

Student Number

Exam Choice

2012

**TRIAL HIGHER SCHOOL
CERTIFICATE
EXAMINATION**

Biology

Total marks – 100

Section I Pages 2 - 24

75 marks

This section has two parts, Part A and Part B

Part A – 20 marks

- Attempt Questions 1-20
- Allow about 35 minutes for this part

Part B – 55 marks

- Attempt Questions 21-30
- Allow about 1 hour and 40 minutes for this part

Section II Pages 25 - 31

25 marks

- Attempt **ONE** Question from Questions 31-35
- 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 – 20 marks

Attempt Questions 1-20

Allow about 35 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 ☐

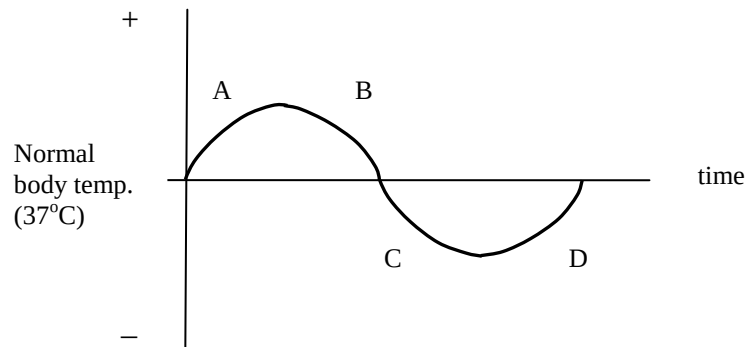
If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

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.

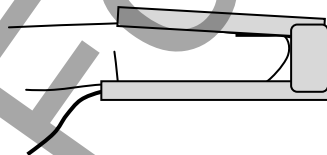
A ☒ B ☒ C ☐ D ☐
correct

1. The graph below shows a person's body temperature fluctuating over a period of time.



At which point(s) are negative feedback mechanisms operating?

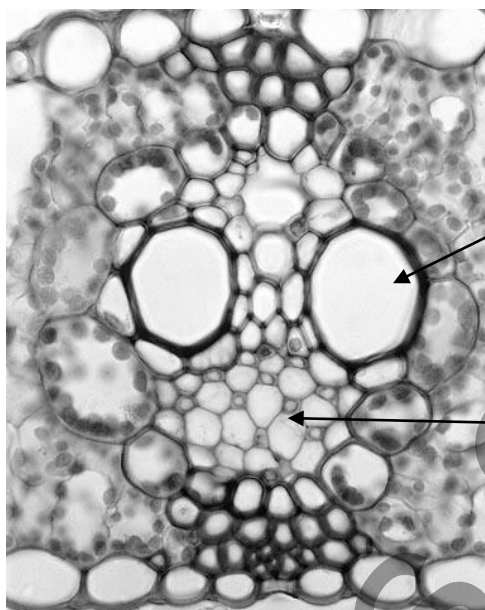
- (A) A
 - (B) B
 - (C) B & C
 - (D) B & D
2. The diagram below shows a pulse oximeter attached to the finger of a hospital patient.



This device measures the absorption by the blood of different wavelengths of light and is calibrated to give a measure of the blood saturation of:

- (A) oxygen
- (B) carbon dioxide
- (C) urea
- (D) glucose

3. The photomicrograph below shows transport tissue in a flowering plant.



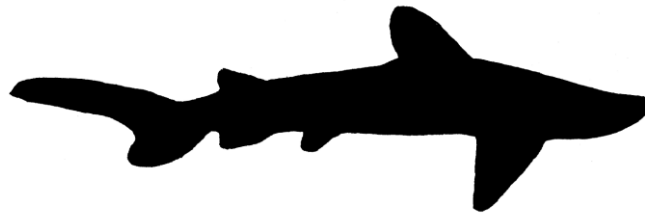
Select the row of the table below which correctly identifies the tissues indicated and the type of section.

	Type of section	Tissue X	Tissue Y
(A)	Longitudinal	Xylem	Phloem
(B)	Transverse	Phloem	Xylem
(C)	Longitudinal	Phloem	Xylem
(D)	Transverse	Xylem	Phloem

4. To which group of biological chemicals do enzymes belong?

- (A) Carbohydrates
- (B) Nucleic acids
- (C) Proteins
- (D) Lipids

5. Sharks and rays are osmoconformers. They maintain an internal concentration of body fluids which is similar to their external environment, thus minimising loss or gain of water by osmosis.

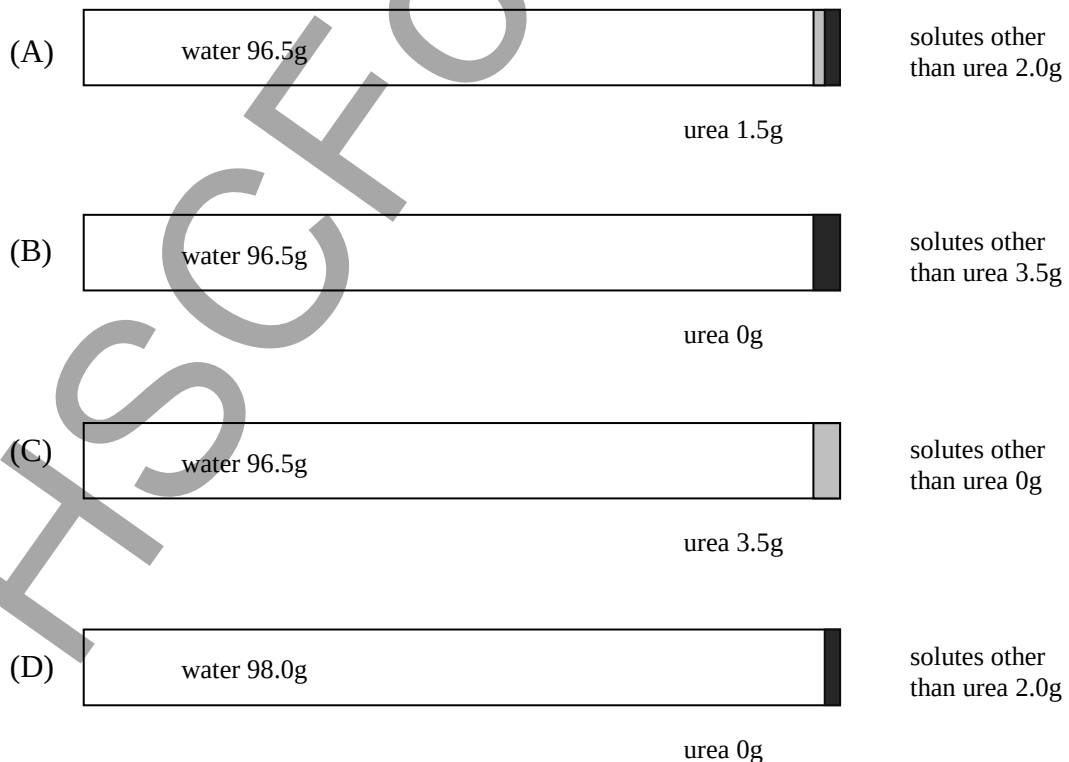


They do this by reabsorbing urea from the nephron and retaining it in the blood. Sharks such as bull sharks, which can move from the open sea into rivers, adjust their body fluid concentration by altering the amount of urea reabsorbed.

The divided bar graph below shows the approximate amounts by mass of water, urea and other solutes in the body tissues of a bull shark swimming in the open sea.



Select the divided bar graph below which best represents the body fluids of a bull shark which has moved up into a freshwater river.



6. Select the row below which correctly links the blood products with the conditions they are used to treat.

	Red blood cells	Platelets	Lymphocytes
(A)	Blood clotting problems	Low oxygen carrying capacity	Susceptibility to infection
(B)	Low oxygen carrying capacity	Blood clotting problems	Susceptibility to infection
(C)	Blood clotting problems	Susceptibility to infection	Low oxygen carrying capacity
(D)	Susceptibility to infection	Low oxygen carrying capacity	Blood clotting problems

7. Which one of the following stimuli will trigger release of aldosterone?

- (A) high blood sodium
- (B) low blood glucose
- (C) high blood urea
- (D) low blood volume

8. The trees of the *Casuarina* genus are common in Australia. Their leaves are reduced to small scales arranged around the stem.

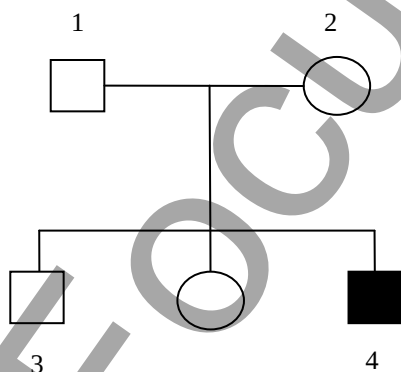
Which one of the following best explains why this is an adaptation that helps the plant survive in a dry environment.

- (A) Water is a raw material in photosynthesis. Smaller leaves photosynthesise less, thus conserving water.
- (B) The scale leaves make the stems more streamlined, causing rain which falls to run more efficiently down to the roots.
- (C) The scale leaves break up the air flow over the stems, reducing the evaporation of water from the lenticels.
- (D) The much smaller leaves mean a reduction in overall leaf surface area, reducing water loss through evaporation.

9. Select the row in the table below which best describes the response of an ectotherm and an endotherm to a drop in temperature.

	endotherm	ectotherm
(A)	changing skin colour to a darker shade	shivering
(B)	basking in the sun	changing skin colour to a darker shade
(C)	shivering	vasoconstriction
(D)	vasoconstriction	basking in the sun

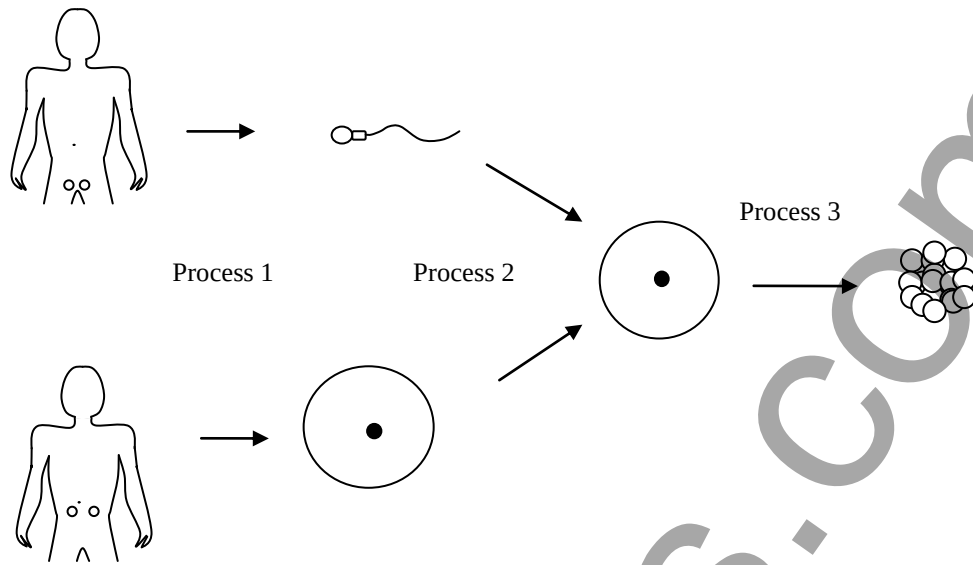
10. The pedigree below shows the occurrence of the sex-linked condition, red-green colour blindness in a family. (Shading indicates colour blindness)



Select the row in the table below which correctly identifies the genotypes of individuals 1 – 4.

	1	2	3	4
(A)	$X^N Y$	$X^N X^n$	$X^N Y$	$X^n Y$
(B)	$X^N X^n$	$X^N Y$	$X^N X^n$	$X^n X^n$
(C)	$X^n Y$	$X^N X^N$	$X^N Y$	$X^n Y$
(D)	$X^N X^N$	$X^n Y$	$X^N X^N$	$X^N X^n$

11. The diagram below represents three processes that occur during reproduction.



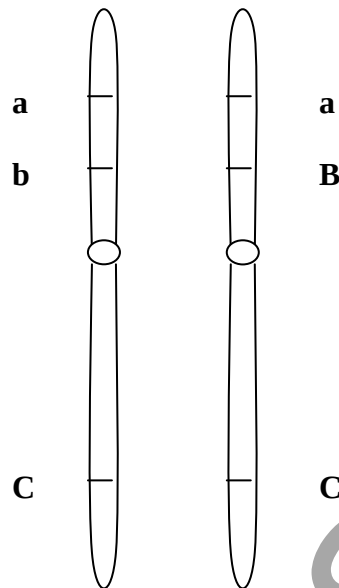
Which processes contribute to variation between individuals?

- (A) Process 1 only
 - (B) Processes 1 and 2
 - (C) Processes 1 and 3
 - (D) All three processes
12. Our knowledge of genetics has developed over the last 150 years.

Who was/were responsible for establishing that the hereditary material is carried in the nucleus of the cell?

- (A) Sutton and Boveri
- (B) Morgan
- (C) Mendel
- (D) Watson and Crick

13. The diagram below shows a homologous pair of chromosomes. The alleles of three genes are indicated.



Which one of the following statements is true?

- (A) This person's gametes will all carry the B allele.
 - (B) All of this person's offspring will inherit the a allele.
 - (C) If this person marries someone with the same genotype, then their children will also have this genotype.
 - (D) These two chromosomes can be said to be homozygous.
14. During your study of Biology you performed a simulation of Natural Selection.

Which one of the following is an essential part of any such simulation.

- (A) a 'predator'
- (B) random selection of prey
- (C) variation amongst individuals
- (D) high rates of reproduction

15. The koala (an Australian marsupial) and the rhesus monkey (an Asian primate) are both skilful tree climbers. They possess opposable digits and forward facing eyes.

These adaptations help them grasp branches and judge distances.

These similarities are due to:

- (A) adaptive radiation.
 - (B) punctuated equilibrium.
 - (C) common ancestry.
 - (D) convergent evolution.
16. Some groups such as the ancient Chinese and the Hebrews of 3000 years ago advocated cleanliness in food, water and personal hygiene.

Which one of the following is the most likely explanation for this.

- (A) They had learnt to associate these practices with staying healthy.
 - (B) They understood about the biology of pathogenic organisms.
 - (C) They had not yet developed antibiotics or other effective drugs.
 - (D) They placed a higher value on life than other cultures.
17. Transplant patients require immunosuppressant drugs to prevent them from rejecting the transplanted organ.

Which one of the following would also be a consequence of taking such medication?

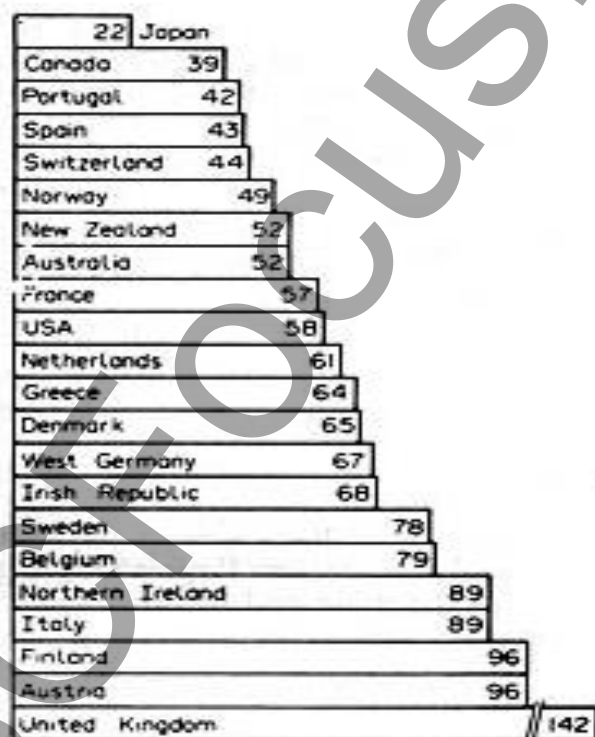
- (A) They would be more susceptible to allergies.
 - (B) Vaccinations they receive would be ineffective.
 - (C) They would experience a drop in red blood cell numbers.
 - (D) Their 'natural' bacterial flora might develop an imbalance.
18. Which type of lymphocyte would be principally involved in directly combating an infection by a virus floating in the blood?
- (A) B lymphocyte
 - (B) Killer T lymphocyte
 - (C) Memory B lymphocyte
 - (D) Helper T lymphocyte

19. Which one of the following is a barrier guarding against entry of pathogens via the digestive system?

- (A) low stomach pH.
- (B) cilia lining the oesophagus
- (C) impermeable skin lining the small intestine
- (D) mucous membranes lining the mouth

20. The bar graph below shows deaths from lung cancer per 100,000 men aged 45 – 54 per million pounds of tobacco consumed in each country. (A pound is a unit of mass equivalent to about 0.45 kg).

The information is from 1973 and is taken from WHO data, presented in 'Food and Health in the Scottish Highlands' by W. W. Yellowlees.



Which one of the following conclusions can be drawn from these data?

- (A) The United Kingdom had the highest lung cancer death rate for this group of men.
- (B) Japan had the lowest lung cancer death rate for this group of men.
- (C) Tobacco consumption was highest in the United Kingdom.
- (D) Factors other than tobacco consumption must have also influenced lung cancer death rates.

Section I (continued)

Part B – 55 marks

Attempt Questions 21 - 30

Allow about 1 hour and 40 minutes for this part

Answer the questions in the spaces provided.

Marks

Question 21 (3 marks)

- (a) Complete the table below to identify the forms in which the substances named are transported in human blood. 2

Substance	Form in which transported in the blood
Carbon dioxide	
Nitrogenous waste	

- (b) Indicate, on the diagram of a nephron below, the point at which nitrogenous waste is extracted from the blood. 1



Question 22 (11 marks)

Read the information on these two pages about avian influenza, and use it and your own knowledge to answer the questions.

Text box 1.

Avian influenza is a disease which has greatly concerned the health authorities of many countries over the past ten years.

It has been shown to be caused by the H5N1 virus, which infects birds. The great majority of human cases have occurred in people living in close proximity to poultry, mainly in Asia and Egypt.

The World Health Organisation (WHO) is monitoring the incidence of the pathogen and the disease worldwide and the information used in this question is taken from their website.

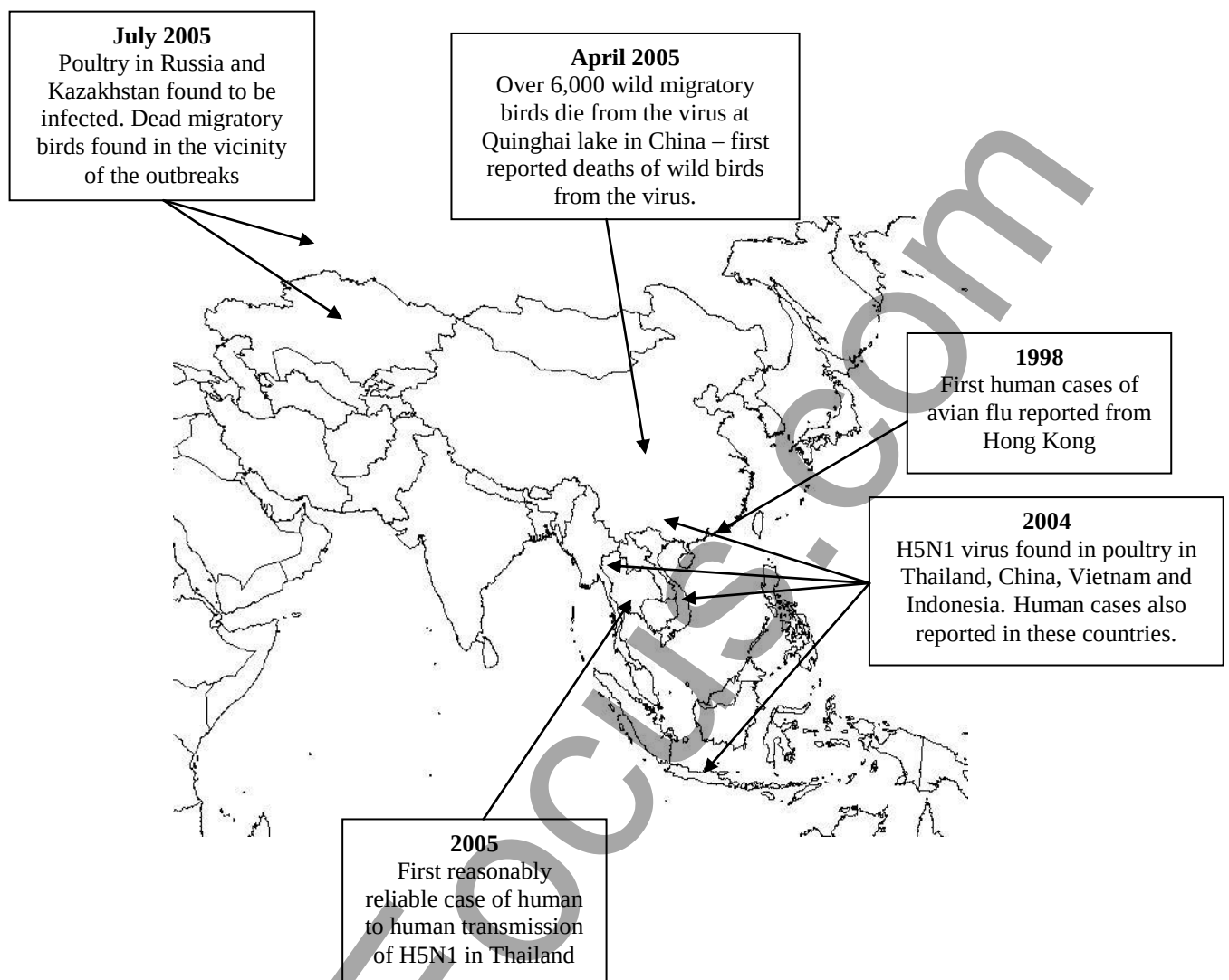
Figure 1. Human cases and deaths as a result of H5N1 infection up to the end of 2011.

Country	Cases	Deaths
Cambodia	18	16
China	41	27
Egypt	157	55
Indonesia	182	150
Thailand	25	17
Turkey	12	4
Vietnam	119	59
World Total*	576	339

*This table only includes the seven countries with the highest numbers of cases. The world total is greater than the sum of the totals for those seven countries.

Question 22 continues on page 14.

Figure 2. Important events in the spread of the H5N1 virus.



Text box 2.

The picture in 2012.

H5N1 virus has been detected in poultry and in wild birds in North America, Europe and Africa, as well as in Asia. As yet it has not been found in Australia.

The great majority of human cases have been contracted directly from poultry, usually by people living in close proximity to them.

Human to human transmission is believed to be very rare.

The great majority of cases are individual, only rarely are clusters detected.

Egypt and Indonesia are currently the main areas in which humans are becoming infected.

Question 22 continues on page 15.

Question 22 (continued)

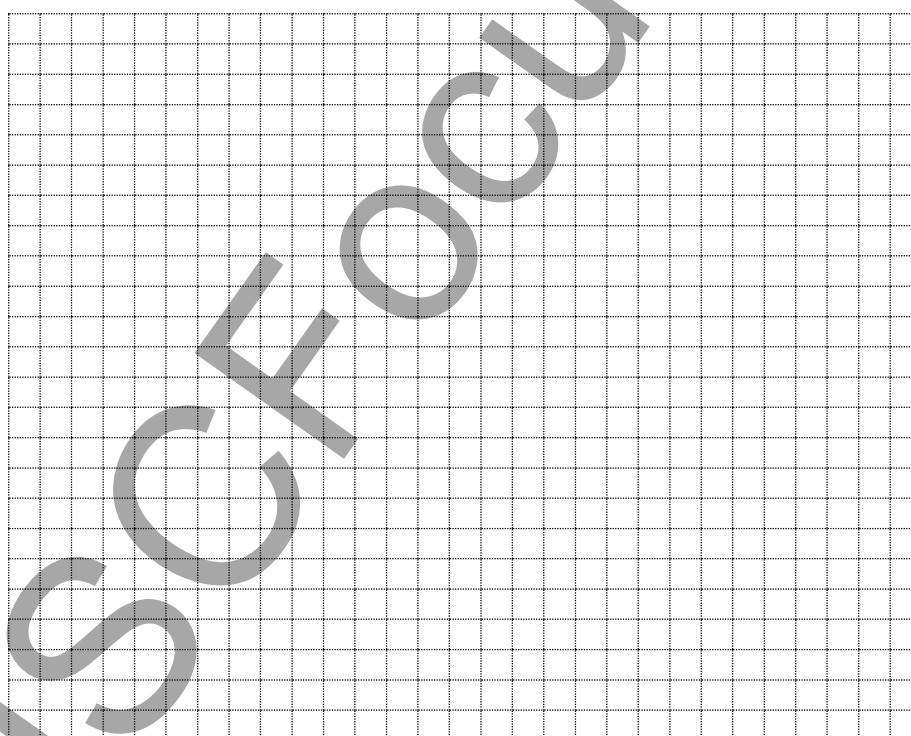
- (a) Calculate the worldwide mortality rate for this disease. (The percentage of cases which have resulted in death) **1**

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- (b) Use the grid below to draw an appropriate graph to compare the number of cases in the seven countries. **3**



Question 22 continues on page 16.

Question 22 (continued)

- (c) Discuss the concerns for human health arising from the information contained in figure 2 and text box 2. 4

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- (d) So far, Australia is free of the H5N1 virus.
- Justify two quarantine measures that you would propose to protect Australians from the pathogen. 3

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Question 23 (4 marks)

Analysis of the amino acid sequence of one of the haemoglobin proteins in closely related primate species reveals that while the number of amino acids in the protein is the same for each species (146), the sequence of amino acids varies slightly between species.

The table below summarises the amino acid differences between the haemoglobin proteins of some primates.

Primate	Number of amino acids different from human haemoglobin
Chimpanzee	0
Gorilla	1
Rhesus monkey	8

- (a) Which species is most closely related to humans?

1

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- (b) Explain why biologists consider information of this sort to be useful in inferring evolutionary relationships.

3

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Question 24 (5 marks)

(a) Make a labelled drawing of a nucleotide in the space below.

2

(b) Outline the steps involved in the production of a polypeptide.

3

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Question 25 (7 marks)

(a) Complete the comparative table of pathogens below.

3

Pathogen	Description of structure	Example of disease caused by this pathogen
Prion		
Bacterium		
Protozoans		

(b) Describe how the body's defence barriers guard against bacterial infection of the respiratory system.

2

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(c) Explain why antibiotics which were effective 30 years ago are no longer effective today.

2

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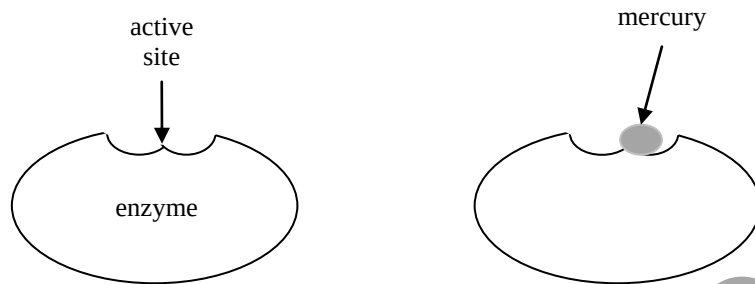
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Question 26 (5 marks)

The diagram below shows how the heavy metal mercury can attach itself to the active site of an enzyme.



- (a) Explain why this would inhibit enzyme action.

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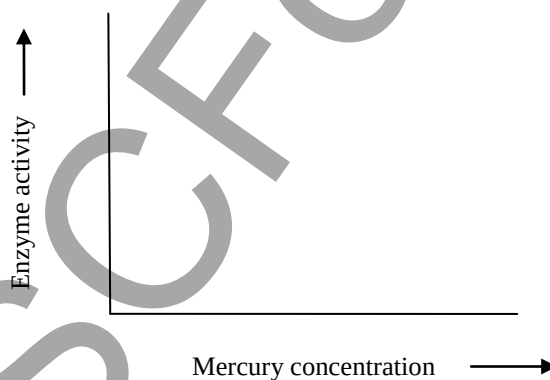
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- (b) Sketch a line on the graph below to show the effect on enzyme activity that you would expect from increasing mercury concentration.

1



- (c) Explain why homeostasis is essential for optimal enzyme functioning.

2

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Question 27 (4 marks)

- (a) Distinguish between the terms 'infectious, and 'non-infectious' disease. 1

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- (b) Complete the table below to describe the features of a **non-infectious** disease that you have studied. 3

Name of disease	
Cause	
Effect on body	
Treatment/management	

Rising sea levels due to global warming, and increasing inland salinity due to inappropriate irrigation and land clearing practices are likely to greatly reduce the productivity of many areas in the years to come.

Describe a practical procedure you could follow to assess the ability of a new strain of wheat to tolerate salinity.

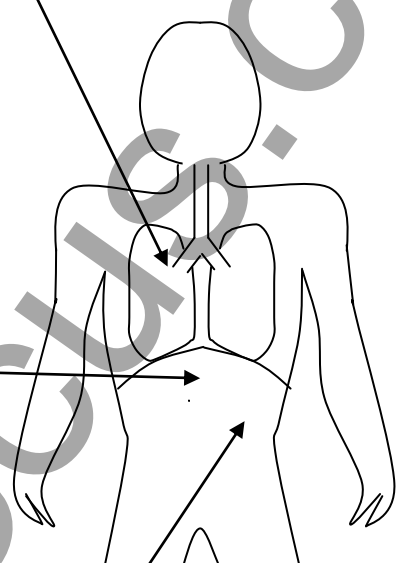
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Question 29 (3 marks)

Annotate the diagram below to show **one** change to the composition of the blood caused by each of the three organs indicated.

3



The diagram shows a human torso with three arrows pointing to specific organs: one to the lungs, one to the liver, and one to the kidney. Each organ is associated with a text box for annotation.

Lungs

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Liver

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Kidney

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7

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Section II

25 marks

Attempt ONE question from Questions 31-35

Allow about 45 minutes for this section

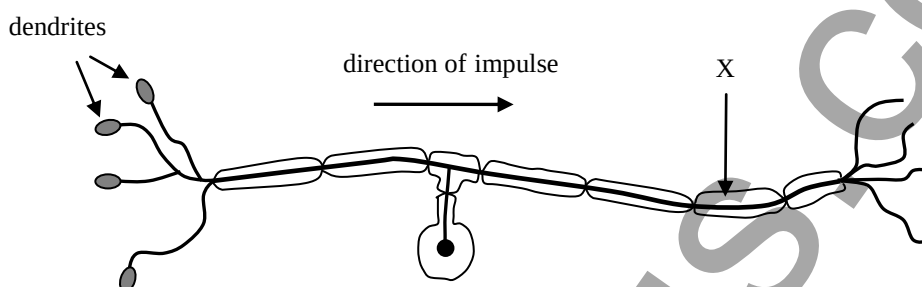
Answer in a writing booklet. Extra writing booklets are available.

	Pages
Question 31 Communication	26
Question 32 Biotechnology	27
Question 33 Genetics: The Code Broken?	28 - 29
Question 34 The Human Story	30
Question 35 Biochemistry	31

Question 31 --- Communication (25 marks)

- (a) (i) Outline the role of the iris. 1
- (ii) Explain how the structure of the human larynx allows the production of sounds of different pitch. 3

- (b) The drawing below is of a sensory neurone.

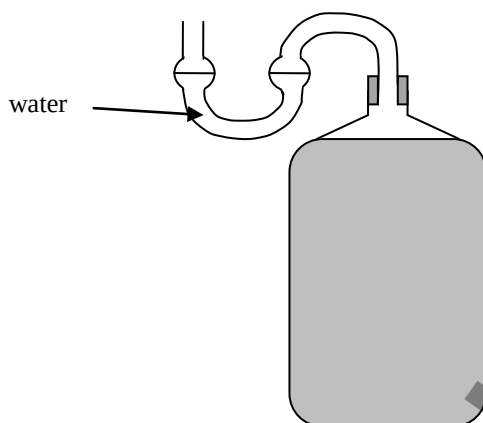


- (i) Outline the role of the structure X which surrounds the axon. 1
- (ii) Name a structure to which the dendrites might be attached. 1
- (iii) Explain how an action potential is able to pass along the axon. 3
- (iv) Explain how the nervous system interprets information from action potentials to bring about a response. 3
- (c) Using named examples, assess the extent to which technological advances have changed the lives of people with hearing problems. 7
- (d) (i) Explain how the distribution of photoreceptor cells in the retina contributes to the way humans see the world. 3
- (ii) All vertebrates which can see have two eyes rather than one. Assess the adaptive value of having two eyes rather than one, using a named example. 3

Question 32 – Biotechnology (25 marks)

- (a) (i) Outline the role of restriction enzymes in biotechnology. 2
- (ii) Describe an ancient Australian Aboriginal use of biotechnology. 2

- (b) The diagram below shows a typical arrangement for fermenting home made wine.

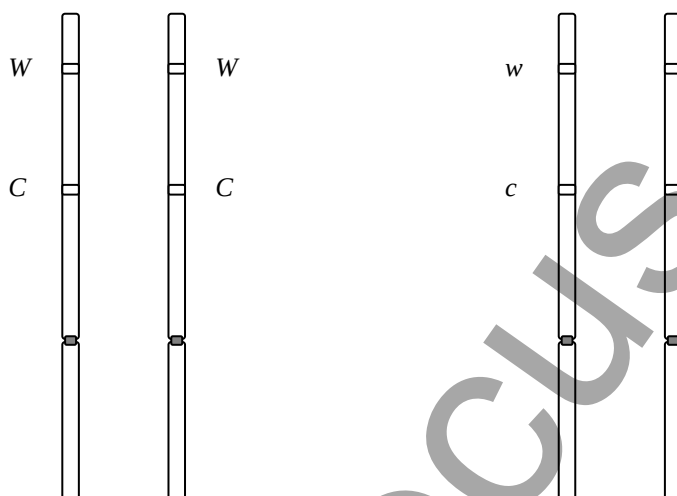


- (i) Explain why it is necessary to have the curved tube with water in it. 1
- (ii) Write a word equation for the fermentation process occurring inside the bottle. 2
- (iii) Describe an industrial fermentation process, naming the micro-organism involved and the principal raw materials and products. 3
- (c) Using named examples of biotechnologies, assess the extent to which advances in biotechnology have changed people's lives. 7
- (d) (i) Describe the steps involved in the production of a transgenic organism that you have studied. 3
- (ii) Outline an application of the polymerase chain reaction. 3
- (iii) Explain why different groups in society might have different views about the ethics of biotechnology. 2

Question 33 – Genetics, the Code Broken? (25 marks)

- (a) (i) Name a characteristic determined by multiple alleles. 1
- (ii) Explain why a frame shift mutation is more likely to affect the phenotype than a base substitution mutation. 3

- (b) The drawings below show a homologous pair of chromosomes for each of a pair of fruit flies (*Drosophila melanogaster*). Two gene loci are shown.



Allele	Phenotype
W	Normal wings
w	Vestigial wings
C	Normal body colour
c	Black body colour

- (i) Determine the expected ratio of phenotypes in a cross between the offspring of these two flies. 3
- (ii) Explain how the relative positions of linked genes such as those shown above were determined using cross breeding experiments. 3
- (c) Using named examples, assess the extent to which genetic technologies have benefitted people with health problems. 7

Question 33 continues on page 29.

Question 33 (continued)

(d) (i) Discuss the benefits and limitations of the Human Genome Project. **4**

(ii) The technologies developed for the Human Genome Project have now been used to investigate the genomes of other species.

One discovery to come from this has been the existence of gene homologues.

Explain how these contribute to our knowledge about evolutionary relationships. **4**

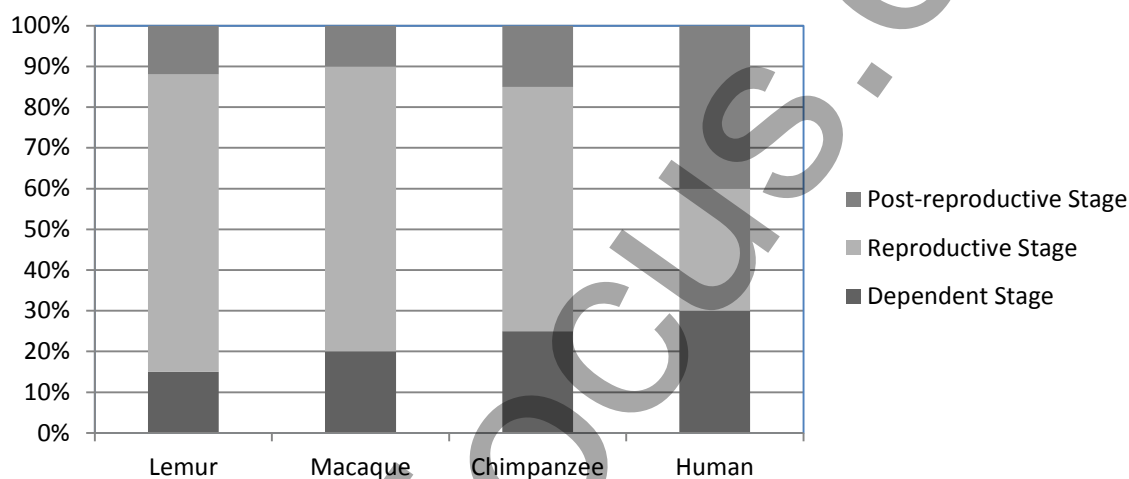
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Question 34 – The Human Story (25 marks)

- (a) (i) Give two features of humans that allow them to be classified as mammals. 1
- (ii) *Homo habilis* is regarded by most authorities as a direct human ancestor. Construct a table to compare its characteristics with *Homo sapiens*. 3

- (b) Examine the bar graph below.

Relative Length of Life Stages of a Range of Female Primates.

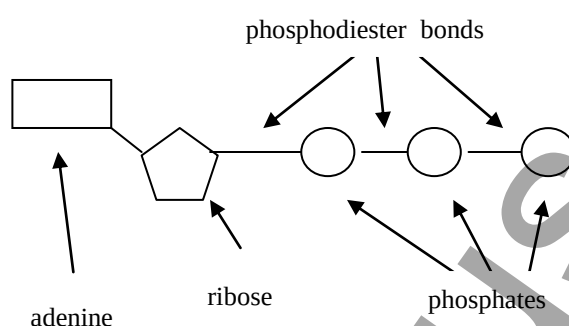


- (i) Account for the relative length of the dependent and reproductive stages of humans compared to the other primates. 3
- (ii) Suggest an evolutionary reason for the much longer post-reproductive life of human females compared to other primates. 1
- (iii) Assess the importance of an upright stance in the evolution of intelligence in humans. 3
- (c) Using named examples, assess the extent to which modern technologies might affect future human evolution. 7
- (d) (i) Using a named human example, explain how a clinal gradation can evolve. 3
- (ii) Discuss the evidence for the 'Out of Africa' model. 4

Question 35 – Biochemistry (25 marks)

- (a) (i) Name a radioactive isotope used in the investigation of photosynthetic pathways. 1
- (ii) Describe the sequence of developments in microscopy that would have assisted Englemann in his work with *Spirogyra*. 3

(b) The diagram below represents the structure of ATP.



- (i) Explain how the phosphodiester bonds allow ATP to perform its function. 3
- (ii) Outline the process of ATP synthesis in photophosphorylation. 3
- (c) Using named examples, assess the extent to which applications of photosynthesis have the potential to reduce our dependence on non-renewable resources. 7
- (d) (i) Draw a chloroplast and label it to indicate the sites of light absorption and the Calvin cycle. 3
- (ii) Evaluate chromatography as a technique used in studies of photosynthesis. 3
- (iii) Explain the significance of the difference in the functions of photosystems I and II 2