

# HURLSTONE AGRICULTURAL HIGH SCHOOL



## TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION BIOLOGY 2013

### General Instructions –

- \* Reading time – 5 minutes
- \* Working time – 3 hours
- \* Write your student number at the top of each page.
- \* Write in blue or black pen only.
- \* Draw diagrams in pencil.
- \* Board-approved calculators may be used.

### Examiners –

Mr. R. Schippers, Mr. G. Spies,  
Miss V. Garrick, Mr. N. Mahfouz

**Total marks – 100**

### SECTION I (85 marks)

#### Part A – Multiple Choice – 20 marks

- \* Attempt questions 1 to 20
- \* Your answers should be placed on the multiple choice answer sheet.
- \* Allow about 30 minutes for this part.

#### Part B – Extended response – 65 marks

- \* Attempt questions 21 to 31
- \* Allow about 2 hours for this part.

### SECTION II (15 marks)

- \* Questions on **your option**.
- \* Allow about 30 minutes for this section.

**SECTION I****PART A – 20 marks****Attempt questions 1 to 20****Allow 30 minutes for this part**

Use the Multiple Choice answer sheet to answer these questions

**Question 1.**

In the normal kidney of a human which of the following substances would not be found in the Bowman's capsule.

- (A) Glucose.
- (B) Haemoglobin.
- (C) Water.
- (D) Urea.

**Question 2.**

A biologist studied the nitrogenous waste produced by a terrestrial mammal, a freshwater fish and an insect. Which row of observations would be the most likely for these organisms in their natural environment?

	<i>Terrestrial mammal</i>	<i>Freshwater fish</i>	<i>Insect</i>
(A)	Produces dilute urine	Produces concentrated urine	Produces dilute ammonia
(B)	Produces concentrated urine	Produces dilute urine	Produces dilute urea
(C)	Produces dilute urine	Produces concentrated urine	Produces concentrated ammonia
(D)	Produces concentrated urine	Produces dilute urine	Produces uric acid

**Question 3.**

Transpiration in desert plants needs to be reduced as much as possible.

An adaptation that reduces transpiration is –

- (A) succulent leaves.
- (B) more stomates on the top surface of the leaves.
- (C) thorns on the plant's branches.
- (D) sunken stomates on the plant's leaves.

**Question 4.**

The function of haemoglobin is to –

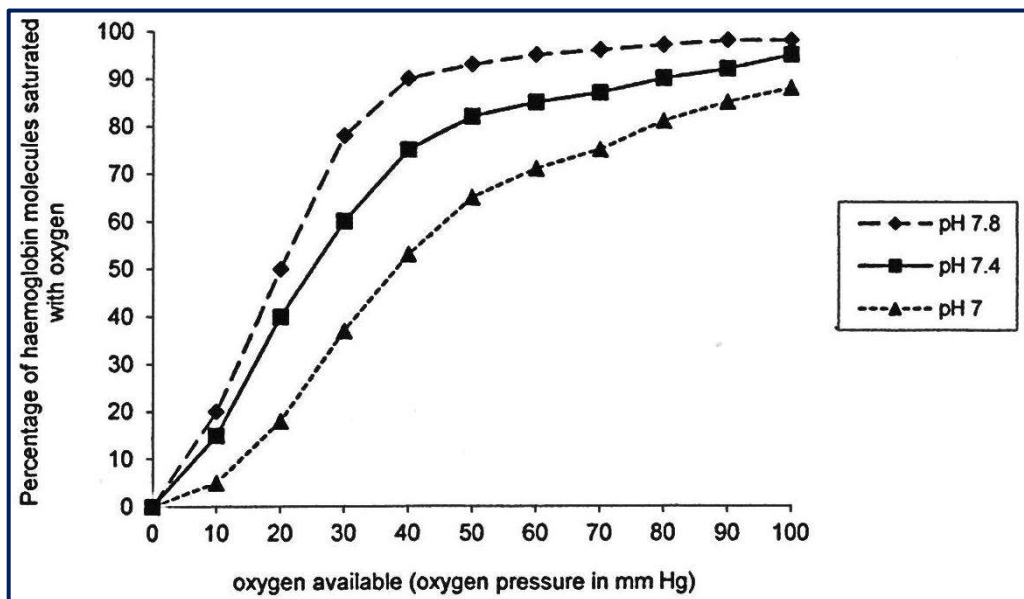
- (A) maintain body temperature.
- (B) transport oxygen.
- (C) maintain blood pH.
- (D) transport salts.

**Question 5.**

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

There are two important 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?



	<b>Reason 1.</b>	<b>Reason 2.</b>
(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 an increase in the oxygen saturation of haemoglobin

**Question 6.**

One advantage of the pulse oximeter is –

- (A) it measures blood pH as well as the percentage of carbon dioxide in the blood.
- (B) it uses safe ultra-violet light to make the measurement.
- (C) it is non-invasive, ie. no sample needs to be taken.
- (D) that the pulse is measured as well as the percentage carbon dioxide saturation of the blood.

**Question 7.**

One major difference between renal dialysis and the natural function of the kidney is –

- (A) The kidney only uses passive osmosis but renal dialysis uses a lot of energy.
- (B) Renal dialysis uses artificial replacement aldosterone, where the kidney uses naturally produced aldosterone from the adrenal cortex.
- (C) Dialysis tubing is permeable to salt, so patients lose most of their salt during dialysis treatment, which does not happen in the kidney.
- (D) Renal dialysis produces a large volume of waste dialysing solution but the kidney produces only a few litres of urine.

**Question 8.**

Which of the following provides the strongest evidence for the Theory of Evolution?

- (A) Many of the native animals in Australia are related to those in South America.
- (B) A gene that controls eye growth in mice is different to the same gene in fruit flies.
- (C) Fossil evidence shows that many animals were larger than they are now.
- (D) Dinosaurs became extinct around 65 million years ago.

**Question 9.**

Red/green colour blindness in humans is a recessive condition inherited on the X-chromosome. A non-colour blind woman, whose father is colour blind marries a colour blind man.

What is the probability that any child they have will be colour blind?

- (A) 100%
- (B) 50%
- (C) 25%
- (D) 0%

**Question 10.**

Which of the following is an example of convergent evolution?

- (A) The different species of finch on the Galapagos islands which have adapted to their own particular environmental niches.
- (B) The Thylacine of Tasmania and the wolf of the Northern hemisphere both adapted to a predatory lifestyle.
- (C) In farming areas, insects developed resistance to the powerful insecticide DDT.
- (D) New species evolved rapidly following the appearance of transitional forms.

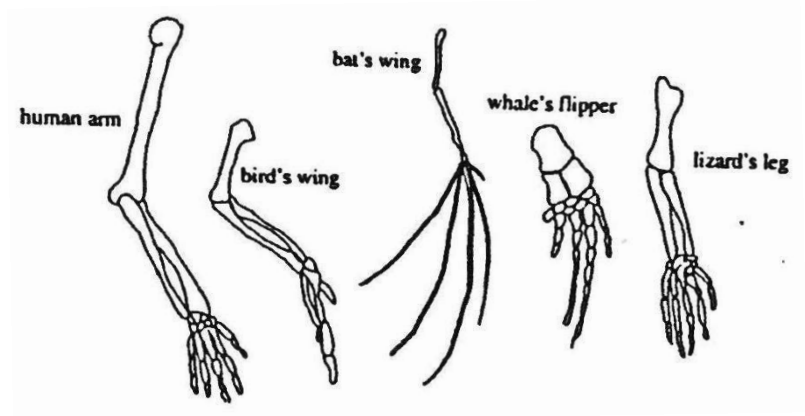
**Question 11.**

A section of DNA molecule has 30 base pairs. What is the maximum number of amino acids this would code for?

- (A) 6 amino acids.
- (B) 10 amino acids.
- (C) 15 amino acids.
- (D) 30 amino acids

**Question 12.**

The diagram shows the forelimbs of several different vertebrates.



What form of evidence is shown by the diagram?

- (A) Homologous structures.
- (B) Comparative embryology.
- (C) Biochemistry.
- (D) Transitional species.

**Question 13.**

A single strand of DNA has the following base sequence - CAT GAC TCG

The base sequence on the complementary strand of DNA would be –

- (A) CAT GAC TCG
- (B) GUA CUC AGC
- (C) CAU GAC UCG
- (D) GTA CTG AGC

**Question 14.**

In humans the gene for normal skin pigmentation (N) is dominant over the gene for albinism (n).

An albino woman, whose father is albino and whose mother has normal skin pigmentation, marries a man of normal skin pigmentation, but whose father is also albino.

They have a daughter with normal skin pigmentation.

The genotypes of the woman, her husband and their daughter would be respectively –

- (A) nn, Nn and Nn.
- (B) NN, nn and Nn.
- (C) Nn, NN and Nn.
- (D) Nn, NN and Nn.

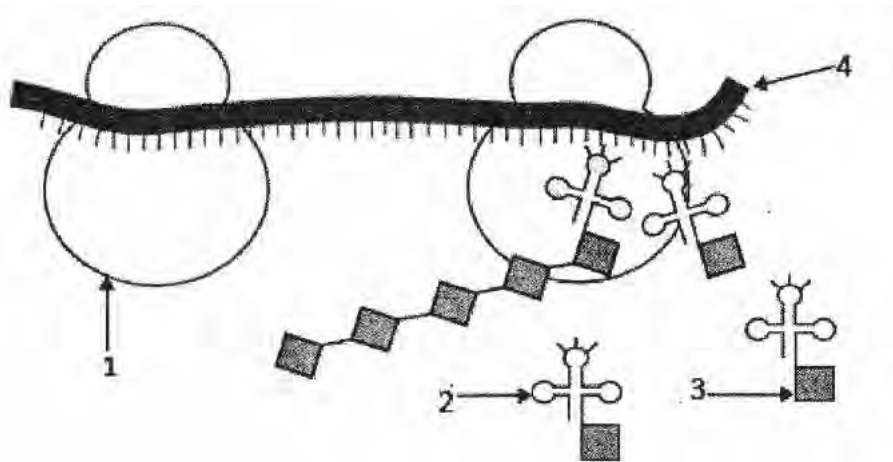
**Question 15.**

What was the evidence which led to Beadle and Tatum's 'one gene – one protein' theory.

- (A) Inter-breeding different pea plants to form hybrids.
- (B) Showing that the bacterium, *E. coli*, can be infected by viral DNA.
- (C) Growing bread mould, *Neurospora crassa*, on different agar growth mediums.
- (D) Splicing RNA of the ciliated protozoan, *Tetrahymena*, using ribosomes.

**Question 16.**

During polypeptide synthesis, translation of the genetic code occurs in the cytoplasm of the cell. The following diagram is one representation of the translation process.



From the diagram –

- (A) 1 represents a ribosome.
- (B) 2 represents mRNA.
- (C) 3 represents tRNA.
- (D) 4 represents a polypeptide.

**Question 17.**

Rosalind Franklin’s major contribution to our understanding of the structure of DNA was –

- (A) her X-ray diffraction photographs of crystallised DNA.
- (B) her deduction that there were covalent bonds within nucleic acid polymers.
- (C) her suggestion that DNA had a double helix structure.
- (D) her deduction that there were purine-pyrimidine nitrogenous base pairs.

**Question 18.**

Distemper is a serious, extremely infectious disease of dogs. It is transmitted by droplets sneezed or coughed into the air. The agent causing the disease cannot be cultured on nutrient agar plates and the course of the disease is unaffected by antibiotics. There is no known cure for the disease and vaccination is the best preventative measure.

From the information, it could be concluded that the agent causing distemper is probably –

- (A) a virus.
- (B) a bacterium.
- (C) a protozoan.
- (D) a prion.

**Question 19.**

A group of students conducted an experiment that produced the results shown in the table. Students washed their hands and then touched nutrient agar dishes with their fingers. Some students acted as controls by not washing their hands.

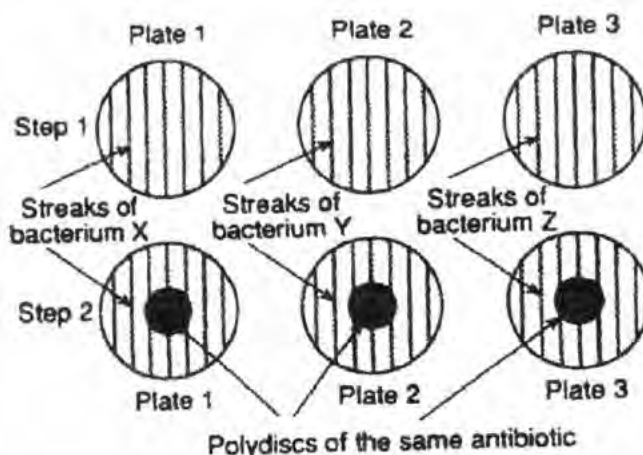
	Unwashed hands	Hands washed with anti-bacterial soap	Hands washed with normal soap
<i>Number of bacterial colonies grown on agar</i>	58	21	24
<i>Number of fungal colonies grown on agar</i>	34	12	11

Which of the following is the most appropriate hypothesis for this experiment?

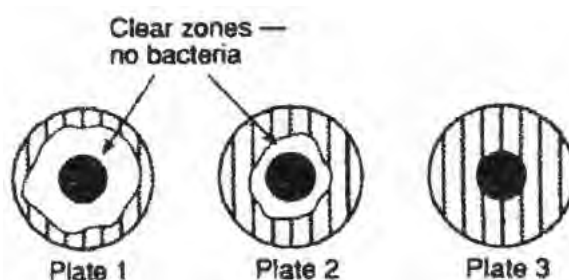
- (A) Anti-bacterial soap prevents the spread of disease.
- (B) Anti-bacterial soap kills microbes on the hands.
- (C) Microbes are present in the air, food and water.
- (D) Washing hands prevents disease.

**Question 20.**

In an experiment to study the effects of an antibiotic on bacterial growth, agar plates were set up as shown -



The plates were incubated at 37°C for 48 hours and the plates showed the results shown at the right.



You could conclude from these results that –

- (A) bacteria Z was not effectively controlled by the antibiotic used in the experiment.
- (B) the antibiotic in plate 1 was different to the antibiotic in plate 3.
- (C) the incubation procedures for plate 3 must have been inadequate.
- (D) when bacteria compete, it is likely that only the strongest will survive.

**SECTION I**

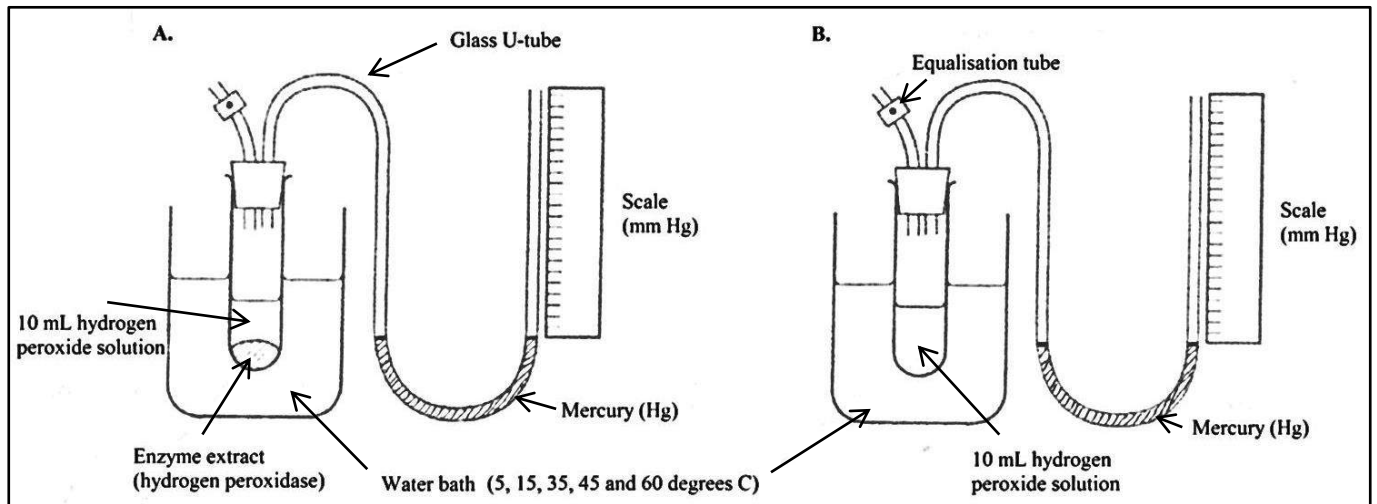
**PART B – 65 marks**

Attempt ALL questions in the spaces provided.

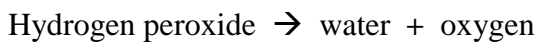
Allow 2 hours for this part.

**Question 21.**

The following experiment was carried out to investigate the action of an enzyme over a given temperature range. Five different temperatures were used, they were 5°C then 15°C then 35°C then 45°C and lastly 60°C.



The enzyme, hydrogen peroxidase, speeds up the following reaction.



(a) Identify two controlled variables for this first hand investigation. (1 mark)

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(b) How does the production of oxygen gas in diagram A result in a reading in mm Hg on the scale ? (1 mark)

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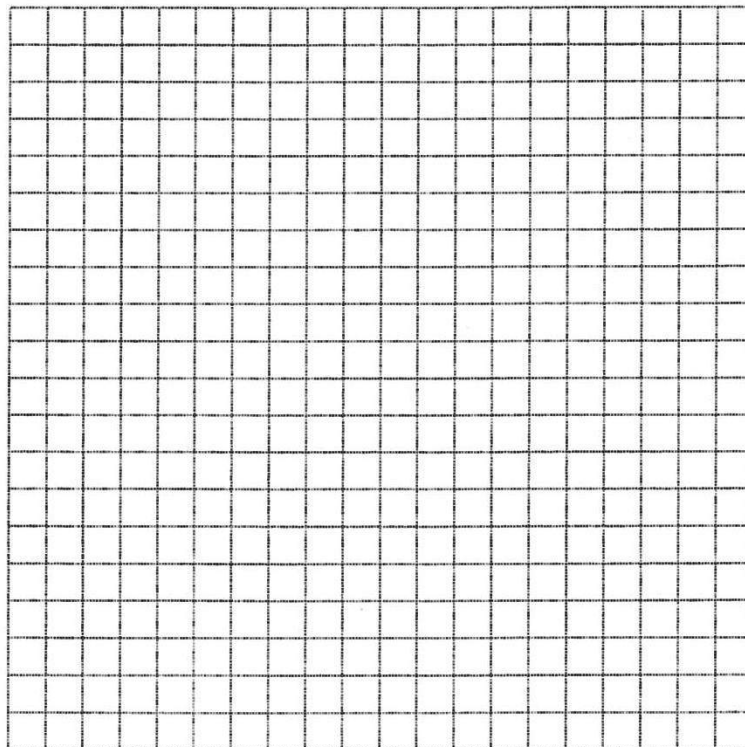


(c) Data was collected from the equipment shown in diagram A and tabulated below.

Temperature ( <sup>o</sup> C)	Enzyme activity (mm Hg)
5	8
15	20
35	48
45	15
60	3

Draw a line graph of this data.

(3 marks)



(d) From the graph –

(i) determine the enzyme activity at 25<sup>o</sup>C: .....

(ii) the temperature at which an enzyme activity of 10mm Hg is obtained: .....

(1 mark)

(e) How do you account for the low enzyme activity at 60<sup>o</sup>C ?

(1 mark)

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**Question 22.**

- (a) Normal venous pressure in the feet is about 25mm Hg. When a person stands completely still, the blood pressure in the feet rises very quickly to about 90mm Hg.  
Apply your understanding of the structure and function of blood vessels to explain this situation. (2 marks)

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- (b) The chemical composition of the blood changes significantly as it travels around the body. Describe the main changes in the concentration of carbon dioxide in the blood and identify the tissues in which these changes occur. (2 marks)

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- (c) Justify continued research into the development of artificial blood. (3 marks)

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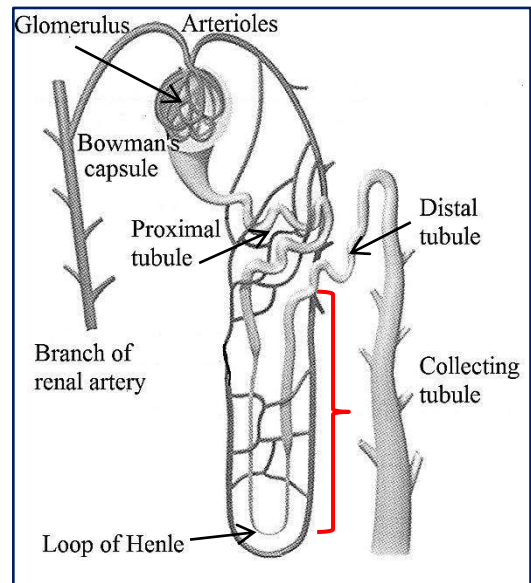
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**Question 23.**

The diagram of a human kidney nephron shows where the hormone aldosterone mostly acts (red bracketed ascending loop of Henle).



Discuss the importance of hormone replacement therapy for those people who cannot secrete aldosterone.  
(3 marks)

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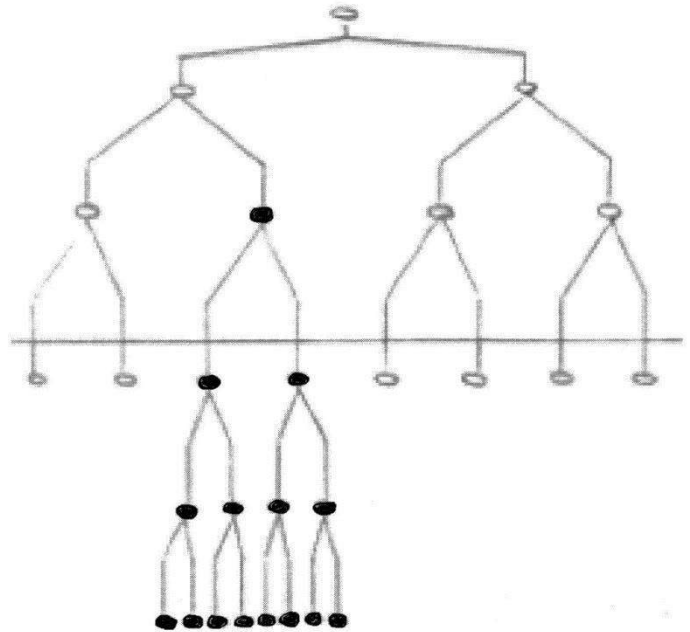
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**Question 25.**

The diagram shows what happens over a period of time after one type of *E. coli* bacteria (coloured white within the diagram) is placed in a normal environment.

After some time the normal environment is changed by adding the antibiotic streptomycin.



- (a) Explain how the diagram supports the Darwin and Wallace Theory of Evolution through natural selection. (4 marks)

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(b) Using an example, describe how the theory of evolution is supported by palaeontological (fossil) evidence. (3 marks)

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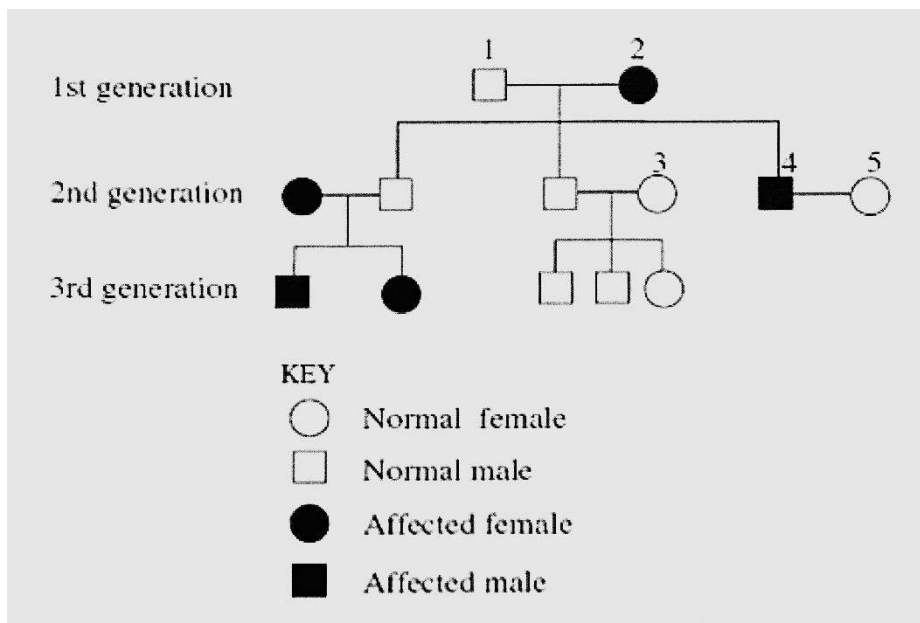
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**Question 26.**

The pedigree chart shows the inheritance of a non sex linked disease in a family.

Let the allele for the disease be **D** (a dominant allele) and the normal allele be represented by **d**.



(a) Identify the genotypes of individuals 1, 2, 3 and 4. (2 marks)

1 : ..... 2 : .....

3 : ..... 4 : .....



**Question 28.**

- (a) Compare the reproductive technologies – artificial pollination and artificial insemination – and include their ability to alter the genetic composition of a population. (3 marks)

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- (b) (i) Outline the processes used to produce a named transgenic plant or animal through genetic engineering. (3 marks)

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(ii) Identify two advantages gained through the use of this transgenic organism. (2 marks)

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(c) Describe two processes that ensure genetic diversity in sexually reproducing natural populations. (2 marks)

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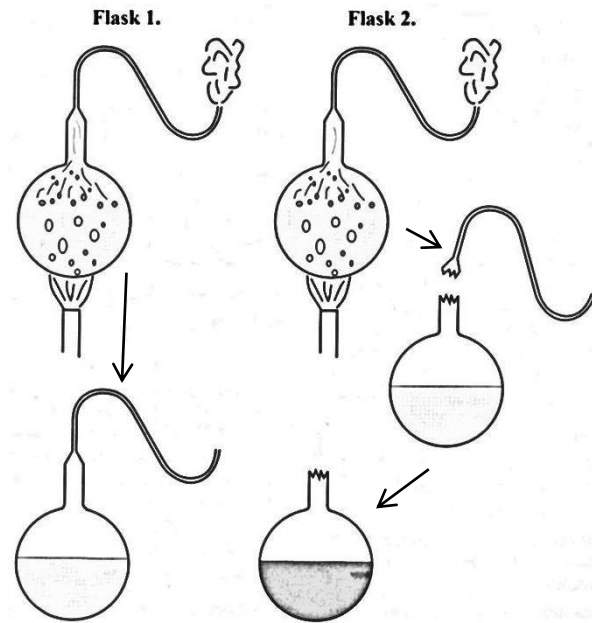
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**Question 29.**

(a) The diagram models Louis Pasteur's Swan-necked flasks experiment.



(i) What were Pasteur's conclusions from this experiment? (2 marks)

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(ii) Outline two other contributions by Pasteur, to our knowledge and understanding of disease. (2 marks)

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**SECTION II (15 marks)**

**Option question. Allow about 30 minutes for this section.**

Answer part (a) and part (b) in a writing booklet.

Part (c) is answered on the question sheet.

Place your student number on each writing booklet that you use and on the question sheet.

Extra writing booklets are available.

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**Question 32.**

(a) For Polygenic inheritance –

- (i) Define polygenic inheritance. (1 mark)
- (ii) Identify two human characteristics that are under the control of polygenes. (1 mark)
- (iii) Describe two features of polygenic inherited characteristics. (2 marks)

(b) During your studies you modelled DNA.

- (i) In step form, describe the method you used. (2 marks)
- (ii) Outline two advantages of using modelling in biology. (2 marks)

(c) Complete the table, comparing the blood types ABO with Rhesus. (7 marks)

<i>Feature compared</i>	<i>ABO</i>	<i>Rhesus</i>
<b>Alleles</b>		
<b>Dominance, recessive, co-dominance relationships</b>		
<b>Possible genotypes and their phenotypes</b>		