

Student Number

Exam Choice

2008

**TRIAL HIGHER SCHOOL
CERTIFICATE
EXAMINATION**

Biology

Total marks – 100

Section I Pages 2 - 22

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 16-28
- Allow about 1 hour and 45 minutes for this part

Section II Pages 23 - 28

25 marks

- Attempt **ONE** Question from Questions 29 - 33
- Allow about 45 minutes for this section

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black or blue pen
- Draw diagrams using pencil
- Approved calculators may be used
- Write your student number in the space provided

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 oval completely.

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

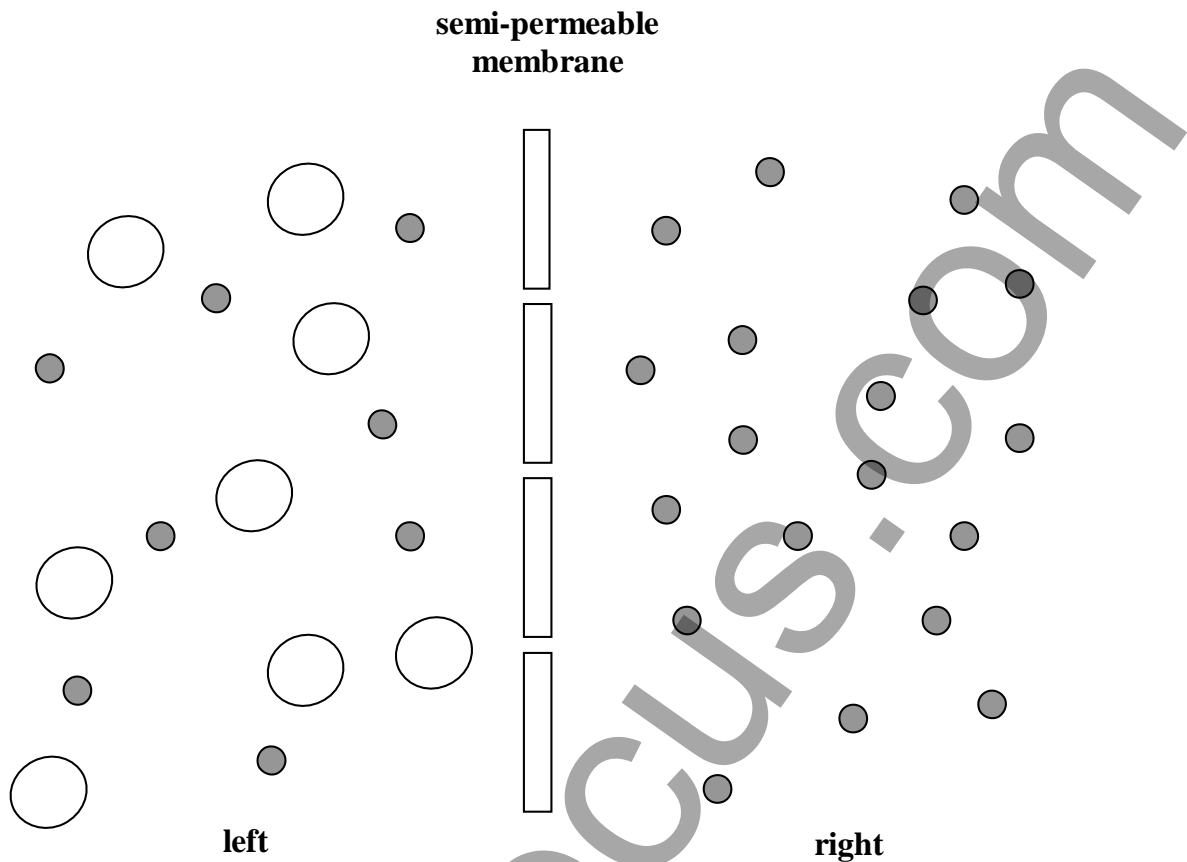
If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A B C D

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

A B C D
correct

1. The diagram below shows a glucose solution to the left, separated by a semi-permeable membrane from water, to the right.



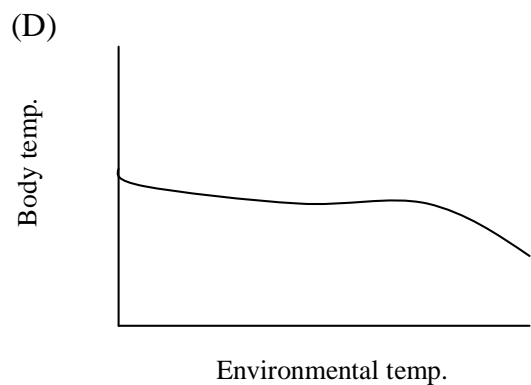
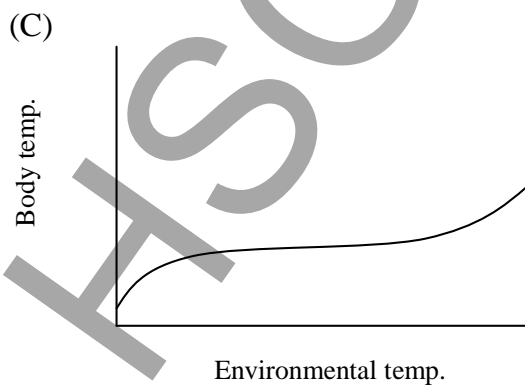
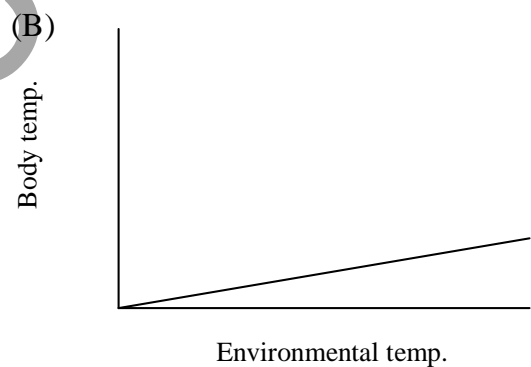
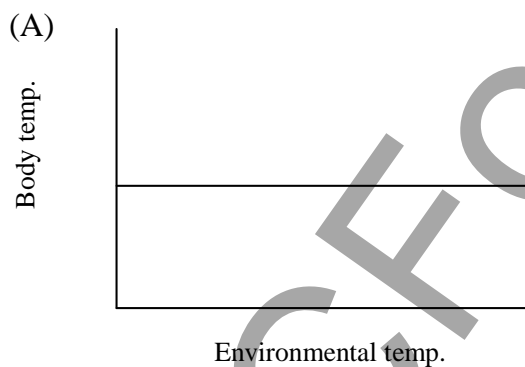
- Which one of the statements below best represents what is likely to happen through osmosis?
- (A) Water molecules will move in both directions, but more from right to left.
 - (B) Water molecules will move from right to left only.
 - (C) Glucose molecules will move in both directions, but more from left to right.
 - (D) Glucose molecules will move from left to right only.
2. A number of different processes are involved in the transport of materials through the phloem. Which one of the following involves active transport?
- (A) The translocation of sugars from sieve element to sieve element.
 - (B) The movement of water into the phloem.
 - (C) The movement of water from sieve element to sieve element.
 - (D) The movement of sugars out of the phloem.

3. The Thorny Devil is found in the deserts and semi deserts of Central Australia.

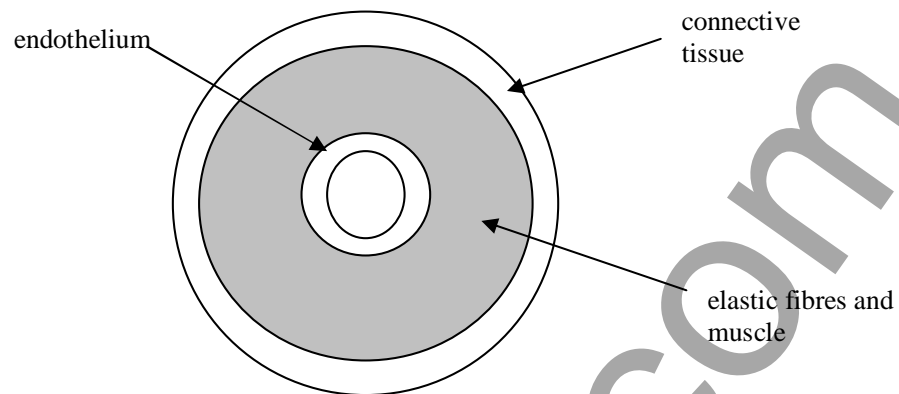
It is an ectotherm.



Choose the graph below that best represents how its body temperature would respond to changes in environmental temperature. (Assuming that its behaviour remains constant throughout)



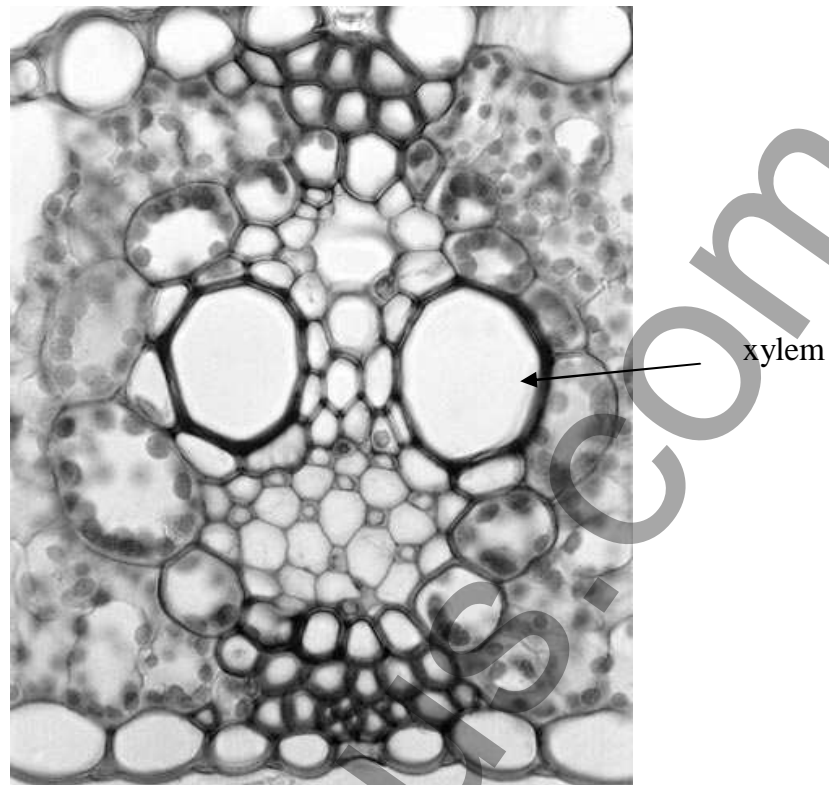
4. The drawing below represents a cross section through a type of blood vessel.



Which type of blood vessel does this represent?

- (A) lymph
 - (B) vein
 - (C) capillary
 - (D) artery
5. After a long day in the sun a worker becomes dehydrated.
- Which one of the following hormonal responses would best counteract this?
- (A) The secretion of ADH to increase the permeability of the collecting ducts.
 - (B) The suppression of ADH to decrease the permeability of the collecting ducts.
 - (C) The secretion of aldosterone to boost salt movement into the nephron.
 - (D) The suppression of aldosterone to decrease salt movement into the nephron.

6. The photomicrograph below shows a transverse section through a vascular bundle.



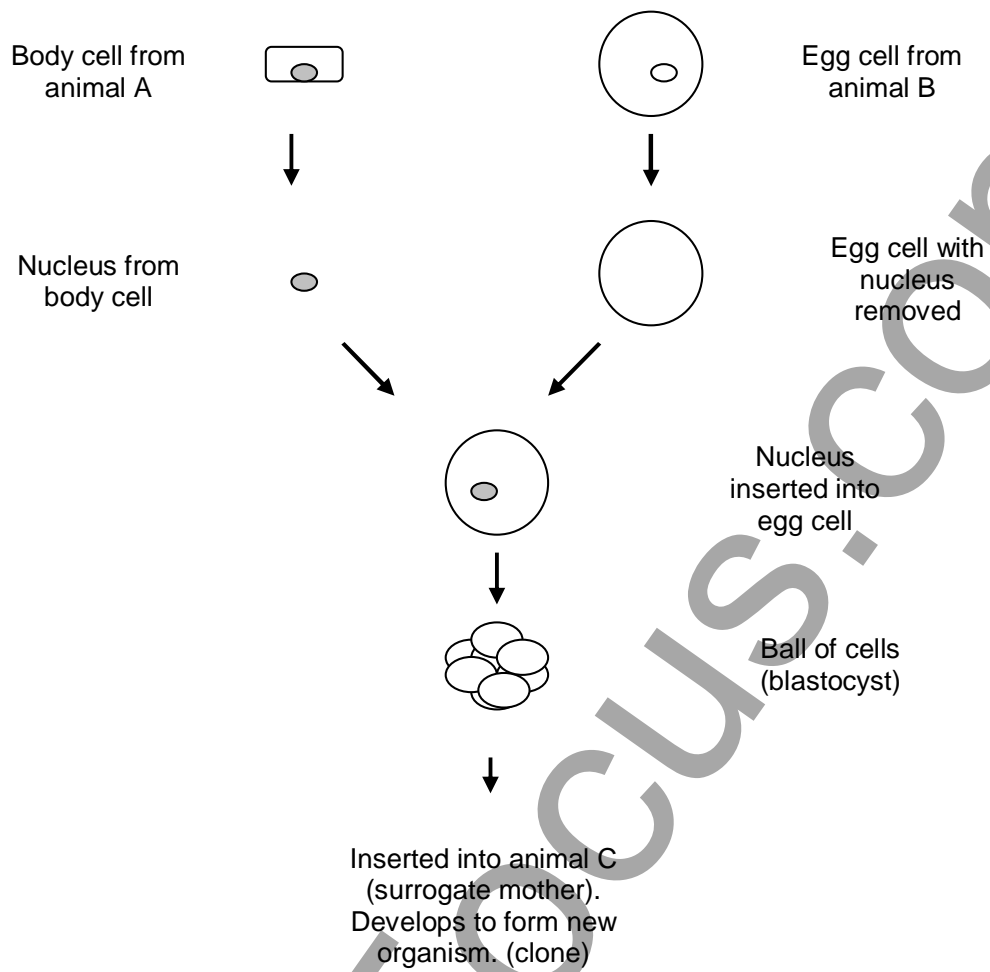
The area of the photomicrograph is 1.00 mm X 0.80 mm.

Use this information to determine the diameter of the large xylem vessel indicated.

- (A) 0.2 μm
 (B) 2 μm
 (C) 20 μm
 (D) 200 μm
7. Which one of the following best describes the contributions of mutation, crossing over and segregation of chromosomes to producing variation within a population?

	mutation	crossing over	random segregation
(A)	Produces new alleles	Gives new combinations of alleles	Gives new combinations of chromosomes
(B)	Gives new combinations of alleles	Gives new combinations of chromosomes	Produces new alleles
(C)	Gives new combinations of chromosomes	Produces new alleles	Gives new combinations of alleles
(D)	Gives new combinations of chromosomes	Gives new combinations of alleles	Produces new alleles

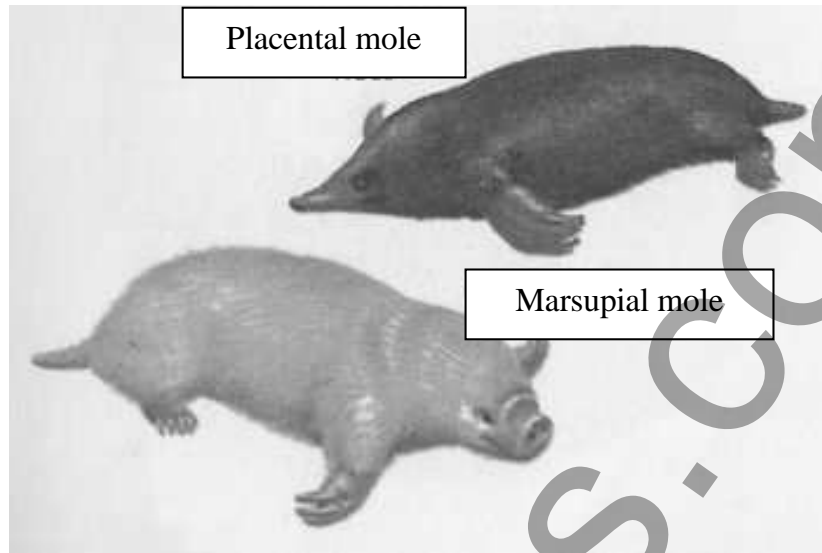
8. The drawing below represents the steps followed in the cloning process.



Which animal will the clone be genetically identical to?

- (A) A
- (B) B
- (C) C
- (D) it will be genetically unique.

9. The picture below shows both the marsupial mole from Australia and the placental mole from Europe and Asia.



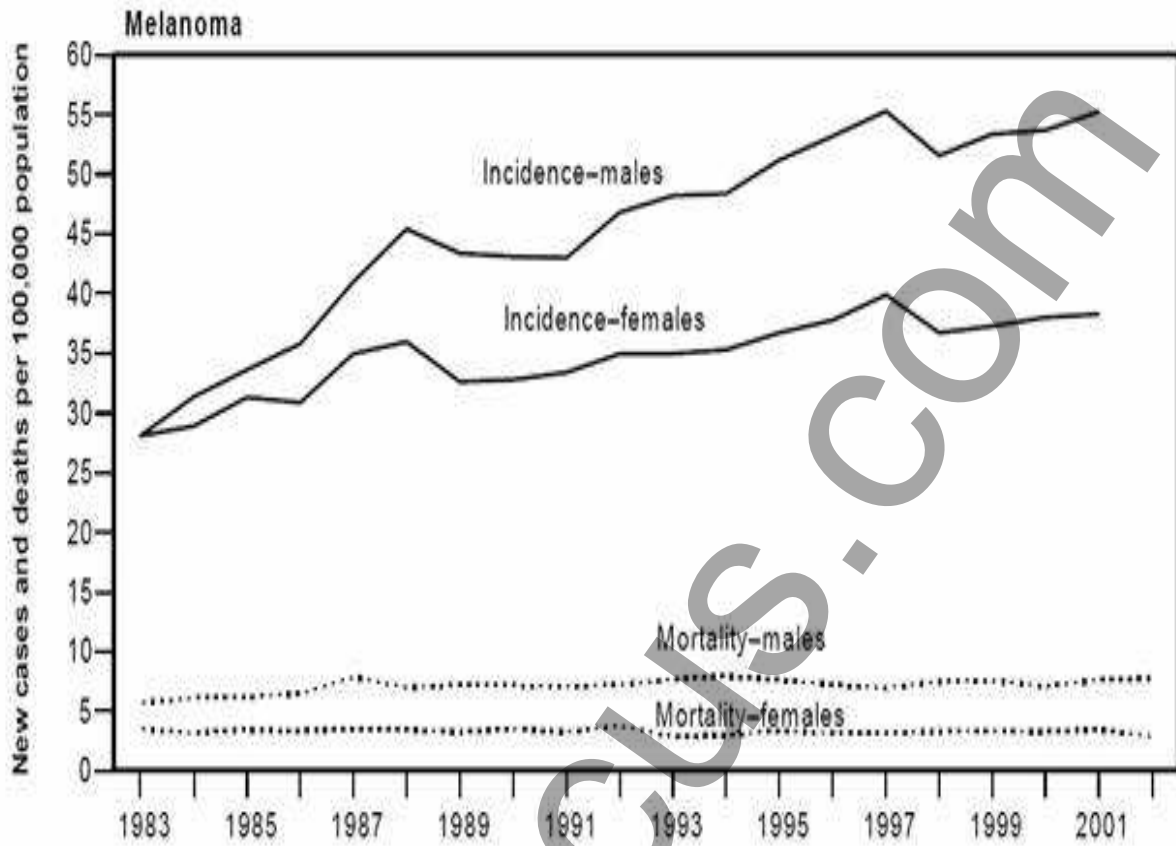
Although they are not closely related they show a remarkable similarity of features.

This is an example of:

- (A) convergent evolution
 - (B) punctuated equilibrium
 - (C) divergent evolution
 - (D) homologous structures
10. Which one of the following best describes the characteristics of prions, viruses and bacteria?

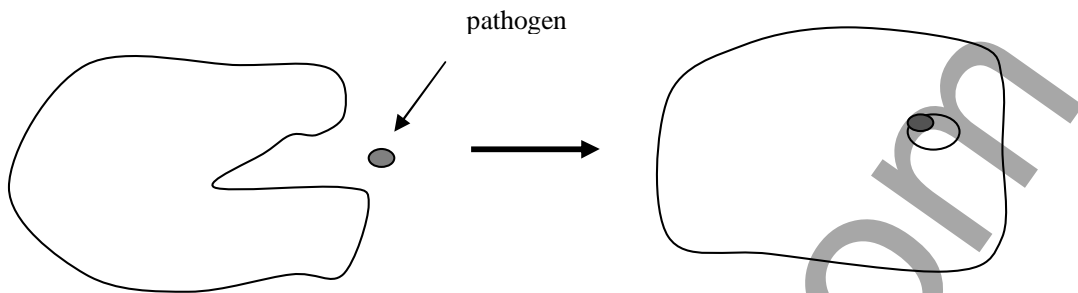
	prions	viruses	bacteria
(A)	Reproduce without nucleic acid	Colonise a host cell to reproduce	Possess membrane bound organelles
(B)	Possess a chitin cell wall	Do not contain nucleic acid	Have no distinct nucleus
(C)	Possess a chitin cell wall	Do not contain nucleic acid	Possess membrane bound organelles
(D)	Reproduce without nucleic acid	Colonise a host cell to reproduce	Have no distinct nucleus

11. The graph below shows incidence and mortality (death) rates from melanoma in NSW for males and females from 1983 to 2001.



- Which one of the following statements is supported by the information in the graph?
- (A) Mortality rates in both males and females are steadily increasing.
 - (B) Incidence rates in both males and females have started to decrease.
 - (C) Fluctuations in incidence in one gender are also seen in the other gender.
 - (D) The incidence rate in males has always been greater than that in females.
12. Organ transplant recipients need to receive medication for the rest of their lives.
- Which one of the following is the best explanation for this?
- (A) To prevent the organ from rejecting the recipient.
 - (B) To protect against infection of the new organ.
 - (C) To prevent the recipient from rejecting the organ.
 - (D) To boost the recipient's damaged immune system.

13. The diagram below shows one of the body's defence adaptations in action.



- The defence adaptation illustrated is:
- (A) the inflammation response
 - (B) phagocytosis
 - (C) the lymphatic system
 - (D) cell death to seal off a pathogen
14. Avian influenza is a disease which has crossed the species barrier from poultry to humans and has led to a number of deaths in Asia. It is not present in Australia.
- Which one of the following is the most effective and practical way of preventing it from breaking out in Australia?
- (A) Public Health campaigns warning against the danger.
 - (B) Strict control of poultry imports by quarantine authorities.
 - (C) Vaccination of poultry to give them immunity to the pathogen.
 - (D) Treatment of poultry with antibiotics to combat the pathogen.
15. A substance which provokes an immune response is:
- (A) a pathogen
 - (B) an antigen
 - (C) an antibody
 - (D) an antibiotic

Section I (continued)

Part B – 60 marks

Attempt Questions 16 – 28

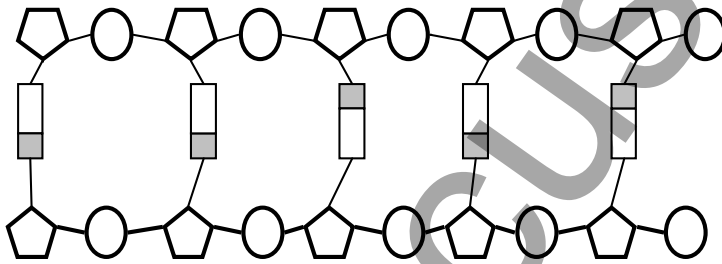
Allow about 1 hour and 45 minutes for this part

Answer the questions in the spaces provided.

Marks

Question 16 (3 marks)

The diagram below represents a section of a molecule of DNA.



- (a) Draw a circle around a single nucleotide. **1**
- (b) Explain why the 'one gene one protein' theory was changed to the 'one gene one polypeptide' theory. **2**

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Question 17 (6 marks)

Carbon dioxide is transported in the blood in three different forms.

As hydrogen carbonate ions (HCO_3^-)

As dissolved carbon dioxide (CO_2)

Bound to protein (ie. as carbaminohaemoglobin)

The table below shows the relative amounts of these substances in the blood of a man who is monitored while at rest and during exercise.

	Concentration of CO_2 in the blood (mmol l^{-1})			
	arterial blood	venous blood (at rest)	venous blood (after light exercise)	venous blood (after heavy exercise)
CO_2 in hydrogen carbonate ions	13.52	14.51	14.6	14.66
Dissolved CO_2	0.68	0.78	1.02	1.32
CO_2 bound to protein	0.3	0.3	0.28	0.24
Total CO_2 in plasma	14.50	15.59	15.90	16.22
pH of blood	7.4	7.37	7.26	7.14

- (a) Identify the form of CO_2 transport which shows the greatest increase due to exercise.

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Question 17 continues on page 13.

Question 17 (continued)

- (b) Describe the effect of exercise on the levels of CO₂ bound to protein. 2

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- (c) Explain the differences in pH between arterial and venous blood. 3

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Question 18 (3 marks)

Using an example of a **non-infectious** disease that you have studied, explain how a knowledge of its cause is important in its treatment or management. 3

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Question 19 (5 marks)

Homeostasis is the maintenance of a stable internal environment.

- (a) Using an example of homeostasis that you have studied, complete the table below 3

Example of homeostasis	
One way in which changes from the stable state are detected.	One way in which changes from the stable state are counteracted.

- (b) Explain why it is important to maintain homeostasis. 2

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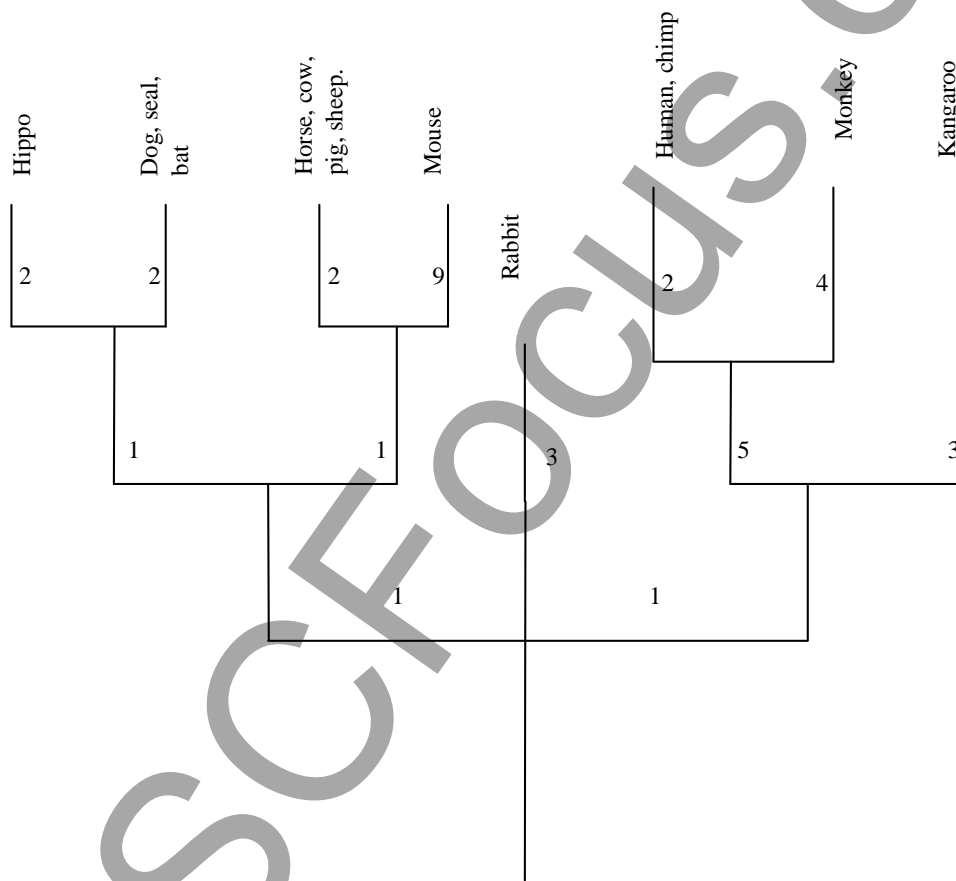
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Question 20 (5 marks)

Cytochrome C is a respiratory enzyme found in all aerobically respiring organisms. It consists of a chain of about 100 amino acids.

The amino acid sequence of the molecule has been determined for a number of species and the information used to infer their evolutionary relationships.

In the diagram below the numbers represent the number of amino acid differences between the species and the junction leading to it. To determine the number of amino acid differences between two species you trace the line between them and add together the numbers on it. For example: the differences between a hippo and a human = $2+1+1+1+5+2 = 12$.



- (a) How many amino acid differences are there between the kangaroo and the rabbit? **1**

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- (b) According to these data which species is most closely related to the human? **1**

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Question 20 continues on page 16.

Question 20 (continued)

- (c) Explain why biochemical differences of the sort shown here are thought to reflect evolutionary relationships. 3

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Question 21 (4 marks) 4

Complete the table below to outline the roles of some components of the immune response.

Component of the immune response	Role in the immune response
Antibodies	
B cells (B lymphocytes)	
Helper T cells (Helper T lymphocytes or T4 lymphocytes)	
Killer T cells (Cytotoxic T lymphocytes)	

Question 22 (5 marks)

Scientific knowledge builds on the work of past scientists.

Discuss this statement as it applies to the field of Genetics.

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In your answer you should refer to the work of at least THREE named scientists.

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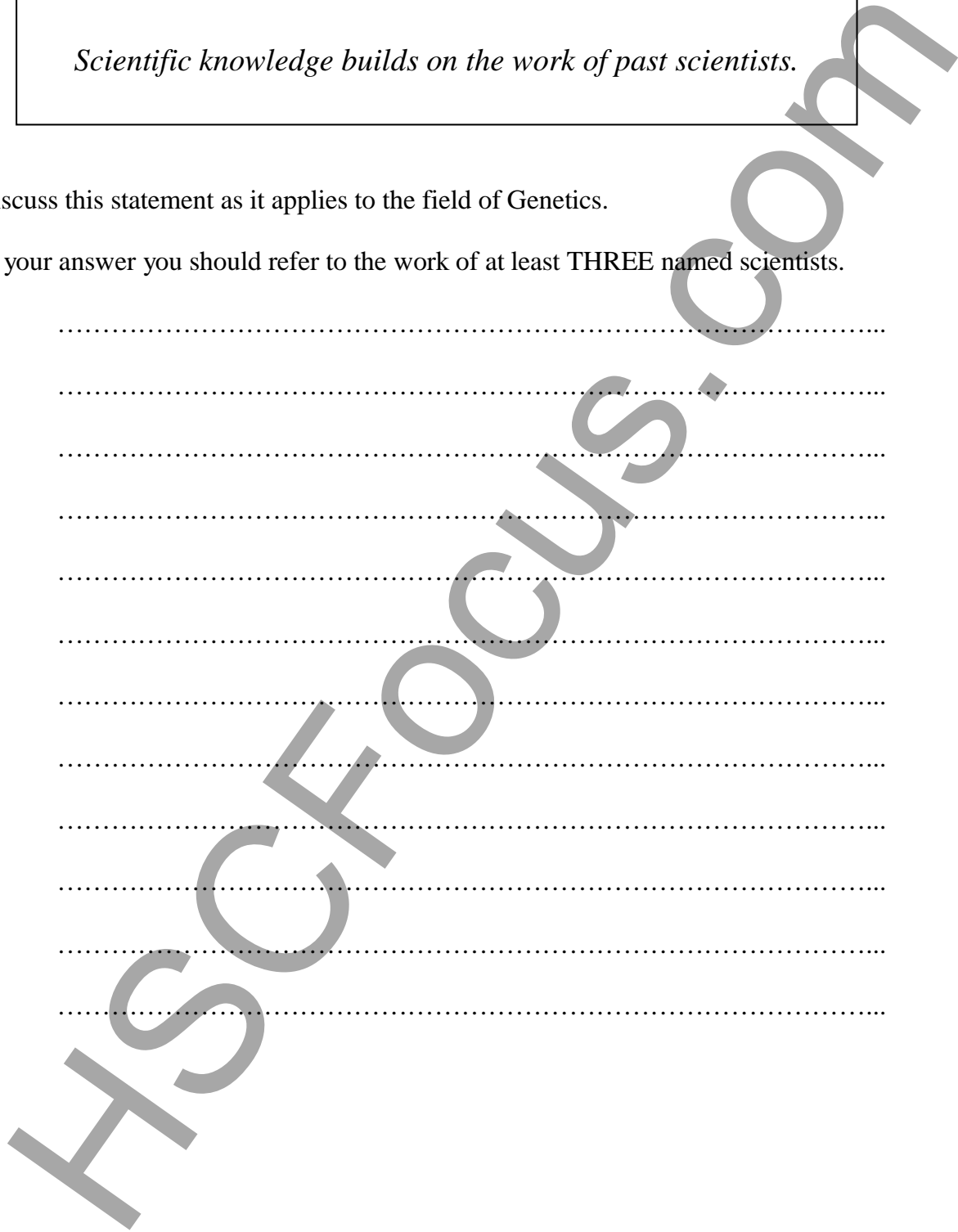
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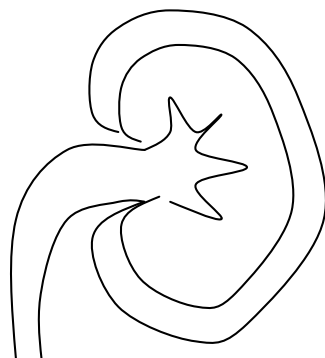
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Question 23 (5 marks)

The drawing below is of a section through a mammalian kidney.



- (a) Label with an X the region where most filtration occurs. 1

- (b) This drawing doesn't show the renal artery or the renal vein, the blood vessels which, respectively, deliver blood to, and take blood away from, the kidney. 4

Account for TWO differences in the composition of the blood between the renal artery and the renal vein.

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Question 24 (6 marks)

An organism's phenotype is determined both by its genotype and its environment.

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Describe a first hand investigation that you have performed to investigate the effect of the environment on the phenotype of an organism.

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Question 25 (4 marks)

Our bodies are home to a vast number of bacteria. This is a healthy arrangement as long as these 'microflora' remain in balance. **4**

Using a named example of a condition, explain how an imbalance in this microflora can come about and cause disease.

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Question 26 (3 marks)

(a) Haemoglobin is a protein found throughout the animal kingdom. **2**

Explain the adaptive advantage given by haemoglobin.

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(b) Propose one reason for researching into the production of artificial blood. **1**

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Question 27 (3 marks)

Red Green colour blindness is a recessive sex-linked condition.

3

A girl who has the condition surveys her parents and grandparents. Only one of these six people is colour blind.

Use a pedigree diagram, showing her, her parents and grandparents, to help you explain how she inherited the condition.

Make sure you identify the relative who is colour blind and any 'carriers' of the condition.

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Question 28 (8 marks)

In his book ‘In Defence of Science’ Richard Dawkins wrote that:

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“...Science has given us a life expectancy that would have astounded our ancestors.”

Assess the contribution of developments such as vaccination, antibiotics and modern hygiene to the improvement of human life expectancy.

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Section II

25 marks

Attempt ONE question from Questions 29-33

Allow about 45 minutes for this section

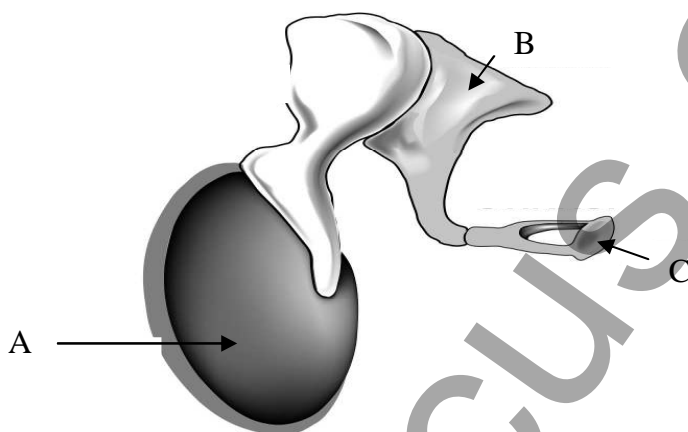
Answer in a writing booklet. Extra writing booklets are available.

	Pages
Question 29 Communication	24
Question 30 Biotechnology	25
Question 31 Genetics: The Code Broken?	26
Question 32 The Human Story	27
Question 33 Biochemistry	28

Question 29 --- Communication (25 marks)

- (a) (i) Outline the function of the iris in the human eye. 1
- (ii) Explain how humans achieve depth perception. 3

(b) The diagram below shows the structures of the middle ear.



- (i) Outline the functions of A, B and C. 3
- (ii) During your study of Communication you performed a first hand investigation to identify the relationship between the wavelength and frequency (pitch) of a sound. 4

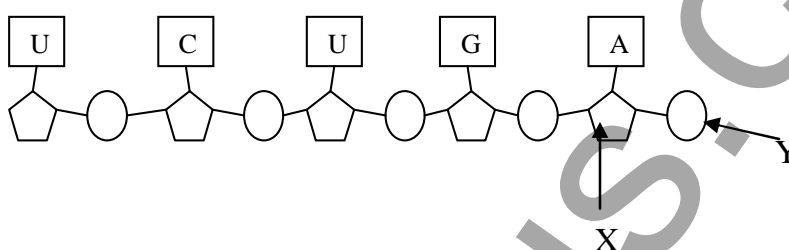
Describe how you did this and outline your findings.

- (c) Describe and account for the differences between the way humans and one other named species see and hear the world. Outline the adaptive value of these differences. 7
- (d) (i) Compare the usefulness of hearing aids and cochlear implants as aids to hearing. 4
- (ii) Explain why not all stimuli generate an action potential. 3

Question 30 --- Biotechnology

- (a) (i) Outline an Australian Aboriginal use of biotechnology. **1**
- (ii) Describe the changes that have occurred in a species of grain or animal as a result of domestication for agricultural purposes. **3**

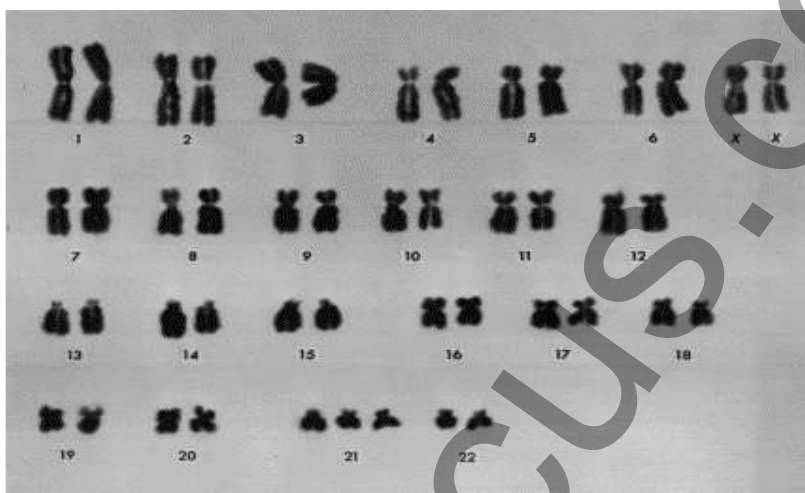
(b) The drawing below shows a section of messenger RNA.



- (i) Identify the subunits X and Y. **1**
- (ii) Outline the process by which the base sequence in mRNA is translated into an amino acid sequence in a polypeptide. **4**
- (iii) Describe how ligases and restriction enzymes are used to make recombinant DNA. **3**
- (c) Assess the potential of some named biotechnologies to improve agricultural production. **7**
- (d) (i) State the micro-organism used in a named fermentation process and identify the products of the process. **2**
- (ii) Describe a specific example of a strain isolation method and outline its benefits. **2**
- (ii) Biotechnology is an issue which provokes much debate in modern society. Explain why different groups might have opposing views about the use of a particular biotechnological process. **2**

Question 31 --- Genetics: The Code Broken? (25 marks)

- (a) (i) Explain why germ line mutations are more significant than somatic mutations in their effect on a species. 2
- (ii) Describe how DNA repairs itself. 3
- (b) The photomicrograph below shows the chromosomes in a human cell arranged as a karyotype.



- (i) Explain how you can tell whether it is a haploid or diploid cell. 1
- (ii) Describe how it differs from a 'normal' human karyotype. 1
- (c) Assess the potential impact of gene therapy on medicine. 7
- (d) In peas, the gene for pea shape is found on a different chromosome to that for plant height. The allele for round seeds (R) is dominant over that for wrinkled seeds (r). The allele for tall plants (T) is dominant over the allele for short plants (t).
 - (i) Perform a dihybrid cross to show the expected phenotype ratios of a cross between a pea plant heterozygous for both traits and one which is heterozygous for height but with wrinkled seeds. 3
 - (ii) Explain why the expected phenotype ratio in (i) would have been different if the two genes were situated on the same chromosome. 2
- (e) (i) Describe how gene cascades operate. 3
- (ii) Explain polygenic inheritance, with the aid of a human example. 3

Question 32 --- The Human Story (25 marks)

- (a) (i) Name TWO features which distinguish primates from other mammals. 2
- (ii) Describe an example of a clinal gradation found in humans. 2
- (b) The photograph below shows a reconstruction of the skull of *Australopithecus afarensis*.



- (i) Identify TWO significant differences between the skull of *A. afarensis* and modern humans. 2
- (ii) Account for ONE of the differences mentioned above. 2
- (iii) One of the ways in which humans and their ancestors differ from other primates is the relative helplessness of their young and the consequent length of the juvenile stage.
- Assess the effect of this on human evolution. 3
- (c) Discuss the statement below. 7
- “Modern Science and Technology have put an end to human evolution. Natural selection no longer operates.”*
- (d) (i) Explain how DNA-DNA hybridisation can be used to show evolutionary relationships between organisms. 3
- (ii) Explain how the evidence justifies the preference of the majority of anthropologists for the ‘Out of Africa’ theory over the theory of regional continuity. 4

Question 33 --- Biochemistry (25 marks)

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|-----|-------|--|---|
| (a) | (i) | Identify an isotope which is used in studying biochemical pathways. | 1 |
| | (ii) | Explain how radioactive isotopes make the study of biochemical pathways easier. | 3 |
| (b) | (i) | Outline the roles of ADP and NADP in the light reactions. | 2 |
| | (ii) | Identify and explain the sites of light absorption and the Calvin cycle in the chloroplast. | 3 |
| | (iii) | Describe how Calvin deduced the products of photosynthesis. | 3 |
| (c) | | Assess the potential use of photosynthesis to reduce greenhouse gas production and the use of non-renewable resources. | 7 |
| (d) | (i) | Make a labelled drawing of a molecule of ATP. | 3 |
| | (ii) | Relate the chemical structure of the molecule to its function. | 2 |
| | (iii) | Describe the role of ATP in the Calvin cycle. | 1 |