

Student name

BIOLOGY

Unit 3

Trial Examination

QUESTION AND ANSWER BOOK

Total writing time: 1 hour 30 minutes

Structure of book

Section	Number of questions	Number of marks
A	25	25
B	6	50
Total		75

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners and rulers.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.
- No calculator is allowed in this examination.

Materials supplied

- Question and answer book of 19 pages with a detachable answer sheet for multiple-choice questions inside the front cover.

Instructions

- Detach the answer sheet for multiple-choice questions during reading time.
- Write your **name** in the space provided above on this page and on the answer sheet for multiple-choice questions.
- All written responses should be in English.

At the end of the examination

- Place the answer sheet for multiple-choice questions inside the front cover of this book.

STAV Publishing

2005

BIOLOGY

Unit 3 Trial Examination

MULTIPLE CHOICE ANSWER SHEET

STUDENT NAME:	
--------------------------	--

INSTRUCTIONS:**USE PENCIL ONLY**

- Write your name in the space provided above.
- Use a **PENCIL** for **ALL** entries.
- If you make a mistake, **ERASE** it – **DO NOT** cross it out.
- Marks will **NOT** be deducted for incorrect answers.
- **NO MARK** will be given if more than **ONE** answer is completed for any question.
- Mark your answer by placing a **CROSS** through the letter of your choice.

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
16.	A	B	C	D
17.	A	B	C	D
18.	A	B	C	D
19.	A	B	C	D
20.	A	B	C	D
21.	A	B	C	D
22.	A	B	C	D
23.	A	B	C	D
24.	A	B	C	D
25.	A	B	C	D

SECTION A - Multiple Choice Questions**Specific instructions for Section A**

This section consists of 25 questions. You should attempt **all** questions.

Each question has four possible correct answers. Only **one** answer for each question is correct. Select the answer that you believe is correct and indicate your choice on the Multiple Choice Answer Sheet by crossing the letter that corresponds with your choice of the correct answer.

If you wish to change an answer, erase it and cross your new choice of letter.

Each question is worth **one** mark. **No** mark will be given if more than one answer is completed for any question. Marks will **not** be deducted for incorrect answers.

Question 1

A plasma membrane is made up of:

- A. a lipid bilayer.
- B. a protein bilayer.
- C. an enzyme bilayer.
- D. a single layer of protein and a single layer of lipid forming a double layer.

Question 2

The main energy-trapping molecule in plants is:

- A. chloroplasts
- B. carotenoids
- C. stroma
- D. chlorophyll

Question 3

Energy is released from a molecule of ATP when the bond is broken between:

- A. two phosphate groups.
- B. adenine and ribose.
- C. adenine and phosphate.
- D. ribose and phosphate.

Question 4

Mitochondria are sometimes called the powerhouses of the cell. This is because they:

- A. are able to take energy from food molecules and store it as high energy bonds in ATP.
- B. use oxygen to react with high-energy molecules in a process known as aerobic respiration.
- C. are the only site of production of ATP.
- D. are able to directly convert solar energy to high energy sugar molecules in the process known as photosynthesis.

Questions 5 and 6 refer to the diagram below



Question 5

The organelle in the diagram above is:

- A. part of the endoplasmic reticulum.
- B. a mitochondria.
- C. part of the cell membrane.
- D. a golgi body.

Question 6

The function of this organelle is to:

- A. store fats.
- B. modify proteins.
- C. synthesise proteins.
- D. package molecules into vesicles before removing them from the cell.

Question 7

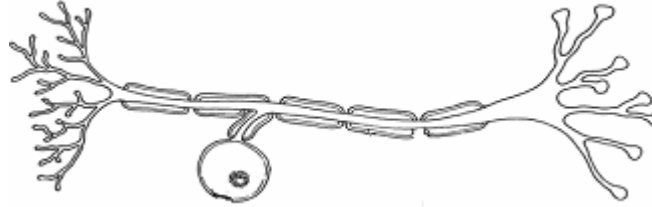
Enzymes are chemicals produced by cells. It is correct to say that:

- A. enzymes are found only in the cells where they are produced.
- B. enzymes are specific for their substrate because of their shape.
- C. enzymes are large macromolecules of monosaccharide chains.
- D. enzymes form an enzyme-substrate complex by binding permanently with the reactant.

Question 8

Gibberillic acid is a plant hormone. It is beneficial to plants because it:

- A. suppresses lateral bud growth, thus enabling the plant not to form too many branches that would block the light.
- B. hastens the ripening of fruit, enabling the plant's seeds to be spread sooner.
- C. promotes leaf senescence, thus enabling the plant to save energy by reabsorbing molecules important for photosynthesis.
- D. increases stem length and internode elongation, thus enabling the plant to grow taller and gain better access to the light.

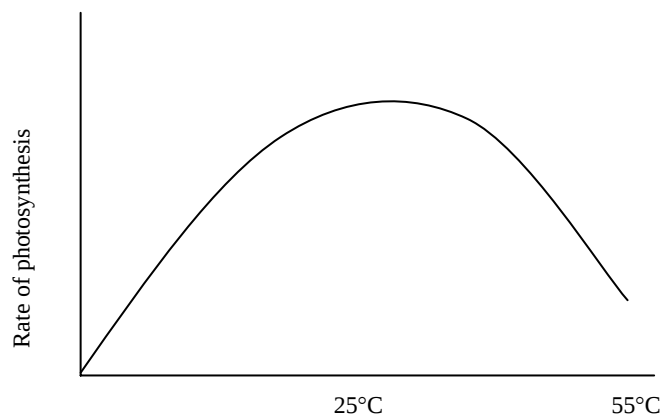
Question 9

The neuron depicted above carries impulses:

- A. from a receptor to the central nervous system.
- B. from the central nervous system to a muscle or gland.
- C. from the central nervous system to the brain.
- D. from one neuron to another in the central nervous system.

Question 10

The graph below shows the rate of photosynthesis at various environmental temperatures.



The graph demonstrates that:

- A. the rate of photosynthesis increases with increasing temperature.
- B. photosynthesis is independent of the environment.
- C. an increase in temperature denatures the enzymes involved in photosynthesis.
- D. the rate of photosynthesis increases to a maximum and then decreases with increase in temperature.

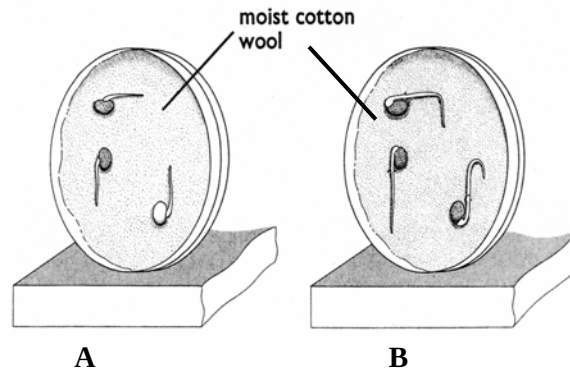
Question 11

Phototropism involves the bending of a plant stem towards the light. This is due to:

- A. the stem cells on the side of the stem away from the light producing auxin.
- B. the stem cells on the side of the stem away from the light elongating more than those on the illuminated side.
- C. the stem cells on the illuminated side producing auxin.
- D. the stem cells on the illuminated side undergoing more cell divisions producing smaller cells.

Question 12

The following two petri dishes containing shooting bean seeds were set up and kept in the dark. Petri dish **A** was rotated 90° each day for 6 days. Petri dish **B** was not rotated.



The hypothesis most likely being tested in this experiment was:

- A. water is needed for plant growth.
- B. gravity affects the direction of root growth.
- C. light is not needed for early seed germination.
- D. dark is needed for plant germination.

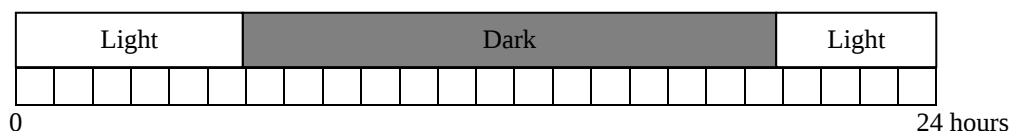
Question 13

Ethylene is a plant hormone. Ethylene differs from other plant hormones in that:

- A. it is produced in the leaves.
- B. it acts as an inhibitor only.
- C. it affects only the plant that produces it.
- D. it is a gas at room temperature.

Question 14

Poinsettia is a “short day” plant and has a critical photoperiod of 12.5 hours. Hibiscus is a “long day” plant with a critical photoperiod of 12 hours. Both plants were exposed to the following photoperiod daily for some time.



The result of this treatment should be that:

- A. neither plant should flower.
- B. both plants should flower.

- C. only the “short day” plant should flower.
- D. only the “long day” plant should flower.

Question 15

A blood sample taken from a patient showed high levels of glucagon and low levels of insulin. The most likely explanation for this would be:

- A. the patient had just eaten a meal rich in carbohydrates.
- B. the patient had been fasting for several hours.
- C. the patient was suffering from diabetes.
- D. the patient suffered from over active alpha cells of the pancreas.

Question 16

Chemicals that diffuse across a synapse and stimulate polarity changes in a neuron are called:

- A. action potentials
- B. hormones
- C. toxins
- D. neurotransmitters

Question 17

The table below shows the maximum concentration of urine produced by humans and the Australian hopping mouse.

Animal	Maximum solute concentration
Hopping mouse	10,000
Human	1,200

Using the data in the table it would be reasonable to conclude:

- A. that the hopping mouse had a relatively longer Loop of Henle than the human.
- B. that the hopping mouse had a relatively larger bladder than the human.
- C. that the hopping mouse would have a faster rate of filtration in the glomerulus than the human.
- D. that the hopping mouse does not drink water.

Question 18

As the stomata of a plant close:

- A. turgor pressure increases.
- B. potassium ions diffuse out of the guard cells.
- C. chloride ions diffuse into the guard cells.
- D. water moves into the guard cells.

Question 19

The Murray Valley python is an unusual snake in that it lays eggs and then wraps itself around the eggs and shivers. This behaviour:

- A. is more like that of a typical endotherm.
- B. maintains a breeze of fresh air over the eggs for gaseous exchange.
- C. is more like that of a typical ectotherm.
- D. keeps the snake cool in order to conserve energy for egg laying.

Questions 20 and 21 refer to the following information

If a person falls into icy water, during the first few minutes his or her body will thermoregulate in order to maintain a constant body temperature.

Question 20

This thermoregulation will involve:

- A. a decrease in enzyme activity in order to conserve energy.
- B. metabolism decreasing in order to conserve heat.
- C. metabolism increasing in order to increase heat production.
- D. the slowing down of oxidation in the mitochondria in order for anaerobic respiration to take place.

Question 21

If the person is not rescued quickly the thermoregulation will not manage to maintain a constant core temperature. As the body cools:

- A. enzyme activity will increase.
- B. enzyme activity will decrease.
- C. oxidation rate in the mitochondria will increase.
- D. metabolism will increase.

Question 22

Mucus is a non-specific defense against pathogens. This is because mucus:

- A. is secreted by the skin.
- B. traps pathogens.
- C. digests pathogens.
- D. produces antibodies.

Question 23

When a foetus receives antibodies from the mother across the placenta, the type of immunity represented is:

- A. natural passive immunity.
- B. natural active immunity.
- C. artificial passive immunity.
- D. artificial active immunity.

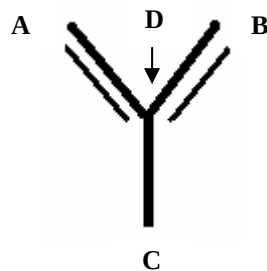
Question 24

B cells and T cells are part of the body's immune system. It is reasonable to state that:

- A. T cells are produced from stem cells in the thymus gland.
- B. B cells are produced by the lymph nodes.
- C. B cells produce antibodies when they have differentiated after activation by certain T cells.
- D. T cells produce antibodies when they have differentiated after activation by certain B cells.

Question 25

The diagram below is one of a generalized antibody.



The antigen binding site(s) is (are):

- A. D and C.
- B. D only.
- C. C only.
- D. A and B.

END OF SECTION A

SECTION B - Short Answer Questions**Specific instructions for Section B**

This section consists of 6 questions. There are 50 marks in total for this section.

Write your responses in the spaces provided. You should attempt **all** questions. Please write your responses in **blue** or **black ink**.

Question 1

ATP is the energy rich molecule produced in the process of respiration.

a What do the letters **ATP** stand for?

(1 mark)

b Write the chemical equation for aerobic respiration.

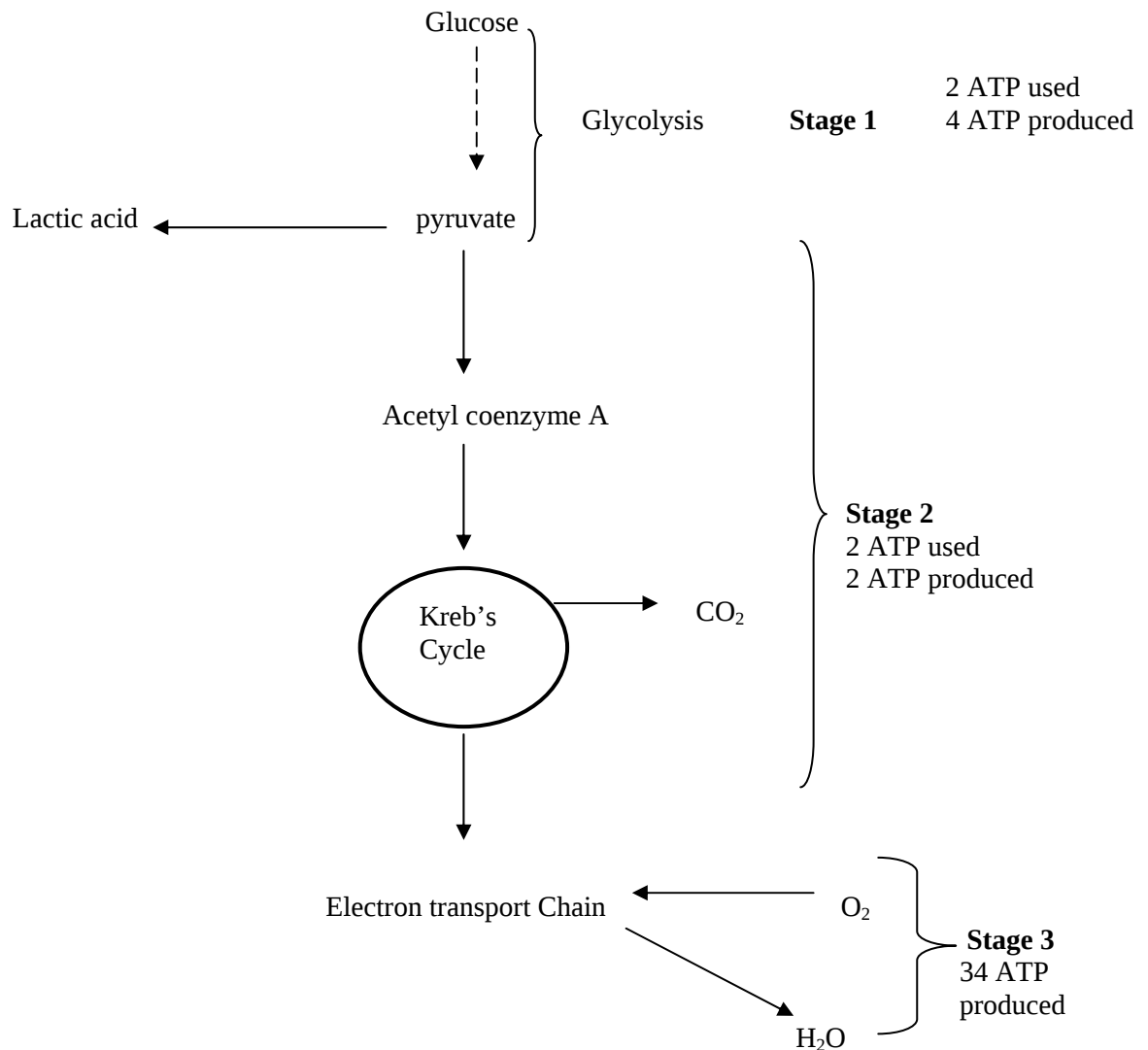
(2 marks)

Aerobic respiration to produce ATP occurs in three stages. The first stage, called glycolysis, breaks the glucose molecule down to pyruvate.

c Where in the cell does this stage of glycolysis take place?

(1 mark)

The following flow diagram represents a simplified version of the various stages of respiration in the presence of plenty of oxygen.



d What is the overall net production of ATP per molecule of glucose in cells?

(1 mark)

When a person undergoes strenuous activity, they are unable to break down glucose all the way to CO₂ and H₂O, and instead produce lactic acid, C₃H₆O₃.

e Besides the difference in the amount of ATP produced per molecule of glucose, give another advantage of aerobic respiration compared to anaerobic respiration.

(1 mark)

Cyanide is a well-known poison. It interferes with certain enzyme components of the electron transport chain, by acting as a competitive inhibitor of an enzyme. In February 2003, many cattle died as a result of eating drought stressed sorghum (a type of plant), which contained high levels of cyanide.

f What is a competitive inhibitor of an enzyme?

(1 mark)

g What effect would the cyanide have on the cells of the cattle that led to their death? Explain your answer.

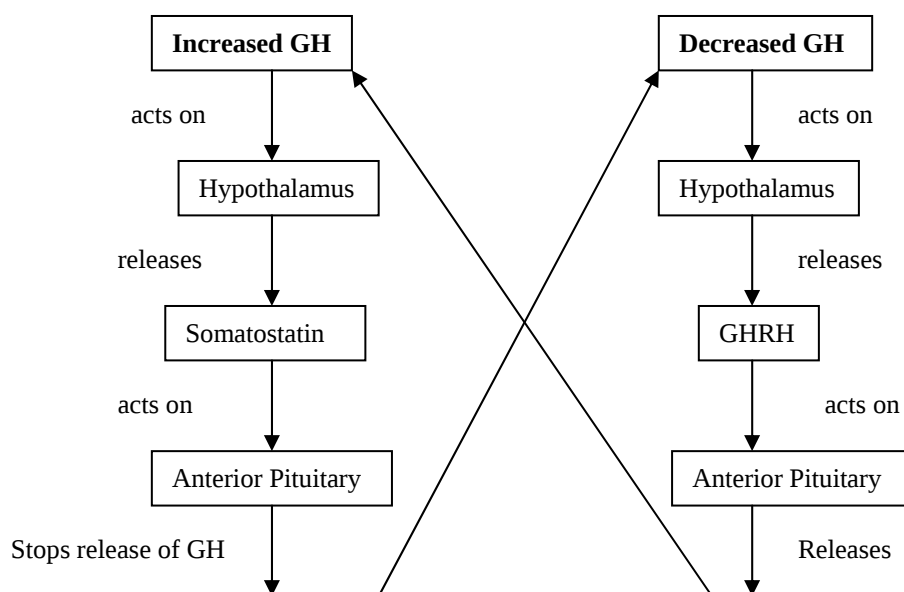
(2 marks)

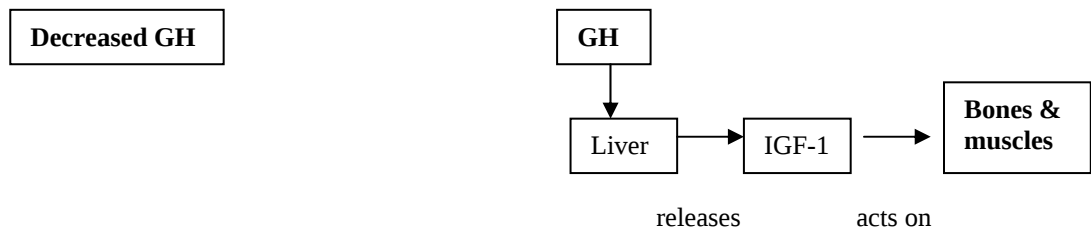
Total 9 marks

Question 2

Growth hormone (GH) is a polypeptide hormone of about 191 amino acids that is synthesised and secreted by cells in the anterior pituitary. The hypothalamus triggers growth hormone production by secreting Growth Hormone Releasing Hormone (GHRH). The Anterior pituitary responds to GHRH by releasing GH in bursts, especially during deep stages of sleep. GH stimulates the liver to produce Insulin – like Growth Factor 1 (IGF-1) and it is this hormone that brings about bone and muscle growth. Once the levels of GH reach a certain high threshold the GH stimulates the Hypothalamus to release a growth hormone inhibitory hormone called Somatostatin and stop GHRH. High levels of GH also stimulate receptors in the anterior pituitary to stop GH production.

The following flow chart summarises the information given above.





- a** Give an example of an effector from the diagram. Justify your choice.

(2 marks)

- b** What is negative feedback?

(1 mark)

- c** Use the information in the diagram to explain how growth hormone release is controlled by a negative feedback mechanism.

(2 marks)

Total 5 marks

Question 3

Diabetes Type 2 is a medical disorder characterized by varying or persistent hyperglycaemia, especially after eating. This condition is usually due to the inability of insulin to bind to specific receptor proteins on the cell membranes of cells.

- a** What is hyperglycaemia?

(1 mark)

- b** What type of substance is insulin?

(1 mark)

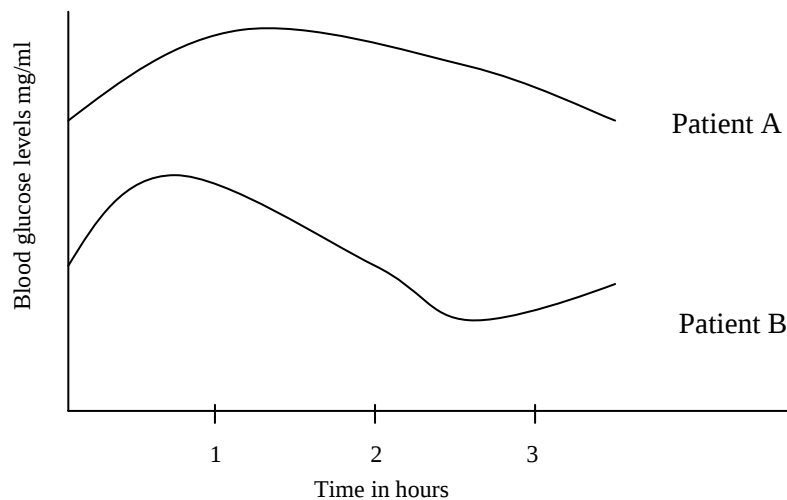
When insulin binds to these receptor proteins on cells the permeability of the cell to glucose is altered and also the rates of activity of enzyme reactions within the cell are altered.

- c** Why are most receptor molecules, for substances such as glucose, protein? Explain your answer.

(2 marks)

A test for diabetes is a glucose tolerance test. The person being tested does not eat anything for at least 10 hours. An initial blood sample is taken and the blood sugar is measured and then the person is given a glucose drink containing 75 grams of glucose. The person then has their blood tested again 30 minutes, 1 hour, 2 hours and 3 hours after drinking the high glucose drink.

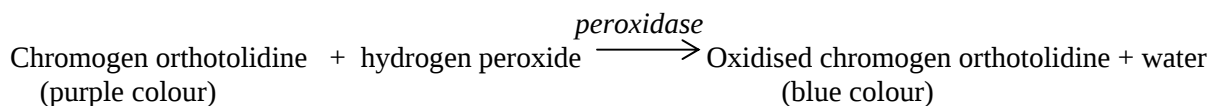
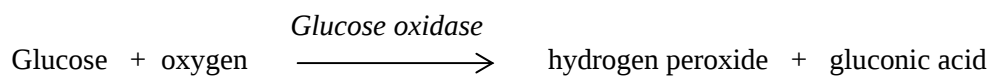
The following graph shows the glucose levels of a patient suspected of having diabetes and a normal person with no diabetes.



- d** Which patient, A or B would you expect of having diabetes? Explain your choice.

(2 marks)

A person, suspected of having diabetes, can have their urine tested with a test strip that has been impregnated with enzymes. The test strip contains two enzymes, glucose oxidase and peroxidase along with a purple indicator that is oxidized by hydrogen peroxide under the catalyzing action of the enzyme peroxidase to a blue colour. If the test stick changes from purple to blue, the individual has glucose in the urine, if it remains purple there is no glucose present. The following chemical reactions are involved.



e Why will this strip detect glucose but not other sugars?

(2 marks)

Total 8 marks.

Question 4

Sea water contains a variety of dissolved ions with a total concentration of about 1 mol/L whereas fresh water has a concentration of about 0.01 mol/L. Very few vascular plants are able to live with their roots in seawater. A group of various species of plants that thrives under salty conditions is the mangroves. Most mangroves are facultative halophytes, that is they can grow in either salt or fresh water. Most mangroves occupy an inter-tidal zone, an area that is periodically flooded by seawater. Their roots are located in salty water-logged soil.

a Why does the presence of salt in the soil water make it difficult for a mangrove plant to take up water?

(2 marks)

Even though they are growing in water, the adaptations of mangroves are similar to those of plants living in a dry environment; that is they try to reduce water loss.

b Name the process involved in water lost via the leaves of a plant.

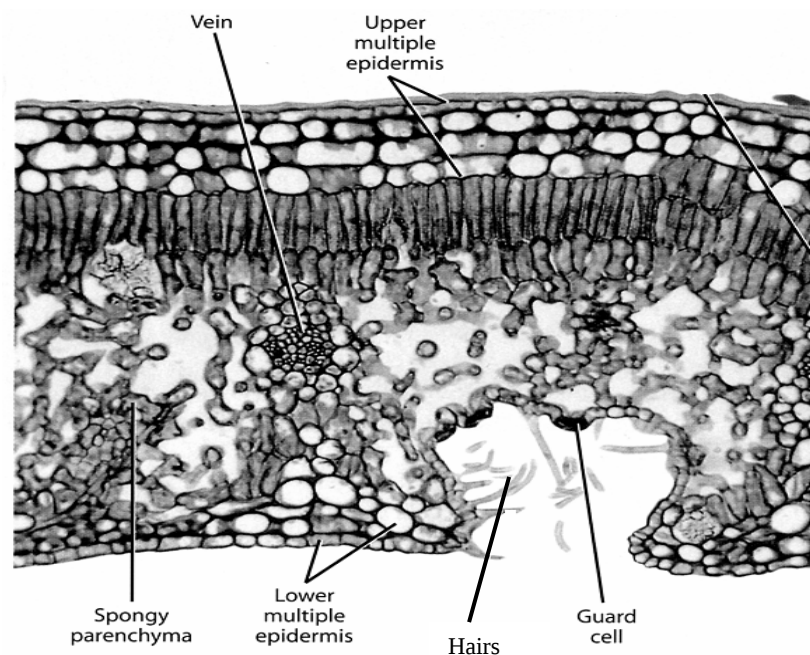
(1 mark)

Many mangrove plants have small narrow leaves that hang vertically.

c Explain how **both** the position **and** shape of the leaves is an adaptation to the mangrove's environment.

(2 marks)

The diagram below shows a transverse section through a leaf similar to a mangrove plant.



d How does the position of the stomata help this plant to conserve water?

(2 marks)

The two main ions found in seawater, Na^+ and Cl^- , can have direct toxic effects on most plants. Some species of mangroves overcome the salt problem by excluding salt uptake in a process called salt exclusion. Scientists investigating salt exclusion in mangroves, used metabolic inhibitors and found that the salt was still excluded the same in treated plants as in untreated plants.

e What conclusions could the scientists make regarding the mechanism of salt exclusion?

(2 marks)

Root systems that arch high over the water are typical of mangroves. These aerial roots, or pneumatophores, contain cell-sized pores called lenticels. The lenticels are open at low tide but close tightly at high tide when the roots are under water.

f (i) What would be the function of the lenticels?

(1 mark)

(ii) Why is it necessary for the mangroves to have them?

(2 marks)

Total 12 marks

Question 5

In September 2004, there was a scare in a Melbourne hospital, when a patient who had died after brain surgery was discovered, on post mortem, to have suffered from Creutzfeld Jacob Disease or CJD. This

disease is caused by an infective protein, which is a slightly changed version of a normal cell protein. The infected cells containing these abnormal proteins burst open and the infective proteins invade other cells. This occurs in brain tissue, causing holes or plaques, resulting in diseases such as CJD. Unfortunately CJD cannot be diagnosed until after death, when a post mortem is performed.

a What term is given to these defective proteins that result in diseases such as CJD?

(1 mark)

The standard heat treatment to sterilise surgical instruments is to heat them to 134°C - 138°C. This does not destroy these infective proteins and therefore instruments used for brain surgery on neurological patients are not used again, but are destroyed.

b How do these infective proteins differ from normal proteins in their susceptibility to heat?

(1 mark)

Some scientists have doubts that these infective agents contain only protein and yet are able to reproduce themselves.

c Why would some scientists doubt the ability of these infective proteins to reproduce? Explain your answer.

(2 marks)

The problem with these infective proteins is that they do not trigger the classical immunological response like other pathogens.

d What is the “classical immune response” referred to here?

(1 mark)

e Suggest a likely reason why these infective proteins do not elicit an immunological response.

(2 marks)

Total 7 marks

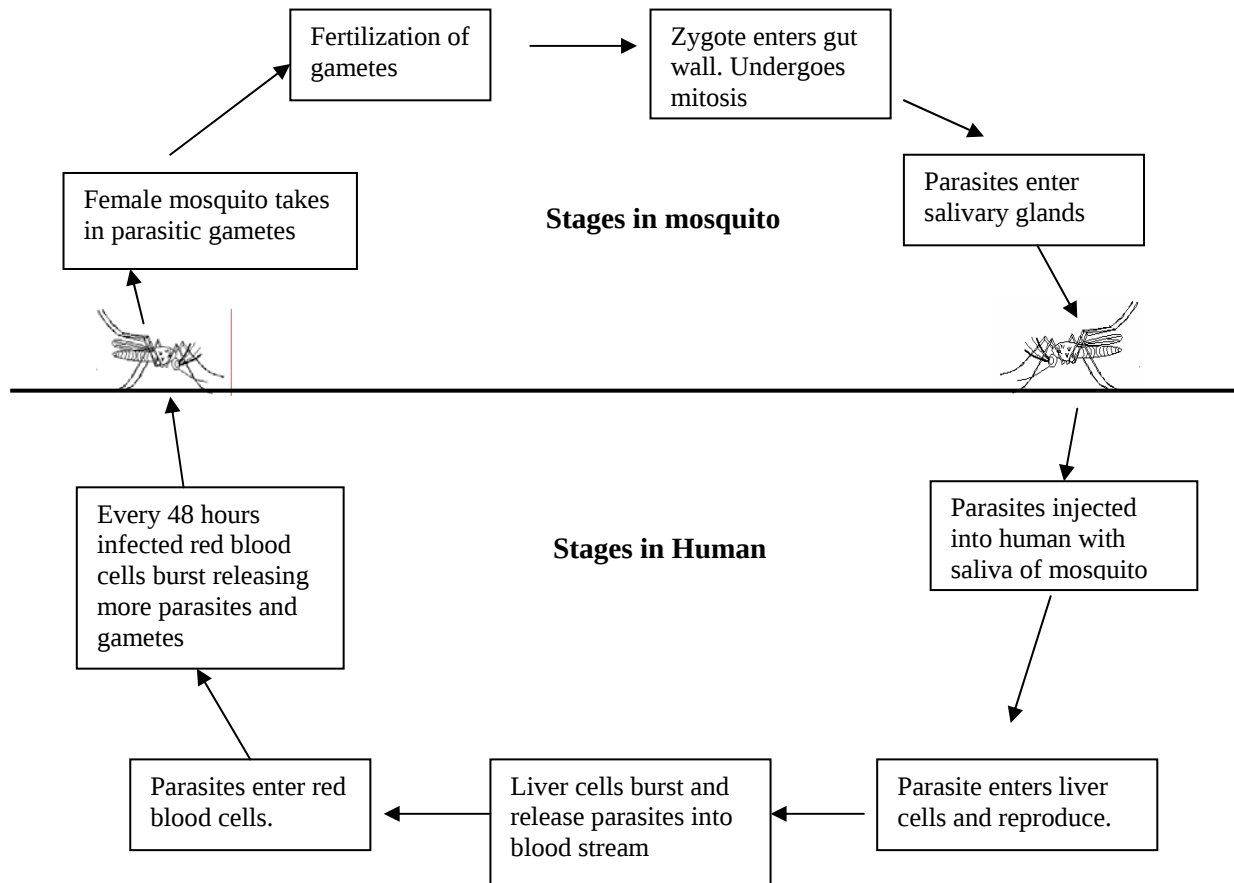
Question 6

Malaria is a tropical disease caused by a parasite, *Plasmodium falciparum*, a microscopic protozoa that is transmitted to humans by the bite of the female *Anopheles* mosquito.

a Is *Plasmodium* a eukaryote or a prokaryote? Explain your answer.

(2 marks)

The female mosquito feeds in the early evening and injects malarial parasites (sporozoites) into the blood stream of the individual. The sporozoites travel to the liver and reproduce asexually and change structure to form merozoites. The merozoites on reentering the bloodstream, invade red blood cells. Every 48 hours the infected red blood cells burst open to release more merozoites that invade other cells. When the patient is bitten by another female *Anopheles* mosquito these merozoites are taken in and reproduce sexually to produce the sporozoites. The diagram below outlines the life cycle of this parasite.



b Give **two** reasons why the female mosquito is significant to the life of cycle of the malaria parasite.

Reason one:

Reason two:

(2 marks)

In October 2004 trials of a malarial vaccine were reported to show some promise.

c What is a vaccine?

(1 mark)

Researchers have been trying to perfect a malarial vaccine for decades.

d Why would the task to perfect a malarial vaccine be so difficult?

(2 marks)

This newest malarial vaccine called RTS,S/ASO2A carries two short proteins RTS and S mimicking a key surface component of the sporozoite.

e Briefly explain how the injection of these two proteins in the appropriately prepared vaccine could result in immunity to malaria.

(2 marks)

Total 9 marks

END OF EXAMINATION

Acknowledgements:

MCQ 9 diagram sourced from:

Sci Art: The New Millenium, Compact Disc, Cambridge University Press.

MCQ 5 & Q4 diagrams sourced from:

<http://ntri.tamuk.edu/cell/golgi.html> accessed October 2004,
<http://www.esb.utexas.edu/mauseth/weblab/webchap10epi/10.3-10.htm> accessed November 2004,
<http://www.enchantedlearning.com/subjects/insects/mosquito/labellifecycle/> accessed November 2004