Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

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General Certificate of Education
June 2003
Advanced Level Examination

ASSESSMENT and QUALIFICATIONS ALLIANCE

BIOLOGY (SPECIFICATION A) BYA6
Unit 6 Physiology and the Environment

Monday 16 June 2003 Morning Session

No additional materials are required.
You may use a calculator.

Time allowed: 1 hour 30 minutes.

Instructions

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided. All working must be shown.
- Do all rough work in this book. Cross through any work you do not want marked.

Information

- The maximum mark for this paper is 75.
- Mark allocations are shown in brackets.
- You will be assessed on your ability to use an appropriate form and style of writing, to organise relevant information clearly and coherently, and to use specialist vocabulary, where appropriate.
- The degree of legibility of your handwriting and the level of accuracy of your spelling, punctuation and grammar will also be taken into account.
- You are reminded that this test requires you to use your knowledge of Modules 1, 2, 4 and 5 as well as Module 6 in answering synoptic questions. These questions are indicated by the letter **S**.

For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
3			
4			
5			
6			
7			
8			
9			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

LEAVE MARGIN BLANK

Answer **all** questions in the spaces provided.

1 Triglycerides are digested into fatty acids and glycerol, which are absorbed into epithelial cells lining the gut. Here they are recombined into triglycerides. The triglycerides are transported to other cells where they may be stored or respired.

(a) (i) Name the enzyme that digests triglycerides into fatty acids and glycerol.

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(1 mark)

S (ii) Why is glycerol able to pass through the plasma membrane into the epithelial cells?

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(1 mark)

S (b) (i) How could you determine experimentally whether a small mammal was respiring triglycerides or carbohydrates? You need not give details of apparatus or experimental procedures.

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(2 marks)

(ii) Suggest why triglycerides are more valuable to a small desert mammal as a food store than carbohydrate.

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(1 mark)

5

2 A person looks at two spots of blue ink on a piece of white paper in bright light. The two spots are close together. Under these conditions, the person can clearly see two blue, circular spots.

(a) Explain how rays of light from a spot are made to form a distinct circular image on the retina.

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(2 marks)

(b) When the same person views the spots in dim light, a single larger spot is seen. It is difficult to see the colour of the ink. Explain why

(i) two separate spots can no longer be seen;

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(2 marks)

(ii) the colour of the ink cannot easily be seen.

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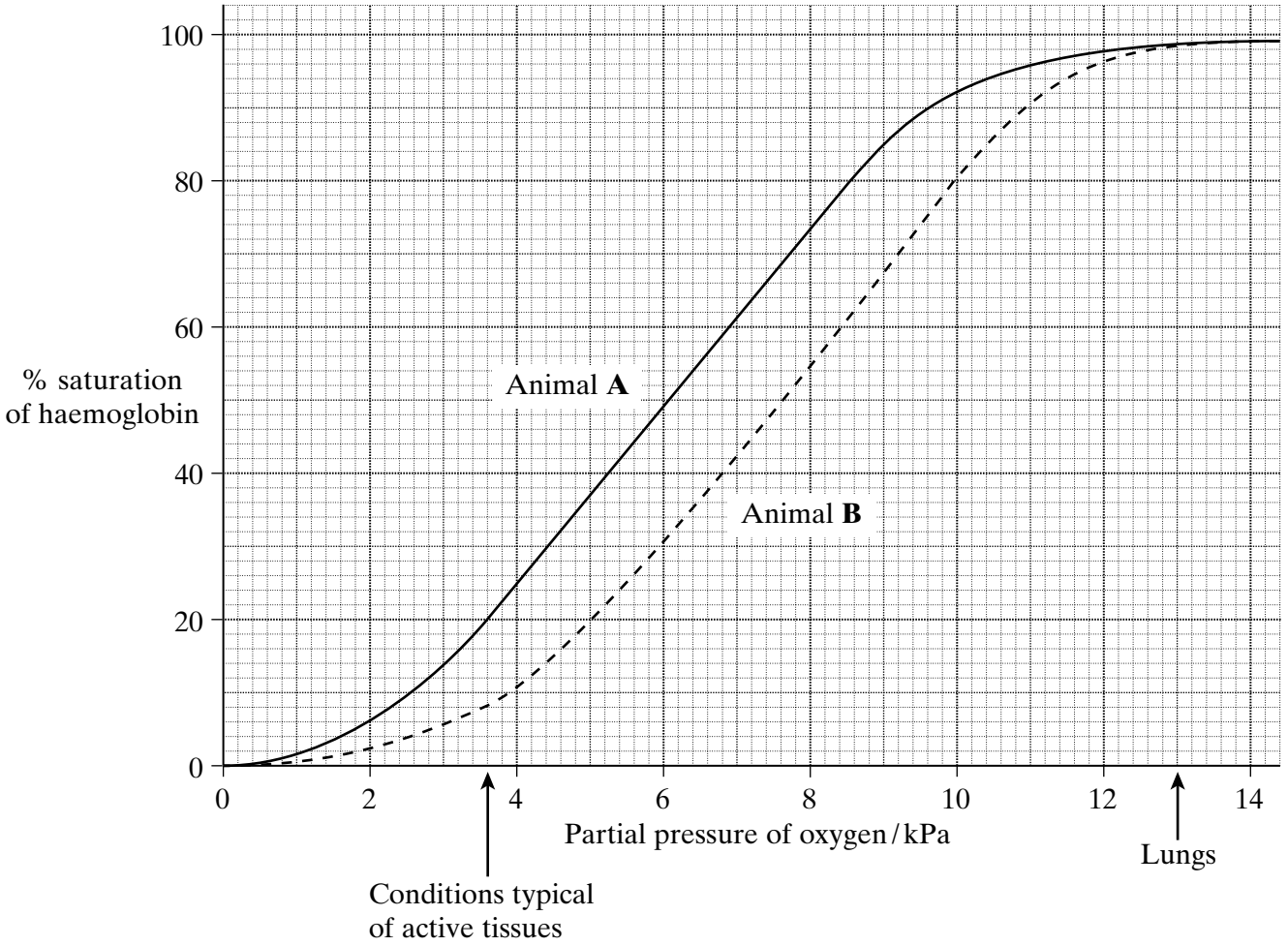
(1 mark)

5

TURN OVER FOR THE NEXT QUESTION

3 The graph shows the dissociation curves for haemoglobin from two different animals. The data for both animals were obtained whilst maintaining the same partial pressure of carbon dioxide.



(a) What is the difference in percentage saturation of the two haemoglobins at the partial pressure of oxygen typical of active tissues indicated on the graph?

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(1 mark)

S (b) Animal **B** is more active than animal **A**. Use the graph to explain how the haemoglobin of animal **B** allows a greater level of activity.

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(3 marks)

(c) Explain how haemoglobin acts as a buffer.

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(1 mark)

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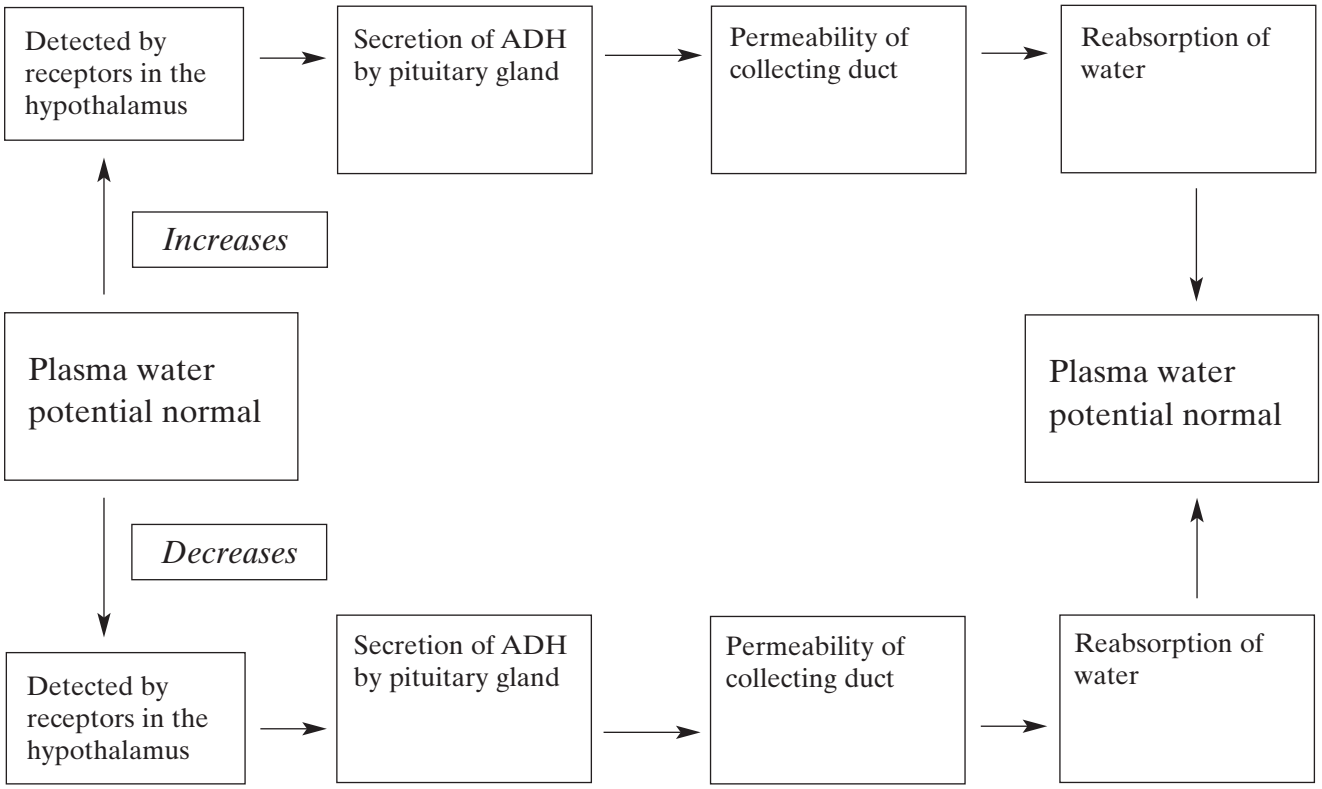
TURN OVER FOR THE NEXT QUESTION

4 (a) The flowchart summarises some of the events involved in the control of the water potential of blood plasma.



(i) Write "increases" in **one** appropriate box and "decreases" in **one other** appropriate box. *(1 mark)*

(ii) Give evidence from the flowchart which shows that the control of plasma water potential involves negative feedback.

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(1 mark)

(b) Describe the role of the loop of Henle in the reabsorption of water from the collecting ducts. You may draw a diagram if it helps your answer.

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(3 marks)

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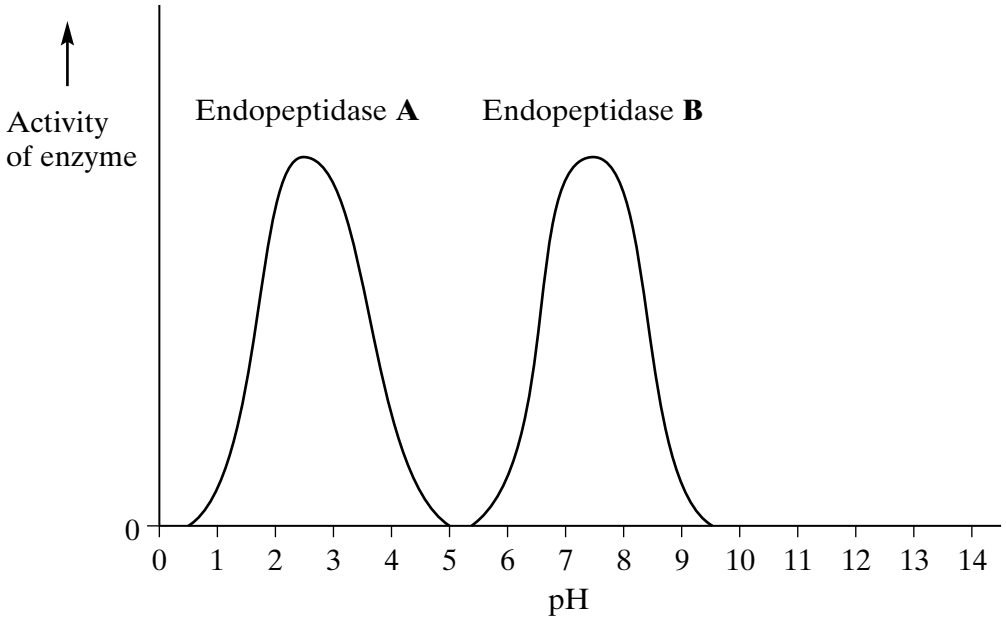
TURN OVER FOR THE NEXT QUESTION

5 The graph shows the activity of two endopeptidases found in mammals.



(a) What is an *endopeptidase*?

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(1 mark)

(b) Suggest the name of endopeptidase **B**. Give a reason for your answer.

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(1 mark)

S (c) Explain why each of these endopeptidases can be active in only one region of the gut.

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(3 marks)

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6 When food is placed in the mouth, the salivary glands immediately secrete saliva, which brings about the digestion of starch into maltose.

(a) Sometimes, just the sight of food can result in the secretion of saliva.

(i) What name is given to this type of response?

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(1 mark)

(ii) Explain the advantage of this behaviour.

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(2 marks)

S (b) Maltose is digested into glucose by maltase. Draw a labelled diagram to show how a molecule of maltose is broken down into glucose. You need not show how enzymes catalyse this reaction in your diagram.

(2 marks)

5

7 **Figure 1** shows two motor neurones, **A** and **B**. It also shows the synapses of neurone **B** with three other neurones, **P**, **Q** and **R**.

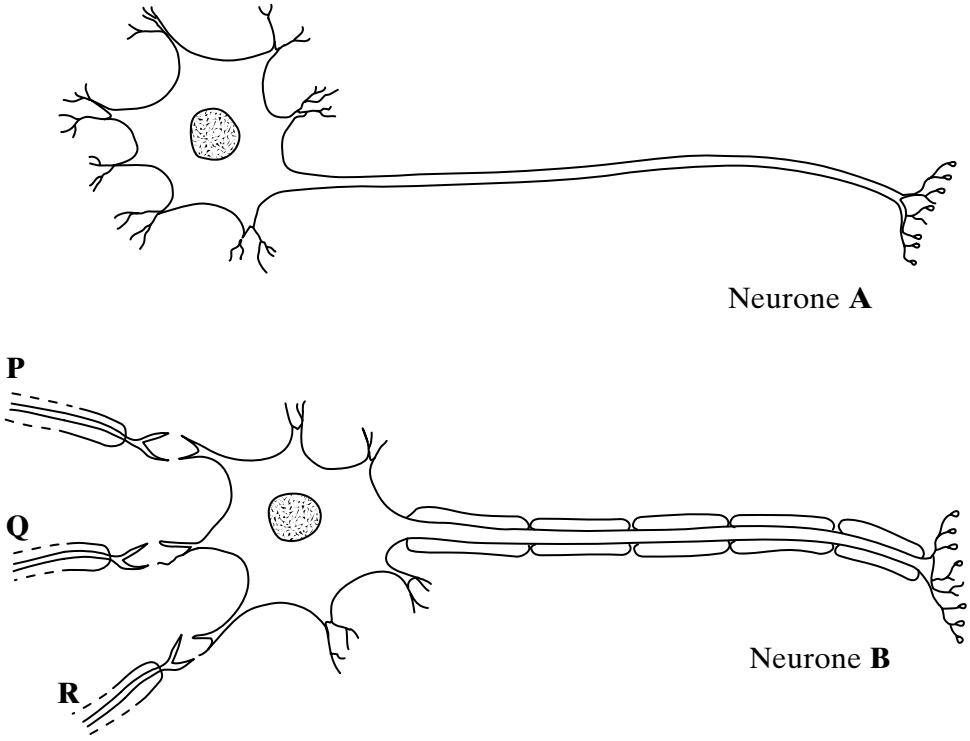

Figure 1

(a) (i) An action potential is produced in neurone **A**. Describe how this action potential passes along the neurone.

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(3 marks)

(ii) Explain why the transmission of a series of nerve impulses along neurone **B** uses less energy than transmission along neurone **A**.

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(3 marks)

(b) Neurones of type **A** are found in the autonomic nervous system. The autonomic nervous system consists of the sympathetic division and the parasympathetic division.

(i) Suggest the effect that stimulation by neurones of the sympathetic division would have on the diameter of arterioles leading to skeletal muscle. Explain your answer.

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(2 marks)

S (ii) Explain the effect of the parasympathetic division of the autonomic nervous system on cardiac output.

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(4 marks)

QUESTION 7 CONTINUES ON THE NEXT PAGE

(c) (i) **Figure 2** shows the effect of impulses from neurones **P** and **Q** on the production of an action potential in neurone **B**.

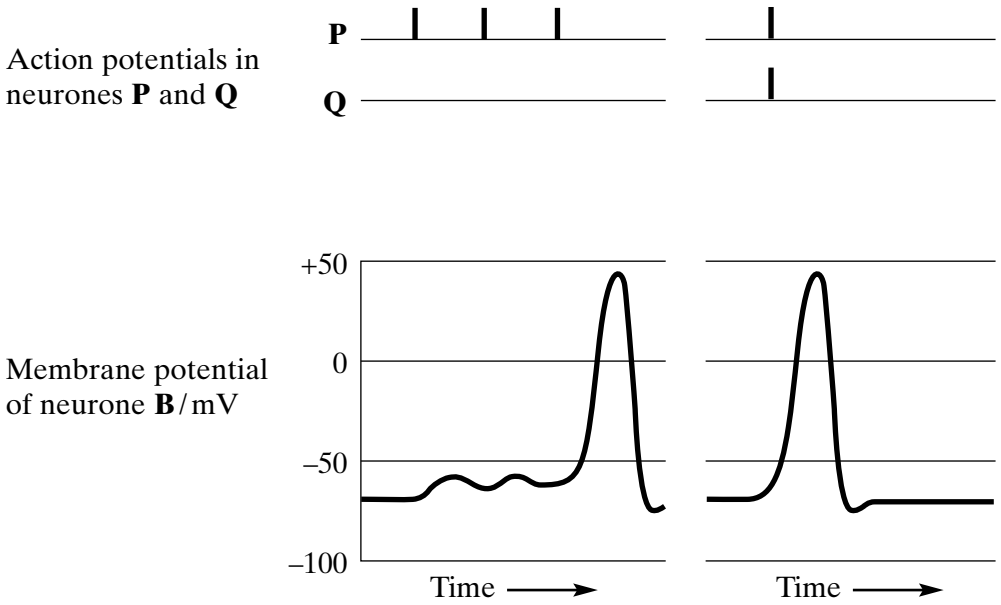

Figure 2

Each effect is a type of summation. Use information in **Figure 2** to explain the two types.

First type .....

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Second type .....

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(2 marks)

(ii) **Figure 3** shows the effect of an impulse from neurone **R** on the membrane potential of neurone **B**.

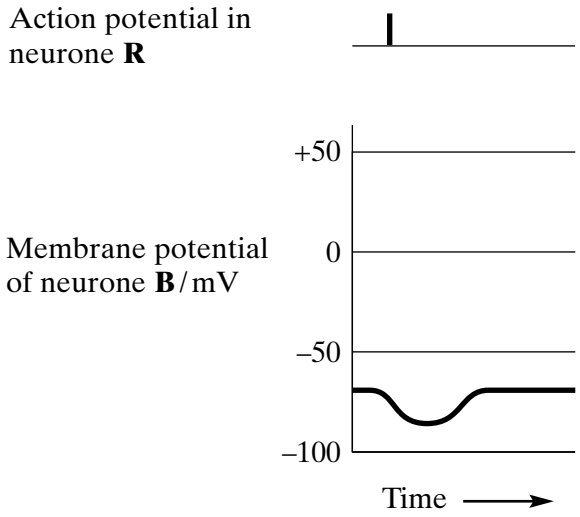

Figure 3

Describe the kind of synapse between neurone **R** and neurone **B**.

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(1 mark)

15

TURN OVER FOR THE NEXT QUESTION

8 Mammals are endotherms; reptiles are ectotherms.

(a) Explain **two** advantages of endothermy over ectothermy.

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2 .....

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(2 marks)

(b) **Figure 1** shows how the rates of metabolic heat generation and evaporative heat loss in a reptile change with environmental temperature. Each plot is the mean of several values. The vertical bars on the graphs represent the standard deviation about the mean.

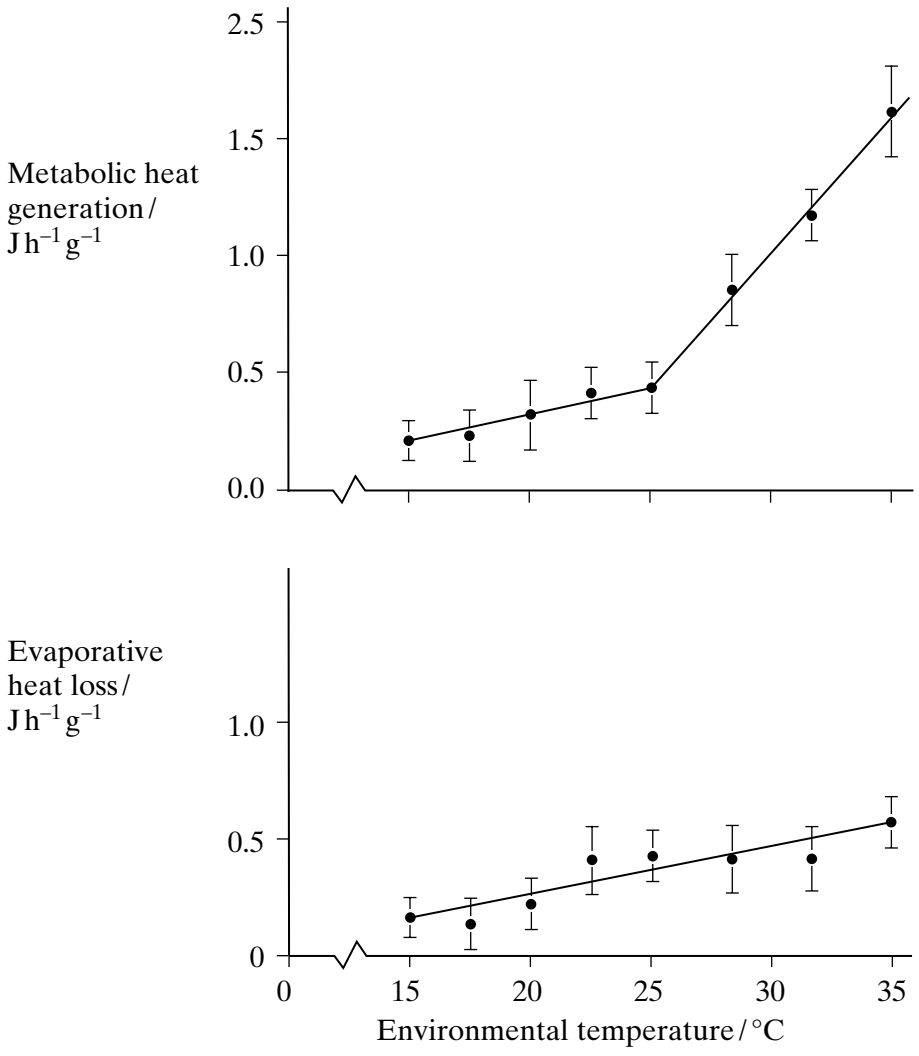

Figure 1

S (i) Explain why it is more useful to show the standard deviation rather than the range of values.

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(2 marks)

(ii) Explain why the values for metabolic heat generation are given per gram of body mass.

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(2 marks)

(iii) Describe the relationship between metabolic heat generation and evaporative heat loss shown in the graphs.

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(2 marks)

(iv) Use the graphs to explain why these reptiles often seek shade when the environmental temperature rises above 25 °C.

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(2 marks)

QUESTION 8 CONTINUES ON THE NEXT PAGE

(c) **Figure 2** shows the relationship between metabolic heat generation and evaporative heat loss in a small mammal.

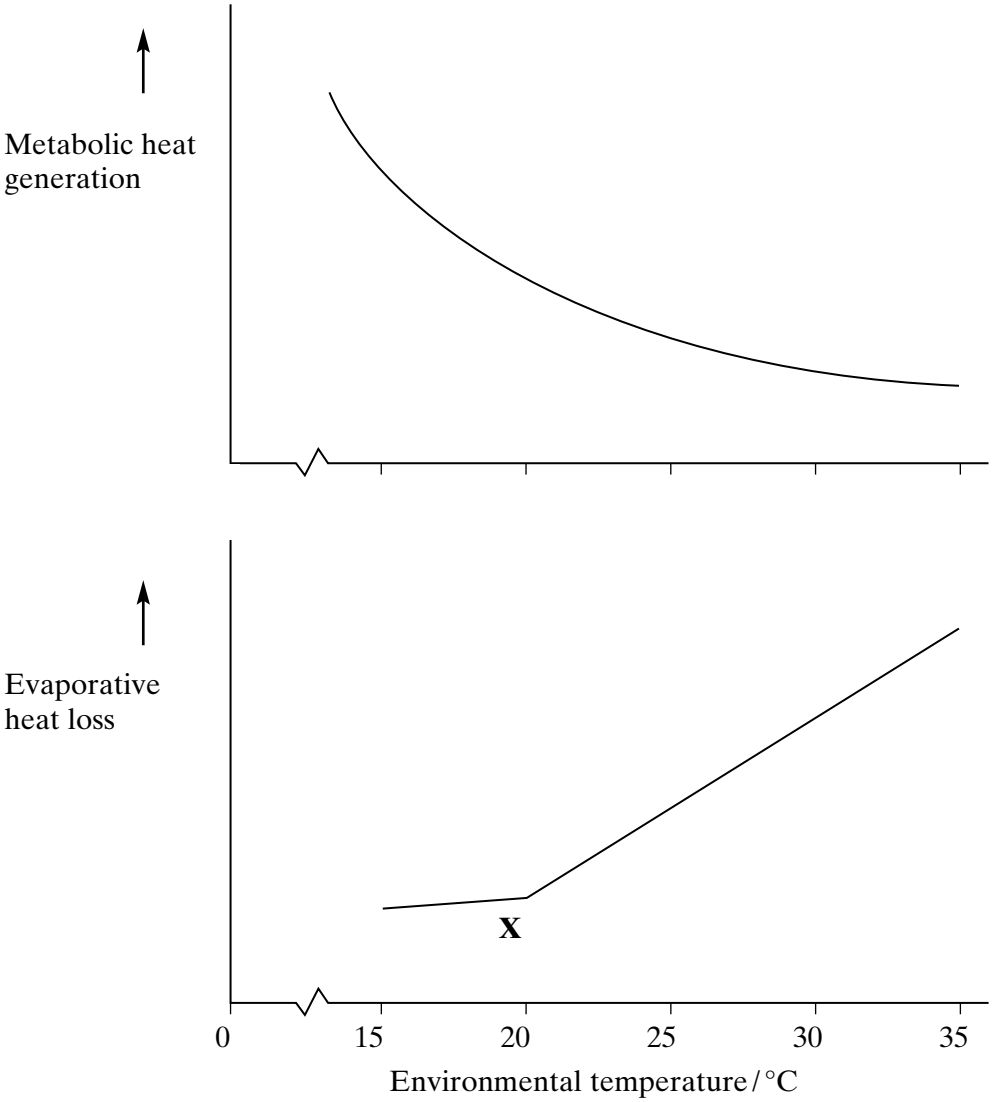

Figure 2

(i) How is the relationship between heat generation and evaporative heat loss in a mammal different from that in a reptile?

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(1 mark)

(ii) Suggest an explanation for the change in the slope of the graph for evaporative heat loss at the point marked **X**.

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(1 mark)

(iii) Explain how the change in metabolic heat generation in a small mammal is brought about as environmental temperature rises.

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(3 marks)

15

TURN OVER FOR THE NEXT QUESTION

9 (a) Root pressure is a force that is partly responsible for the movement of water through xylem in stems. Explain how the active transport of mineral ions into xylem vessels in the roots results in water entering these vessels and then being moved up the xylem tissue.

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(5 marks)

(b) The presence of an air bubble in a xylem vessel in the stem blocks the movement of water through that vessel. Use the cohesion-tension theory to explain why.

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(4 marks)

S (c) Water vapour diffuses through open stomata into the atmosphere. Describe **two** structural adaptations of the leaves of xerophytes that reduce this loss. Using Fick's law, explain how these two adaptations reduce the rate of diffusion of water vapour into the atmosphere.

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(6 marks)

15

END OF QUESTIONS