

QCE Biology Units 1&2

Paper 2

Student's Name: _____

Teacher's Name: _____

Time allowed

- Perusal time – 10 minutes
- Working time – 90 minutes

General instructions

- Answer all questions in this question and response booklet.
- Write using black or blue pen.
- QCAA-approved calculator permitted.
- Planning paper will not be marked.

Section 1 (45 marks)

- 11 short response questions

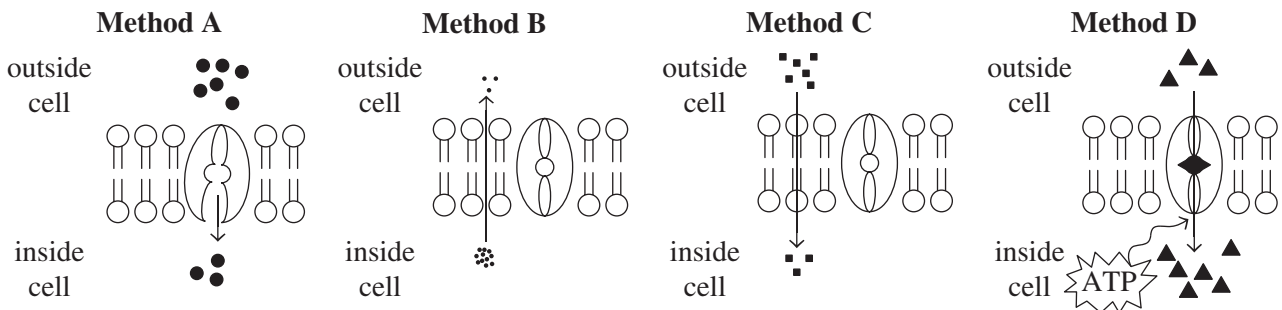
SECTION 1

Instructions

- If you need more space for a response, use the additional pages at the back of this booklet.
 - On the additional pages, write the question number you are responding to.
 - Cancel any incorrect response by ruling a single diagonal line through your work.
 - Write the page number of your alternative/additional response, i.e. See page ...
 - If you do not do this, your original response will be marked.
- This section has 11 questions and is worth 45 marks.

QUESTION 1 (4 marks)

The diagram below shows the methods of movement of four different substances through various parts of the plasma membrane.



Name each method and support your answer using evidence from the diagram.

Method A: _____

Method B: _____

Method C: _____

Method D: _____

QUESTION 2 (4 marks)

Photosynthesis occurs in two stages, with some of the outputs of stage 1 being necessary for stage 2 to occur. Although a source of light energy is essential for stage 1, overall there is no net adenosine triphosphate (ATP) produced at the end of the photosynthesis reaction.

Discuss the statements above with reference to the inputs and outputs of each stage of photosynthesis and the energy transformations that occur in the process of photosynthesis.

QUESTION 3 (4 marks)

Enzymes catalyse reactions by providing a reaction site for a substrate. The 'lock and key' model of enzyme activity uses the analogy of a rigid structure of a lock with a fixed shape for a specific key. The 'induced fit model' appears to better describe the way in which enzymes speed up reactions.

- a) Describe how the induced fit model is different from the lock and key model. *[2 marks]*

- b) Outline the similarities of the models. *[1 mark]*

- c) Outline the importance of the reaction site provided by the enzyme. *[1 mark]*

QUESTION 4 (5 marks)

The individual cells of large, complex organisms depend on long distance transport systems to deliver and remove substances.

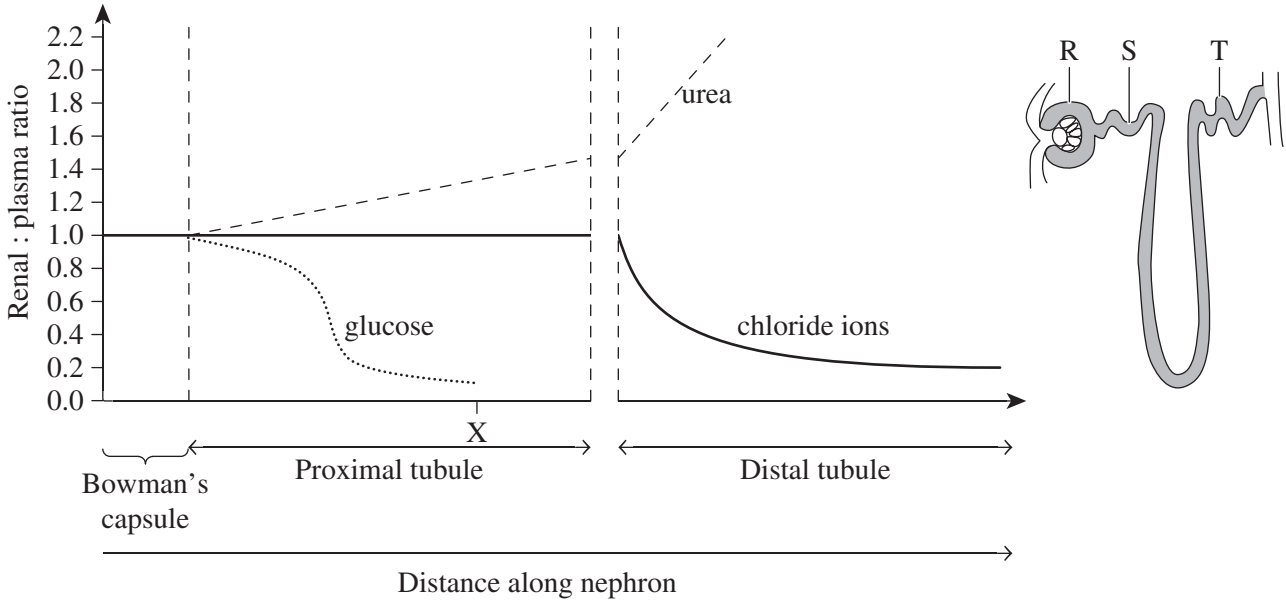
- a) Name the transport systems involved in delivery and removal of the inputs and outputs for a green leaf cell. *[1 mark]*

- b) Name the transport systems involved in the delivery and removal of substances for a human liver cell. *[1 mark]*

- c) Identify three differences between the transport systems involved in delivering and removing substances from a green leaf cell and a human liver cell. *[3 marks]*

QUESTION 5 (4 marks)

The concentration of the substances in the renal fluid in the kidney can be measured at any point along a nephron unit and expressed as the renal : plasma ratio (the concentration of a particular substance in the renal fluid divided by the concentration of the same substance in the plasma). On the graph below, the lines show the renal : plasma ratio for three substances recorded at various distances along the nephron (R, S, T), as shown in the accompanying diagram.



a) Outline how the renal : plasma ratio changes in the graph for

i) chloride ions in the distal tubule. [1 mark]

ii) urea in the distal tubule. [1 mark]

b) Why is there no data for glucose beyond point X? [1 mark]

c) Protein is also a component of blood plasma. However, it is not possible to show its renal : plasma ratio on the graph above.

Why is this not possible? [1 mark]

QUESTION 6 (4 marks)

A student prepared a transverse section of a geranium leaf from the garden and observed it under $\times 400$ magnification under a light microscope, as seen in the diagram below.



Her teacher told her she had the section upside down, and this type of plant would probably not survive if its leaves were arranged this way.

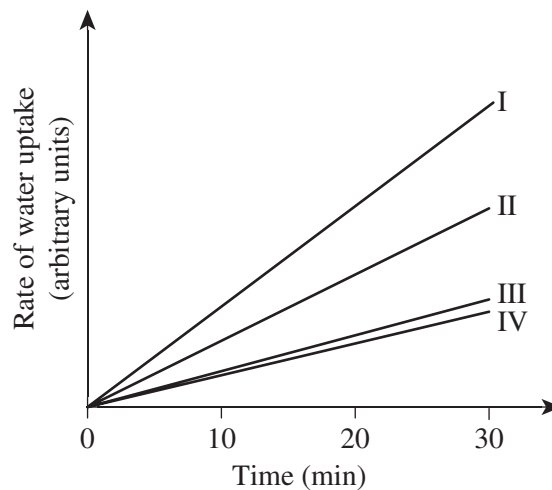
- a) Why would this leaf orientation be a disadvantage for the plant's growth, in terms of the structures or processes involved?

[1 mark]

The student then carried out an experiment to determine the rate of water uptake by leafy shoots from the same geranium plant. She used four leafy shoots with six leaves on each shoot and tested them in the following conditions for 30 minutes.

- I moving air, no treatment to leaves
- II still air, no treatment to leaves
- III still air, underside of leaves covered in grease
- IV moving air, underside of leaves covered with grease

The student kept the set-ups in the same place in the laboratory during testing. Her results are shown in the graph below.



The results for the untreated leaves (I and II) are significantly different to each other. The results for the treated leaves (III and IV) are very similar to each other.

- b) Why is there a significant difference in the results for the untreated leaves (I and II)? [1 mark]

- c) Why are the results for the treated leaves (III and IV) similar? [1 mark]

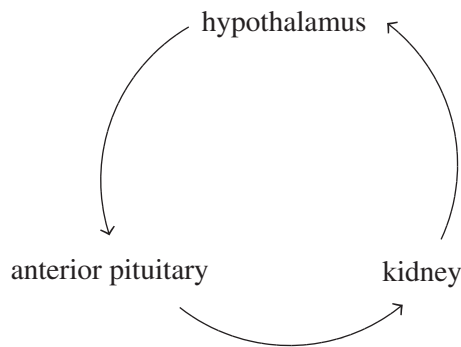
- d) Is this a controlled experiment? Give a reason to support your answer. [1 mark]

QUESTION 7 (4 marks)

Vertebrates have various complex self-regulatory mechanisms that enable them to survive in a wide range of environments. These homeostatic mechanisms help them to respond to changes in both their internal and external environment, thus integrating and maintaining the whole organism. An example of one of these mechanisms is osmoregulation, the regulation of the blood solute concentration.

- a) Define the term *homeostasis*. [1 mark]

- b) Three different major sites are involved in osmoregulation, as shown in the diagram below.



A boy went for a 10 km run on a 30°C day and did not stop for a drink along the way.

Outline how the boy's blood solute concentration would be regulated by each of the three sites in the diagram.

[3 marks]

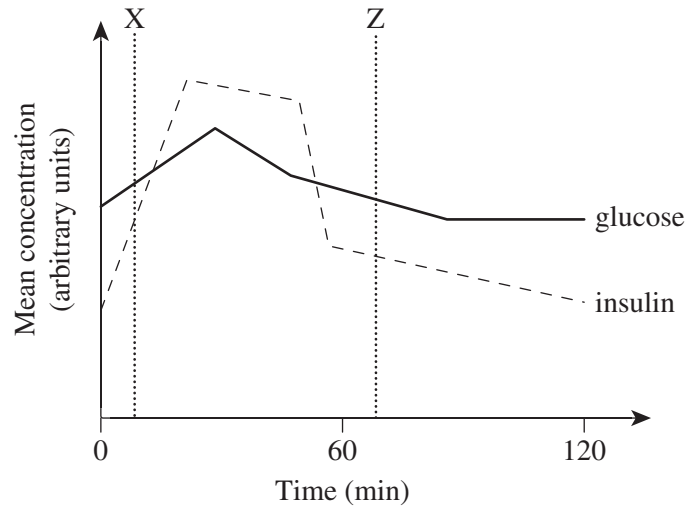
Hypothalamus: _____

Anterior pituitary: _____

Kidney: _____

QUESTION 8 (4 marks)

The graph below shows the results of an experiment carried out to investigate the relationship between the concentrations of glucose and insulin in the blood of healthy people. At the start of the experiment, 20 volunteers drank a syrup containing 50 g of glucose after fasting for eight hours. The concentrations of glucose and insulin were measured in their blood samples at intervals over the next two hours.



- a) Explain the importance of the organ involved in producing the changes in the glucose concentration between X and Z. Use information from the graph to support your answer. [2 marks]

- b) On the graph above, draw the blood glucose concentration for an untreated diabetic person with type 1 diabetes under the same conditions. Justify your response. [2 marks]

QUESTION 9 (4 marks)

Pneumococcus bacteria are a leading cause of death in children worldwide, causing pneumonia and meningitis. Scientists at a research hospital identified that an antibiotic used to treat infected children actually acted on an enzyme in the bacteria, promoting the bacteria's survival, and did not combat the invasive disease. It did this by helping to remove the capsule that surrounds the bacterial cell, thereby allowing it to evade the antimicrobial peptides produced by the surface cells in the lungs and to enter the lung tissue.

- a) The antimicrobial peptides produced by the lung cells are part of a section of the human immune system.

Name and describe this section of the immune system, including reference to the level of defense and specificity to pathogen invasion.

[2 marks]

- b) Will the presence of the capsule in *Pneumococcus* bacteria increase or decrease the virulence of these bacteria? Give a reason to support your answer.

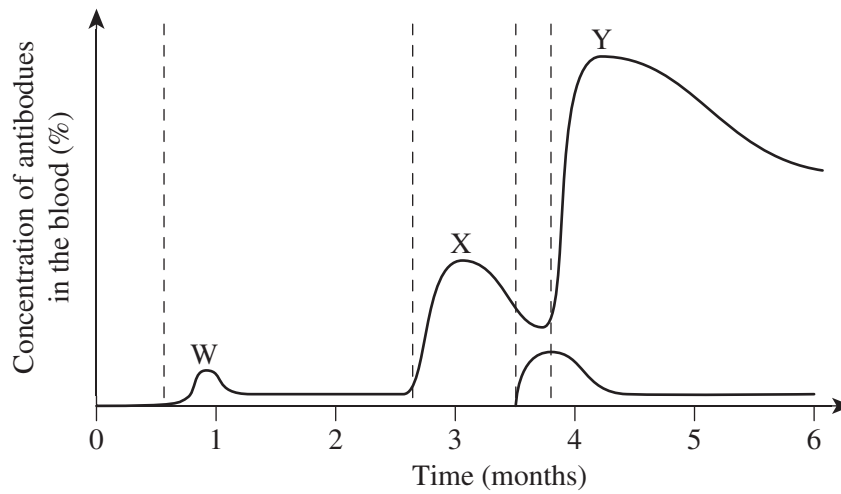
[1 mark]

- c) Outline one adherence factor in viruses that increases their virulence.

[1 mark]

QUESTION 10 (4 marks)

The graph below shows the concentration of antibodies in the blood of a person who was exposed to the antigen of pathogenic organisms on different occasions during a six-month period. Each time of exposure to the pathogen is shown by a dashed line.



- a) From the graph above, infer how many different antigens the person was exposed to during the six-month period. Justify your response. [1 mark]

- b) Explain the difference in concentration at peaks W, X, and Y. [2 marks]

- c) How did the antibodies form initially? [1 mark]

QUESTION 11 (4 marks)

The following two methods can be used to prevent deaths from tetanus poisoning.

I Inject a tetanus toxin, which has been rendered harmless by treatment with formaldehyde. This non-toxic material is called a toxoid and retains the antigenic properties of tetanus toxoid.

II Inject a serum from horses that have previously been injected with tetanus toxoid.

a) Use the appropriate terms from the following list to categorise each method of immunisation. Justify your answers. *[2 marks]*

artificial natural active passive

Method I: _____

Method II: _____

b) A boy stepped on a rusty nail. It was not known when he had his last tetanus vaccination. Outline which method would be most suitable for treating the boy. *[1 mark]*

c) Ten years after a person is injected using method I, a booster tetanus injection should be given to the person. A booster is not needed for other infectious diseases, such as diphtheria. Why is a booster needed for tetanus, but not diphtheria? *[1 mark]*

END OF PAPER

