

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	5	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 16 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

2004

BIOLOGY

Unit 3 Trial Examination

MULTIPLE CHOICE ANSWER SHEET

STUDENT NAME:	
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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 cell contains a nucleus, mitochondria, cell wall and ribosomes.
This cell is most likely:

- A. a prokaryotic plant cell.
- B. a eukaryotic plant cell.
- C. a prokaryotic bacterial cell.
- D. a eukaryotic animal cell.

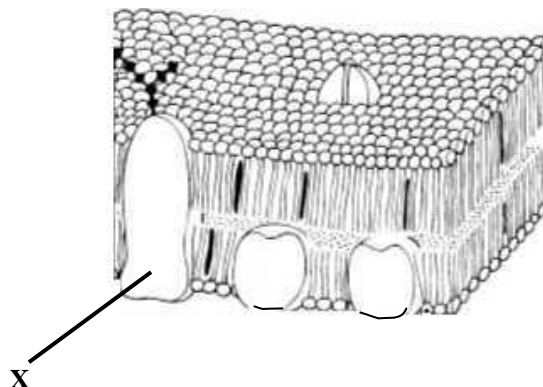
Question 2

The reactants in the process of photosynthesis are:

- A. NADH and ATP
- B. Sugar and oxygen
- C. Carbon dioxide and water
- D. Chlorophyll and sunlight

Question 3

The diagram below represents the fluid mosaic model of a cell membrane



Component labelled X is:

- A. sugar floating in a lipid bilayer.
- B. a ribosome attached to the membrane.
- C. protein floating in a lipid bilayer.
- D. a lipid molecule floating in a protein bilayer.

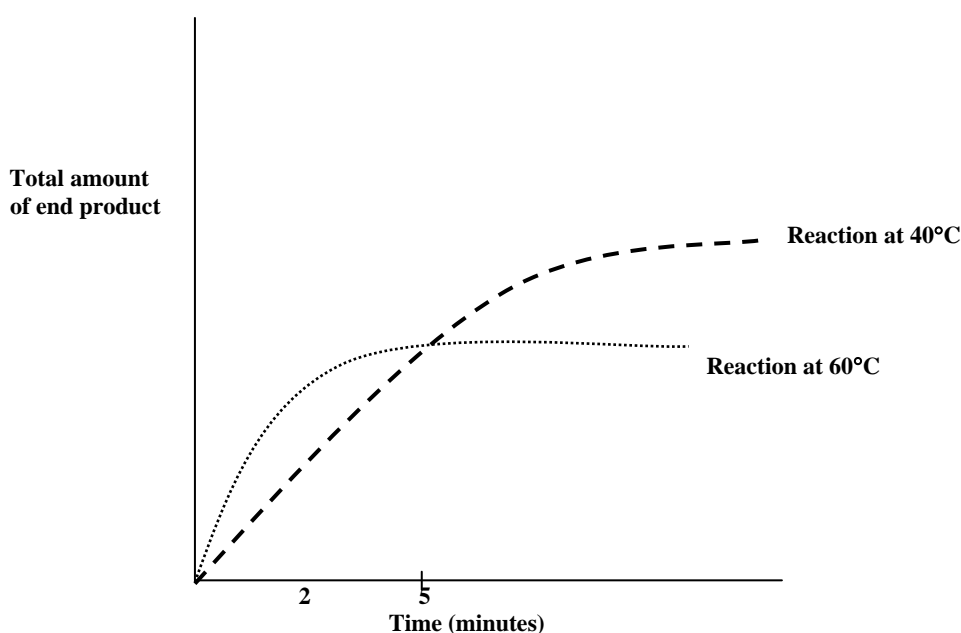
Question 4

Which statement about chloroplasts is correct?

- A. They are found in prokaryotes.
- B. They contain nucleic acid.
- C. They contain ribosomes.
- D. Their function is to carry out cellular respiration.

The following information applies to Questions 5 and 6.

The graph below shows the accumulation of product in the same enzyme-catalysed reaction at two different temperatures. The only difference between the two experiments is the temperature.

**Question 5**

The following information can be deduced from the graph.

- A. There is no more product formed after 5 minutes at 60°C because the enzyme has been denatured.
- B. There is no more product after 5 minutes at 60°C because all the substrate has been used up.
- C. The amount of product formed at 40°C will be the same as that formed at 60°C if the amount of substrate is the same.
- D. There is no more product formed at 60°C after 5 minutes because the enzyme has formed the enzyme-substrate complex.

Question 6

The following information can be deduced from the graph.

- A. The rate of reaction is the same for both temperatures between 0 and 2 minutes.
- B. The rate of reaction is faster at 40°C because more product has accumulated after 10 minutes.
- C. The rate of reaction is initially faster at 60°C because there are more collisions between the enzyme and the substrate molecules.
- D. The rate of reaction is much slower at 60°C because there is less product formed after 10 minutes.

Question 7

Mammals that live in hot, dry conditions would be expected to produce:

- A. urine that is isotonic to their extracellular fluids.
- B. urine that is hypotonic to their extracellular fluids.
- C. urine that is hypertonic to their extracellular fluids.
- D. urine that is identical to their extracellular fluids.

Question 8

Anaerobic pathways of ATP production:

- A. produce ATP without oxygen.
- B. produce ATP without glucose.
- C. occur in the mitochondria of the cell.
- D. produce more ATP than aerobic pathways.

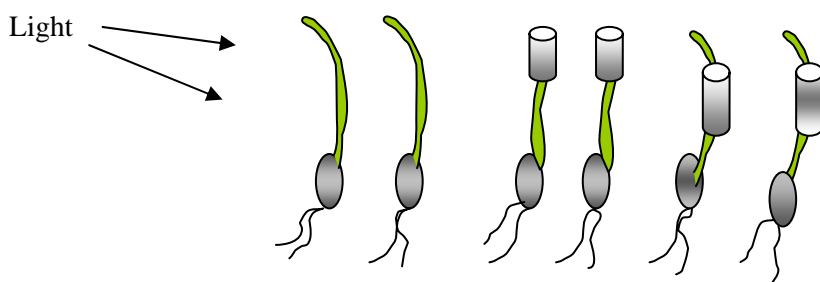
Question 9

If a person experiences a large drop in blood pressure, which of the following would occur as a response?

- A. A constriction of blood vessels leading to the kidney.
- B. A decreased release of antidiuretic hormone.
- C. A constriction of blood vessels leading from the kidney.
- D. A decreased release of rennin.

Question 10

The following experiment was set up using wheat coleoptiles (shooting seeds).



The experiment illustrates that:

- A. Growth occurs only if coleoptiles are exposed to light.
- B. The receptors for light are below the coleoptile tip, and these cells cause the coleoptile to bend towards the light.
- C. Auxin acts directly on the coleoptile tip, causing it to bend towards the light.
- D. The receptors for light are in the tip of the coleoptile, but the growth response occurs below the tip.

Question 11

The hormone glucagon:

- A. is produced in the beta cells of the pancreas.
- B. converts glycogen into glucose.
- C. is lacking in people suffering from diabetes.
- D. enables cells to take up glucose.

Question 12

Many cells maintain a higher concentration of sodium ions outside than inside, and a higher concentration of potassium ions inside than outside. This is achieved by means of:

- A. facilitated diffusion.
- B. exocytosis.
- C. active transport.
- D. endocytosis.

Question 13

A patient is tested for a knee jerk reflex by tapping the leg just below the knee. The pathway of the impulse would be:

- A. sensory neuron, interneuron, motor neuron, muscle.
- B. interneurons, motor neuron, sensory neuron, muscle.
- C. motor neurons, sensory neuron, spinal cord, muscle.
- D. sensory neurons, brain, motor neuron, muscle.

Question 14

The physiological purpose of shivering is to:

- A. release heat into the surroundings of the animal.
- B. release more ATP by muscle contraction resulting in the release of more heat energy.
- C. increase the build up of lactic acid, which has a high heat content.
- D. use up ATP by muscle contraction and thus stimulate more cellular respiration and more heat production.

Question 15

Which of the following statements applies to the transmission of nervous impulses in vertebrates?

- A. Axons synapse with the cell body or dendrites of the next neuron in the pathway.
- B. Myelinated nerve fibres usually transmit the impulse more slowly, as the myelin interferes with the movement of ions across the membrane.
- C. Neurons need to make direct contact with other neurons in the pathway for conduction to occur.
- D. If the distance for the impulse to travel from the spinal cord is a long one, many neurons need to be involved.

Question 16

Various factors control the opening and closing of stomata. These include:

- A. Stomata open when the turgor pressure in the guard cells decreases.
- B. Potassium ions are actively transported into guard cells from the surrounding epidermis when stomata are about to open.
- C. As potassium enters the guard cells, water leaves the guard cells, causing the stomata to close.
- D. As the CO₂ concentration increases, the stomata in most plants tend to close.

Question 17

A laboratory worker placed some cells in a 0.2 M solution of glucose. After 20 minutes the concentration of glucose inside the cell was observed. The experiment was repeated and the cells were placed in a 0.4 M solution of glucose for the same length of time. The concentration of glucose inside the cell was now double that of the previous experiment. This experiment demonstrates that:

- A. glucose enters the cell by active transport.
- B. glucose enters the cell by exocytosis.
- C. glucose enters the cell by diffusion.
- D. glucose enters the cell by osmosis.

Question 18

If a person were outside on a hot, dry, day without anything to drink, a consequence would be:

- A. a decrease in the reabsorption of water from the kidney tubules in order to maintain homeostasis.
- B. an increase in the secretion of antidiuretic hormone from the pituitary gland in order to maintain homeostasis.
- C. a decrease in the concentration of urea in the urine, as less urea is formed without water to hydrolyse the protein.
- D. an increase in the volume of urine produced in order to maintain the water content in the blood as a consequence of sweating.

Question 19

It is common practice for farmers to pick bananas green, although sufficiently mature to ripen after being picked. Prior to selling, the bananas are ripened by exposure to:

- A. cytokinin.
- B. gibberellin.
- C. abscisic acid.
- D. ethylene.

Question 20

Which one of the following could be considered a nonspecific defence?

- A. Production of antibodies.
- B. Tears, saliva, and mucous secretions contain lysozyme, an enzyme that digests the bacterial cell wall.
- C. Differentiation of B cells into plasma cells.
- D. Attachment of T helper cells to macrophages.

Question 21

A woman, who is 2 months pregnant, has come into contact with Rubella or German measles. Not having had the disease herself before, she seeks medical advice concerning her developing baby. Her doctor advises her to have an injection of gamma globulin to protect her.

This is an example of:

- A. active immunity.
- B. passive immunity.
- C. an attenuated vaccine.
- D. non specific immunity.

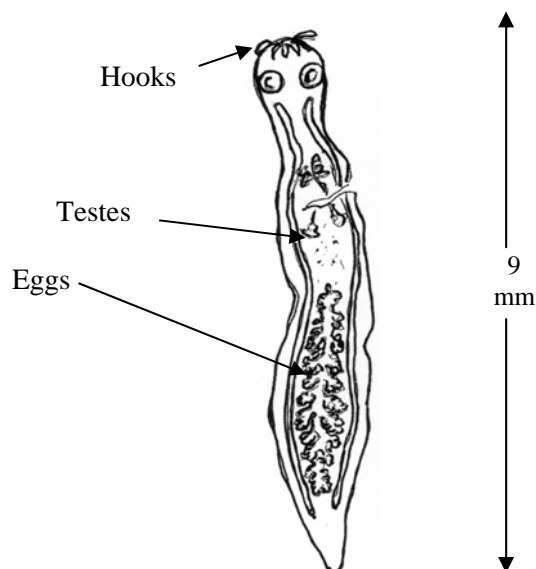
Question 22

Vectors are important in the spread of many diseases. It is reasonable to conclude that:

- A. vectors are the organisms that cause disease.
- B. vectors are involved in viral diseases only, as bacteria are too large to be carried by vectors.
- C. diseases associated with vectors are usually restricted to the geographical area that support the vector.
- D. insects are the only organisms that can act as vectors of a disease.

Question 23

Below is a diagram of *Echinococcus granulosus*, a species of tapeworm that infects dogs. The adult tapeworm is about 9mm long.



- A. *Echinococcus* is likely to attach itself to the wall of the intestine.
- B. *Echinococcus* is structured such that it would be able to move freely in the blood stream.
- C. *Echinococcus* has a digestive system.
- D. *Echinococcus* is only able to reproduce when the dog is infected by another tapeworm of the opposite sex.

Question 24

Creutzfeldt – Jacob disease (CJD) is a degenerative brain disease that is caused by particles called prions. Damage is caused to nerve cells in the brain as these cells burst open to release prions to infect other cells. Prions are:

- A. the protein part of the cell membrane that has broken away and entered other cells.
- B. a section of DNA of the cell that codes for the infective prion protein.
- C. proteins present in the cell that have been modified to become infective agents.
- D. proteins that are so small that they can move through nerve cell membranes to infect other cells.

Question 25

The immune system consists of many different white blood cells, each having a particular function. In the following table, choose the white blood cell that is correctly paired to its function.

A.	Helper T cells	Stimulate B cells to make antibodies
B.	Natural killer lymphocytes	Turn off the immune response by killing off other lymphocytes
C.	Macrophages	Degranulate to release histamine
D.	Mast cells	Present antigen to T cells

END OF SECTION A

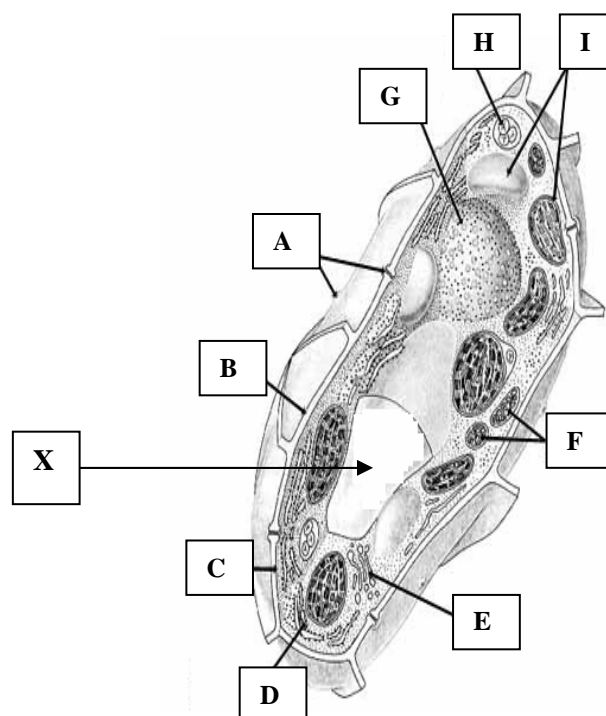
SECTION B - Short Answer Questions**Specific instructions for Section B**

This section consists of 5 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

Below is a diagram of a typical plant cell.



The golgi bodies in plant cells are smaller than in animal cells and are thought to be involved in the formation of the components of the cell wall as well as other complex molecules.

- a** From the diagram above write the letters that correspond to the cell wall and the golgi body.

Cell Wall _____

Golgi Body _____

(2 marks)

b What is the main chemical component of the plant cell wall?

(1 mark)

c What is the function of the cell wall?

(1 mark)

d In the diagram above, name the structure labelled **X**.

(1 mark)

Structure **X** contains a wide variety of substances dissolved in water. Because of this, water tends to flow into this structure.

e What is the process used to describe this movement of water into structure **X**?

(1 mark)

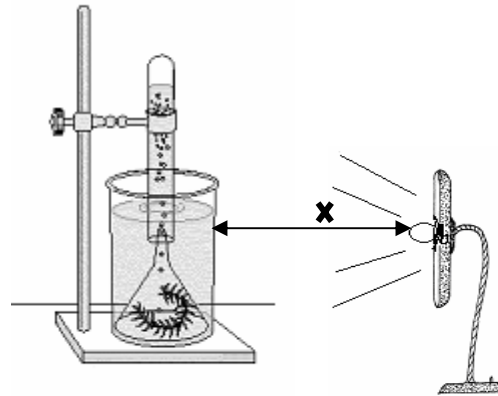
f Explain how the process named in **e** above is important to the survival of the plant.

(2 marks)

Total 8 marks

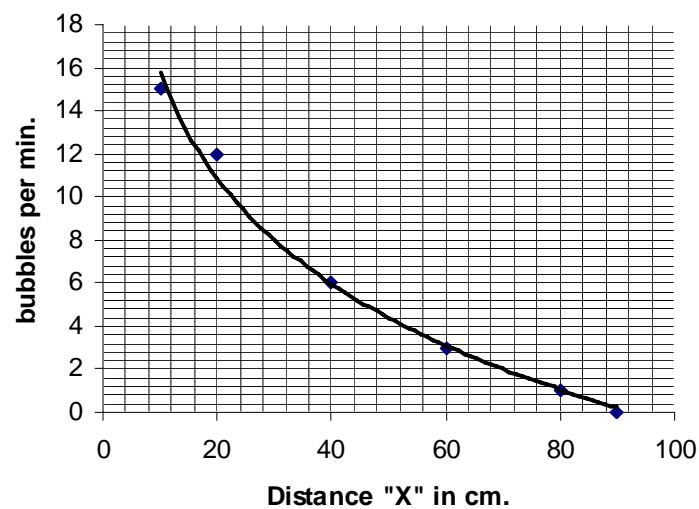
Question 2

Students studying photosynthesis set up the following experiment. A piece of water plant, *Elodea*, was placed in the apparatus as shown, at a temperature of 22°C.



The light source was placed at a distance of 10 cm from the water plant. After 5 minutes the rate of bubbles emerging from the plant was measured. The light was then moved a further 10 cm away, left for 5 minutes, and the rate of bubbling recorded. This was repeated at distances of 40, 60, 80 and 90 cm. A graph of the results is plotted below.

Photosynthesis Experiment



- a** State an hypothesis for the experiment described above.

(1 mark)

- b** What variables are being controlled in this experiment?

(1 mark)

- c** The students used the number of bubbles per minute as a measure of the rate of photosynthesis. How is the number of bubbles per minute a possible measure of photosynthesis?

(2 marks)

- d** Why is the rate of gas production in this experiment not necessarily related to the rate of photosynthesis?

(2 marks)

- e** How could this experiment be improved?

(1 mark)

- f** The intensity of light falling on a given object from a constant light source is inversely proportional to the square of the distance between them. If the distance between the light and the elodea were doubled, what would be the effect on the rate of photosynthesis?

(1 mark)

- g** Why was the lamp left for 5 minutes before counting at each distance?

(1 mark)

The students then decided to repeat the experiment but this time at a temperature of 30°C.

- h** Should they expect the same results? Explain.

(2 marks)

- i** If the students were able to increase the light intensity indefinitely, would you expect the production of gas to increase at the same rate? Explain.

(2 marks)

Total 13 marks

Question 3

The Gila monster (*Heloderma suspectum*) is a venomous lizard, native to several South Western American States. This lizard eats only four times a year. It has the ability to activate its pancreas at these times, whereas other times the pancreas is inactive. In the saliva of this lizard is a hormone, exendin-4. This is a 39 amino acid peptide that is secreted when the lizard eats. The effect of exendin-4 is to stimulate insulin production, inhibit glucagon secretion and slow down the rate of the stomach emptying.

a Name the cells in the pancreas that produce insulin.

(1 mark)

b Why is it necessary for the lizard to produce insulin at a meal?

(1 mark)

c Explain the significance of the action of exendin-4 in inhibiting glucagon production?

(2 marks)

Synthetic exendin-4 is currently being trialed as a drug treatment for people with Type 2 diabetes. Excess glucagon production is a major factor in their hyperglycaemia. Synthetic exendin-4 has all the properties of the naturally occurring exendin-4.

d How does slowing down the emptying of the stomach help people suffering from Type 2 diabetes?

(1 mark)

The drug, exendin-4, stimulates insulin secretion in the presence of elevated glucose concentrations, but not when blood glucose levels are low.

e Explain how this property of exendin-4 gives an advantage over insulin injections for diabetics?

(2 marks)

f Exendin-4 has the disadvantage that it needs to be injected. Give one possible reason why it needs to be injected rather than taken orally.

(1 mark)

Total 8 marks

Question 4

The Kangaroo rat *Dipodomys merriami* lives in the desert in North America where the temperature can rise to 60°C and the air is very dry. The Kangaroo rat has evolved water conserving strategies in order to help it survive. It burrows under the ground to a depth of 25 cm where it stays during the day.

- a** Explain how nocturnal behaviour helps the kangaroo rat conserve water?

(2 marks)

The humidity in the burrow can be as high as 90%, whereas the average water content of the Kangaroo rat is 66%.

- b** How does this environment help the kangaroo rat to conserve water?

(1 mark)

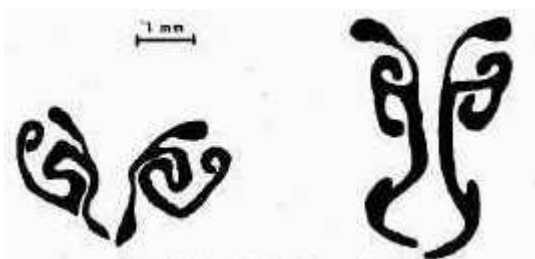
The Kangaroo rat rarely drinks but is able to gain water by the metabolic breakdown of barley seeds that are mainly starch.

- c** Write an equation representing this gain of metabolic water.

(1 mark)

The lungs of mammals are moist and when an animal inhales dry air, there is a higher water content in the lungs than in the inhaled air. Exhaled water vapour can be a source of water loss. A method that the Kangaroo rat uses to decrease water loss to its environment is by means of a counter current heat exchanger in its nose. Below is a diagram of the long, thin, convoluted nasal passages of a Kangaroo rat.

Nasal passages of the Kangaroo rat



- d** What characteristic of these nasal passages suits them to their function? Explain your answer.

(2 marks)

Total 6 marks

Question 5

In February 2003 severe acute respiratory syndrome (SARS) was first reported. In the following few months the disease spread to countries in North America, South America, Europe and Asia. A total of 8098 people were affected world wide, with 747 deaths. The symptoms were high fever, headache, body aches and a dry cough. Many patients developed pneumonia which was life threatening. The disease was caused by a corona virus that is spread by droplets.

a What is a virus?

(1 mark)

This disease is accompanied by fever.

b What is a fever and what causes it?

(2 marks)

c State **two ways** in which the body reacts to bring about the onset of a fever.

(2 marks)

In order to contain the spread of SARS, public health authorities relied on many strategies. One of these was to quarantine people who had been to SARS affected areas and were returning to Australia.

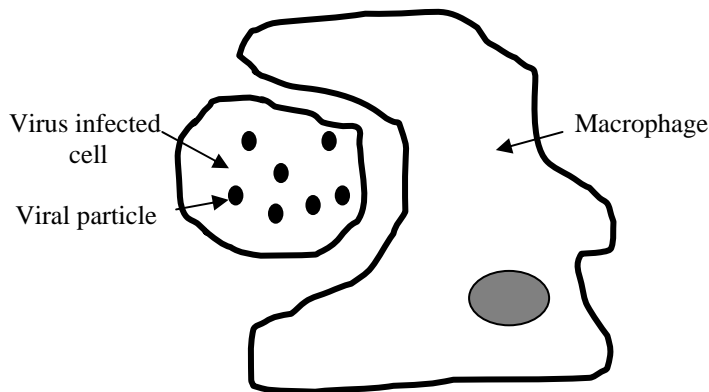
d Explain how quarantine can help to reduce the spread of the SARS virus?

(2 marks)

Total 7 marks

Question 6

When a person's cells are invaded by virus particles, the infected cells are ingested by special cells called macrophages.



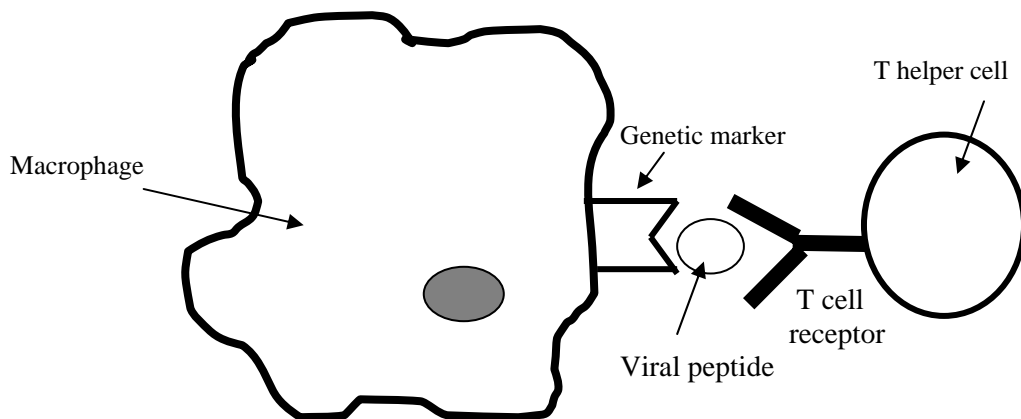
a What is this process of ingestion called?

(1 mark)

The macrophages, having ingested the virus infected cells, display viral peptides on their surfaces along with their own genetically determined markers. The presence of these markers and viral peptides activates T helper cells that have a specific T cell receptor on their cell surface, to bring about the immune response.

b What term is given to this type of immunity?

(1 mark)



c Give one possible immune response that occurs when the T helper cell, with the appropriate receptor, binds to the macrophage displaying viral peptides and genetic markers.

(1 mark)

Sometimes normal cells are attacked by the body's own immune system.

d What term is used to describe such a condition?

(1 mark)

In one such condition, Multiple Sclerosis, the myelin sheaths protecting the neurons in the Central Nervous System are destroyed by the person's own T helper cells. Recent evidence suggests that multiple sclerosis may be triggered in some people, who are genetically susceptible, after being infected with human Herpes virus 6. This is because the displayed viral peptide is similar in structure to the self-peptide on the myelin sheath. Based on this knowledge, investigators are looking at the possibility of developing a vaccine to help Multiple Sclerosis sufferers.

e What is a vaccine?

(1 mark)

One experimental approach is to try to initiate an immune response against the T cells that destroy the myelin. T cells are scanned for the myelin recognizing receptors on their surfaces. A fragment of the surface peptide is then isolated and injected back into the body of the Multiple Sclerosis sufferer as a vaccine, hopefully protecting the individual from further degeneration of the myelin sheaths.

f How would this peptide vaccine work to protect the individual from further attacks on the myelin sheath?

(3 marks)

Total 8 marks

END OF EXAMINATION

Acknowledgements:

MCQ 3: adapted from <http://regentsprep.org/regent/biology/units/organisation/structure>: site accessed Dec 2003

Section B Q2: sourced from

<http://www.tea.stste.tx.us/student.assessment/resources/online/2002/eoc/bioloby/p20no28.gif>: site accessed Mar 2004

Section B Q4: sourced from www.biology.ucsd.edu/classes/bieb102.FA02/BIEB102/lecture9: site accessed Dec 2003

Section B Q6: adapted from Johns, Terrance: *Viruses and MS*, Today's Life Science, Aug 1997, p. 22.