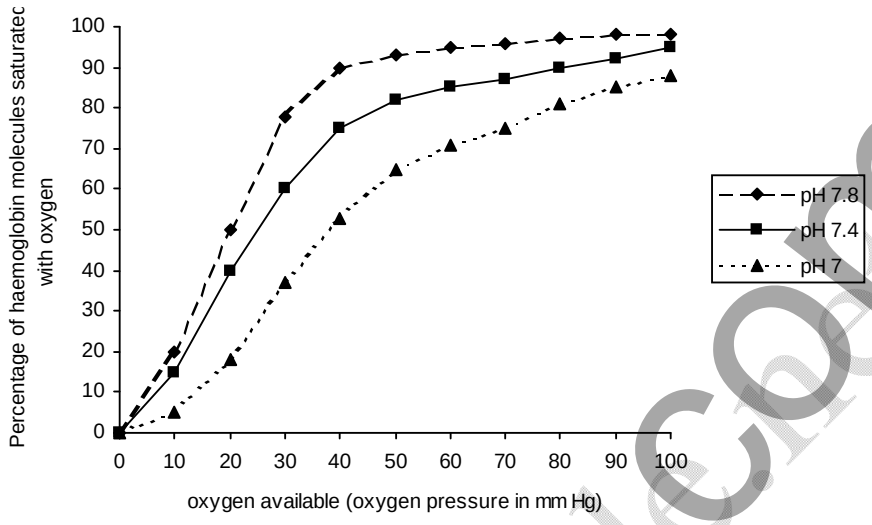
(A) The rabbits in Year 1 had different susceptibilities to the virus. Over the years, the rabbits passed their susceptibility to the virus on to their offspring.

(B) The rabbits altered their ability to survive the virus during the seven-year period: the rabbits that had severe reactions were able to change their phenotype so that they would eventually survive the virus.

(C) The environment affected the rabbits' phenotype.

(D) The virus had competition from other viruses.

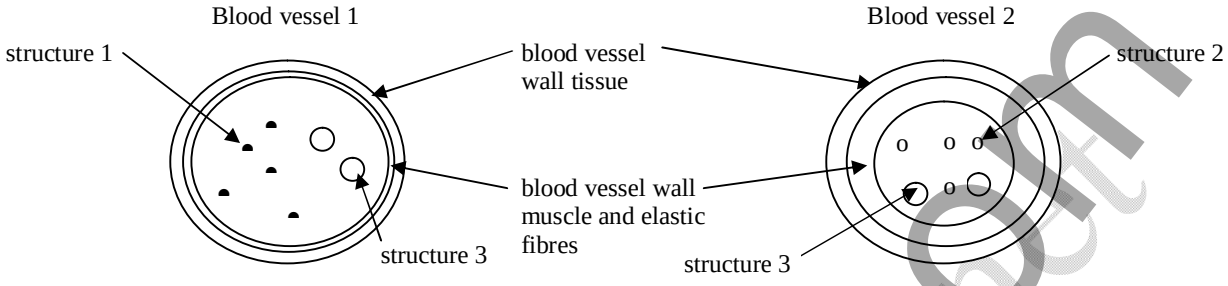
8. The graph shows the effect of pH on the saturation of human haemoglobin with oxygen.



There are two primary reasons for the excretion of carbon dioxide from the human body and the graph demonstrates one of these reasons. What are the two reasons for the excretion of carbon dioxide from the human body?

	Reason 1	Reason 2
(A)	An increase in carbon dioxide causes a decrease in pH.	A decrease in pH leads to a decrease in the oxygen saturation of haemoglobin.
(B)	An increase in carbon dioxide causes an increase in pH.	A decrease in pH leads to a decrease in the oxygen saturation of haemoglobin.
(C)	An increase in carbon dioxide causes a decrease in pH.	An increase in pH leads to a decrease in the oxygen saturation of haemoglobin.
(D)	An increase in carbon dioxide causes an increase in pH.	An increase in pH leads to a increase in the oxygen saturation of haemoglobin.

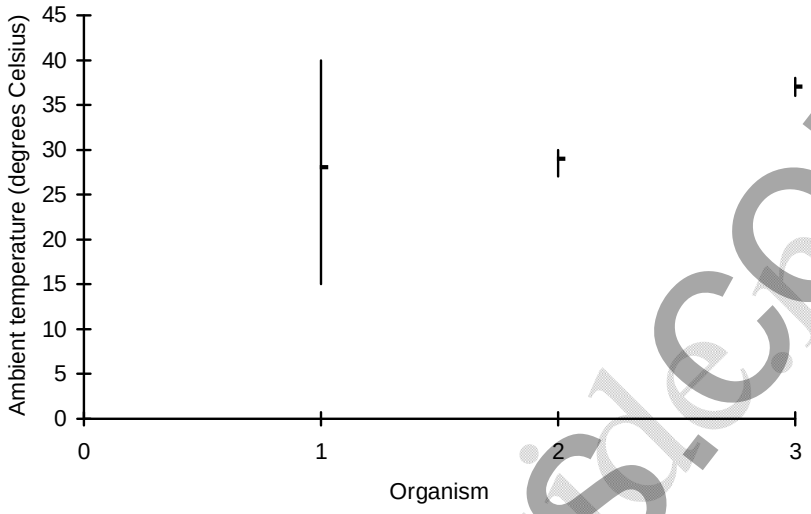
9. The cross-sections of two types of mammalian blood vessels are shown. These diagrams are drawn to scale.



What are the names of the blood vessels and the structures labelled in the diagrams?

	Blood vessel 1	Blood vessel 2	Structure 1	Structure 2	Structure 3
(A)	vein	artery	red blood cell with haemoglobin-oxygen	red blood cell with haemoglobin-carbon dioxide	white blood cell
(B)	vein	artery	red blood cell with haemoglobin-carbon dioxide	red blood cell with haemoglobin-oxygen	white blood cell
(C)	artery	vein	red blood cell with haemoglobin-oxygen	red blood cell with haemoglobin-carbon dioxide	platelet
(D)	capillary	vein	red blood cell with haemoglobin-carbon dioxide	red blood cell with haemoglobin-oxygen	white blood cell

10. The graph shows the core (internal) temperature range of several organisms as a result of the ambient temperature each encounters in their habitat.



Which organism uses the process of homeostasis in response to the changes in the ambient temperature it experiences?

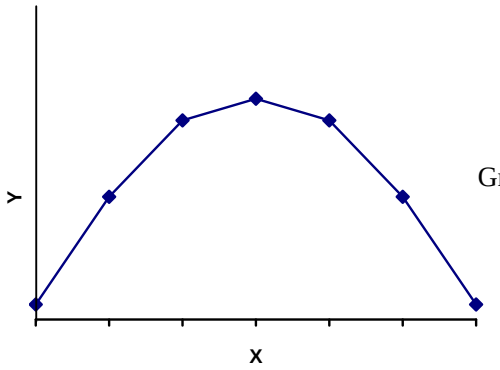
(A) Organism 1 only

(B) Organism 2 only

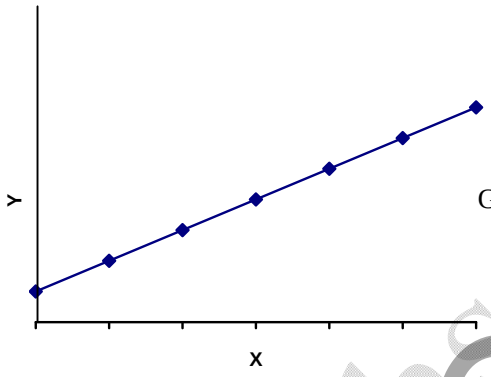
(C) Organisms 1 and 3

(D) Organisms 2 and 3

11. The effect of altering the temperature (from 0°C to 100°C), pH (0 to 14 pH) and substrate concentration on the activity of a human enzyme was investigated. The graphs show the results of two of these factors on the enzyme activity.



Graph 1



Graph 2

What would be the independent and dependent variables in these investigations?

	Independent variable		Dependent variable	
	Graph 1	Graph 2	Graph 1	Graph 2
(A)	enzyme activity	substrate concentration	temperature	enzyme activity
(B)	temperature	enzyme activity	substrate concentration	enzyme activity
(C)	enzyme activity	enzyme activity	temperature	substrate concentration
(D)	temperature	substrate concentration	enzyme activity	enzyme activity

Questions 12 and 13 refer to the following information.

A group of biology students decided to investigate the hypothesis that meat kept warm in smorgasbord food troughs contains a greater number of certain types microbes than meat freshly prepared. For their method, the students placed meat pieces from each condition in sterile agar plates. The agar plates were placed in incubators for 24 hours at a constant temperature and then observed.

12. What would be a control condition for this investigation?

(A) Placing the same amount of meat pieces in each agar plate.

(B) An agar plate that contains all types of meat pieces – smorgasbord meat and fresh meat.

(C) Agar plates with meat pieces not incubated.

(D) Two agar plates with no meat pieces included.

13. What is one variable that needs to be controlled for this investigation?

(A) the amount of meat placed on the agar

(B) the amount of sticky tape used to seal the agar plates

(C) the type of incubator used

(D) an agar plate with no meat pieces included

14. The table shows the characteristics of a particular disease-causing organism.

Characteristics	Characteristic present or absent in disease-causing organism
protein	present
nucleic acids	present
cell membrane	absent
nucleus	absent

What type of disease-causing organism is it?

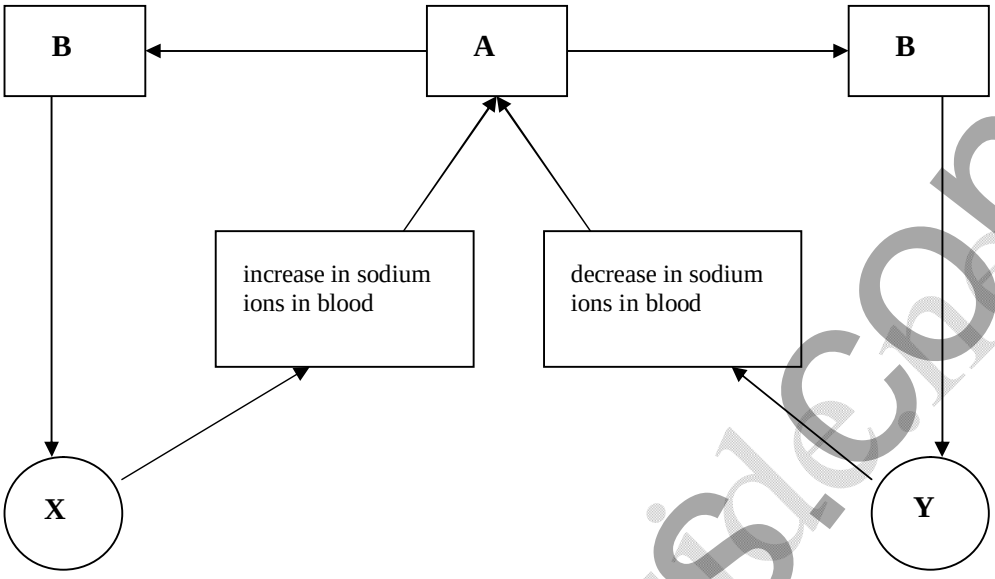
(A) antigen

(B) prion

(C) macro-parasite

(D) virus

15. The diagram shows a process that occurs in the regulation of water and salt levels in mammalian blood.



What would X and Y represent?

	X	Y
(A)	increase in antidiuretic hormone	decrease in antidiuretic hormone
(B)	increase in antidiuretic hormone	increase in aldosterone
(C)	decrease in aldosterone	increase in aldosterone
(D)	increase in aldosterone	decrease in aldosterone

Student Number

Write your Student Number at the top of this Part A Answer Sheet.

Select the alternative A, B, C or D that best answers the question and fill in the response circle completely.

1.	A ○	B ○	C ○	D ○
2.	A ○	B ○	C ○	D ○
3.	A ○	B ○	C ○	D ○
4.	A ○	B ○	C ○	D ○
5.	A ○	B ○	C ○	D ○
6.	A ○	B ○	C ○	D ○
7.	A ○	B ○	C ○	D ○
8.	A ○	B ○	C ○	D ○
9.	A ○	B ○	C ○	D ○
10.	A ○	B ○	C ○	D ○
11.	A ○	B ○	C ○	D ○
12.	A ○	B ○	C ○	D ○
13.	A ○	B ○	C ○	D ○
14.	A ○	B ○	C ○	D ○
15.	A ○	B ○	C ○	D ○

Student Number

Section I (continued)

Part B – 60 marks
Attempt Questions 16 - 29
Allow about 1 hour and 45 minutes for this part

Answer the questions in the spaces provided

Question 16 (4 marks)

Antibiotics have been used to manage some disease conditions.

Discuss the use of antibiotics in treating disease. (4 marks)

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Questions continue on next page →

Question 17 (5 marks)

(a) State one early hypothesis (before the 1800s) for the cause of malaria. (1 mark)

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(b) Describe one piece of evidence that led to the discarding of the hypothesis you stated in (a). (1 mark)

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(c) Describe the evidence that proved the cause of malaria. (1 mark)

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Questions continue on next page →

Question 17 continued.

(d) State one way of preventing malaria. (1 mark)

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(e) Explain how the method you describe in (d) works to prevent malaria. (1 mark)

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Question 18 (2 marks)

Explain why the immune response is suppressed in organ transplant patients. (2 marks)

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Questions continue on next page →

Question 19 (3 marks)

(a) Name a disease that results from an imbalance of microflora in humans. (1 mark)

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(b) Explain how the disease you stated in (a) occurs. (2 marks)

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Question 20 (3 marks)

Boiling water for several minutes is one way of treating water in order to reduce the risk of infection from organisms such as *Giardia* and *Cryptosporidium*.

(a) Describe one other way in which water can be made suitable for drinking. (1 mark)

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Questions continue on next page →

Question 20 continued.

(b) Explain how the method you described in (a) reduces the risk of infection by organisms such as *Giardia* and *Cryptosporidium*. (2 marks)

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Questions continue on next page →

Question 21 (4 marks)

(a) Outline a process used to produce a transgenic species. (3 marks)

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(b) Give one reason for producing the transgenic species you described in (a). (1 mark)

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Questions continue on next page →

Question 22 (7 marks)

"The evolution of organisms can be affected by changes to the environment and the use of modern reproductive technologies."

Discuss this statement.

Questions continue on next page →

Question 23 (4 marks)

Construct a flow chart that shows the changes in DNA sequences can result in changes in cell activity.

Questions continue on next page →

Question 24 (2 marks)

Explain one way by which the environment may affect the phenotype of an organism.

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Question 25 (3 marks)

(a) Give an example of hybridisation within a species. (1 mark)

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(b) Explain the purpose of the hybridisation in the example given in (a). (2 marks)

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Questions continue on next page →

Question 26 (6 marks)

(a) Compare the type of nitrogenous wastes in terrestrial mammals and Australian insects. (2 marks)

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(b) Explain the differences in the type of nitrogenous wastes produced by terrestrial mammals and Australian insects. (4 marks)

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Questions continue on next page →

Question 27 (6 marks)

(a) Draw a labelled diagram of a mammalian nephron. (2 marks)

(b) Explain how the process of passive transport is involved in the nephron's ability to regulate body fluid composition. (2 marks)

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(c) Explain how the process of active transport is involved in the nephron's ability to regulate body fluid composition. (2 marks)

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Questions continue on next page →

Question 28 (6 marks)

Diagram 1 shows one type of plant tissue associated with the transport of certain substances throughout plants.

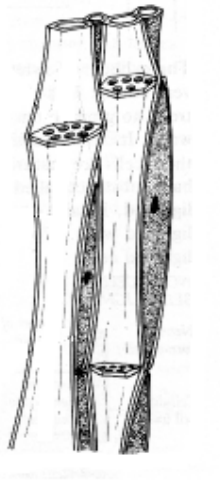

Diagram 1

(a) State the name of the plant tissue shown in diagram 1 and describe one theory about the movement of materials in it. (3 marks)

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Questions continue on next page →

Question 28 continued.

Diagram 2 shows one type of plant tissue associated with the transport of certain substances throughout plants.

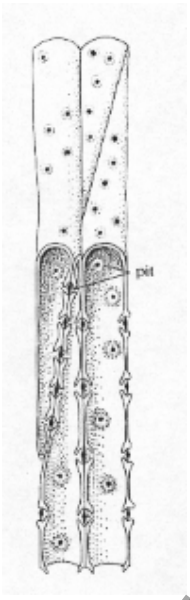

Diagram 2

(b) State the name of the plant tissue shown in diagram 2 and describe one theory about the movement of materials in it. (3 marks)

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Questions continue on next page →

Question 29 (5 marks)

(a) Using a specific example, describe how the theory of evolution is supported by biochemical studies. (2 marks)

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(b) Using a specific example, describe how the theory of evolution is supported by palaeontological studies. (3 marks)

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Questions continue on next page →

Student Number

Section II

25 marks

Attempt ALL parts of Question 33 Genetics-The Code is Broken?

Allow about 45 minutes for this part

Answer the question parts in a writing booklet. Extra writing booklets are available.

Questions continue on next page →

Question 33 Genetics – The Code is Broken? (25 marks)

(a) Explain how DNA fingerprinting can be used for paternity testing. (4 marks)

(b) Discuss the benefits and limitations of the Human Genome Project. (5 marks)

(c) (i) Give one example of a mutation that is a result of chromosomal rearrangements. (1 mark)

(ii) Explain how this mutation may occur. (1 mark)

(d) UV radiation (from the sun) is mutagenic, however DNA has the ability to repair itself when affected by UV radiation.

Describe how this repair is accomplished in eucaryotes. (2 marks)

(e) Explain the effects of the following type of genetic mutation on human health: Sickle cell anaemia. (3 marks)

(f) Discuss the research about the evolution of human haemoglobin genes and their actions. (4 marks)

(g) Describe how recombinant DNA technology can be used to identify the position of a gene on a chromosome. (5 marks)

End of Trial paper