

Topic 5 Exam-style topic test

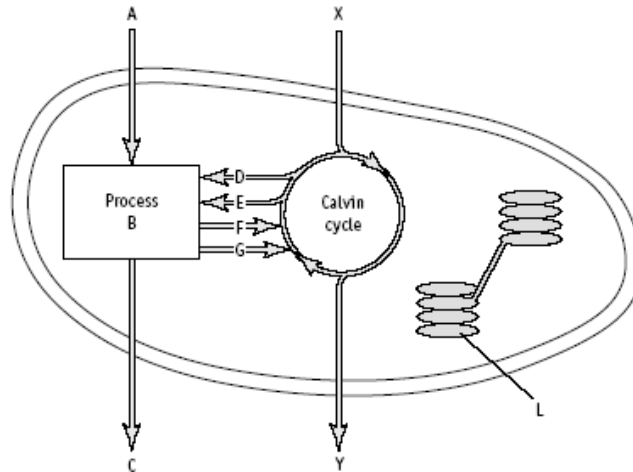
Answer all questions. Write your answers in the spaces provided in this question paper. Some questions must be answered with a cross in a box (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross.

The marks for individual questions and parts of questions are shown in round brackets, e.g. (2).

There are 4 questions in this question paper. The total mark for this test is 40.

You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, taking account of grammar, punctuation and spelling. Answers should be given in a correct biological context.

1.



(a)(i) Put a cross ☒ in one box in each row to name the reactants A and X and products C and Y.

	Oxygen	Water	Carbon dioxide	Glucose
reactant A	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
reactant X	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
product C	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
product Y	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

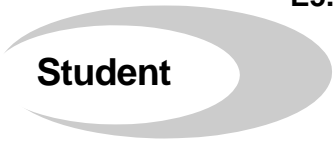
(4)

(ii) Name process B.

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(1)

Turn over



Student

Topic 5 Exam-style topic test

(iii) Name the intermediates D and E.

D

E

(2)

(b) Name structure L and describe how it is adapted to its function in photosynthesis.

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(3)

(Total 10 marks)

2. In 1944 an ecologist called A.S. Watt published a paper titled 'Bracken versus heather'. His suggestion was that the two plants were competing for scarce resources. Competition between bracken (a fern) and heather occurs mainly on moorland and heath, which exist as habitats because of sheep grazing. Soil conditions here are acidic, and poor in mineral nutrients such as nitrates. Rainfall is high and temperatures cool.

(a) Suggest how competition for scarce resources might occur between bracken and heather.

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(3)

(b)(i) Name an abiotic factor referred to in the paragraph at the beginning of the question. Explain your answer.

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(2)

Topic 5 Exam-style topic test



Student

(ii) Describe what you think might happen in areas of moorland or heath if sheep were removed.

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(4)
(Total 9 marks)

3. Global warming has been attributed principally to an increase in the amount of carbon dioxide in the air.

(a) Name one other greenhouse gas whose concentration in the atmosphere has also increased, and state why the atmospheric levels of this gas have increased.

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(2)

(b) It has been argued that an increase in carbon dioxide would increase the rate of photosynthesis. Briefly explain how this could work.

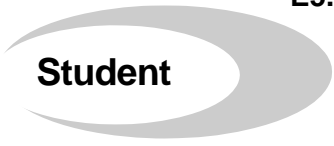
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(3)

(c) Increased temperatures increase the rate of decay of dead organic matter. Explain this observation.

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(4)
Turn over



Topic 5 Exam-style topic test

(d) Describe what is meant by the term biofuel.

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(1)

(e) Explain how the use of biofuels could help reduce global warming.

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(3)

(Total 13 marks)

4. In Death Valley, California there are three species of desert pupfish (*Cyprinodon salticus*) found in isolated creeks and small pools. The pupfish live in an area that once had a much wetter climate and where there was a large lake in which lived a single species of pupfish. Fifteen thousand years ago climate change meant that rising temperatures caused the lake to dry up and fish were left in isolated pools.

(a) Suggest how you think the different species of pupfish found today might have arisen.

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(5)

The pupfish feed on algae in the ponds and creeks that they inhabit. At times in the historic past, Shoshone Indians are known to have used the fish as food.

(b)(i) State the trophic level of the Shoshone when eating pupfish.

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(1)

(ii) There is less energy available to the Shoshone from the pupfish than they could get if they ate the algae. Explain why only a small proportion of the energy in algae is available in the pupfish when the Shoshone eat them.

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(2)

(Total 8 marks)

Topic 6 Exam-style topic test

Answer all questions. Write your answers in the spaces provided in this question paper. Some questions must be answered with a cross in a box (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross.

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- The table below shows the succession of insects commonly found on a human corpse left in the open. Insect succession can be used as evidence in finding out the approximate time of death in murder cases. This is sometimes called 'fly-witness testimony'.

Stage	Insects and mites found on corpse	State of corpse	Age of corpse
1	flies (Calliphoridae and Muscidae)	fresh	
	flies (Calliphoridae and Sarcophagidae)	odour	
	beetles (Dermestidae)	fats rancid	first 3 months
2	various flies		3-6 months
	beetles (Siphidae and Histeridea)	ammoniacal fermentation	4-8 months
3	mites		6-12 months
4	beetles (Dermestidae)	completely dry	1-3 years
5	beetles (Tenebrionidae and Ptinidea)		3+ years

- Explain why the insects on a corpse change over time, as shown above.

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(2)

- State the likely age of a corpse infested with beetles of the family Histeridae.

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(1)

Turn over



Topic 6 Exam-style topic test

(ii) Give one reason why the exact age of a corpse infested with Histeridae beetles cannot be given.

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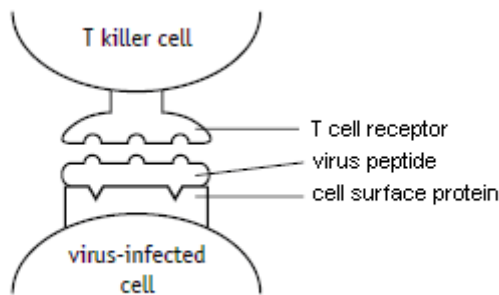
(c) Explain how a more precise time of death, within the first month, could be determined using insect evidence.

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..... (2)

(d) Give two other types of evidence, not involving insects, that might help to determine the time of death.

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..... (2)
(Total 8 marks)

2. Virus-infected cells are usually quickly destroyed by the human immune system. An infected cell presents a piece of viral peptide on its surface, held by a special cell surface protein. T killer cells with the correct receptor bind to the presented peptides. The T killer cells then kill the infected cells.



(a) Explain how killing virus-infected cells helps to control the infection of the human body.

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..... (2)



Student

Topic 6 Exam-style topic test

(b) Suggest one disadvantage of T cells killing infected human cells.

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(1)

A person infected with human immunodeficiency virus (HIV) produces up to 109 new HIV particles every day. On average, each new virus contains one mutation.

(c) Explain how a mutation of HIV could lead to the viral peptide presented by the infected cell being unrecognised by active T killer cells.

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(4)

(d) Suggest one reason why some mutations of HIV reduce the rate of production of new virus particles.

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(1)

(e) Explain the role of T memory cells.

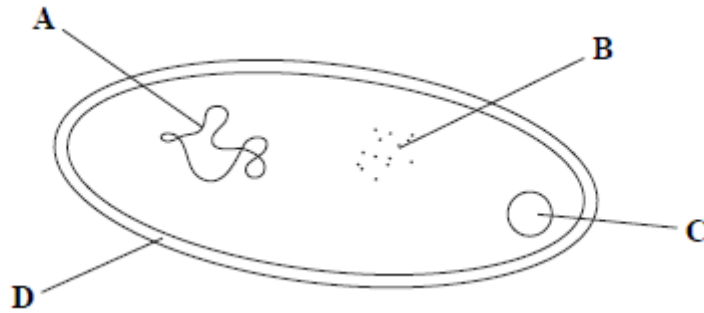
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(2)
(Total 10 marks)

Turn over



3. Many bacteria and viruses are pathogens that cause human diseases.

(a) The diagram below shows a bacterium. Put a cross in the correct box to name the four structures labelled in the diagram.



	cell wall	ribosomes	plasmid	chromosome	mitochondria
A	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(4)

(b) Compare bacteria and viruses under the following headings:

(i) Size

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(1)

(ii) Genetic material

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(2)

(iii) Response to antibiotics.

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(2)



Student

Topic 6 Exam-style topic test

Viruses use the protein synthesis machinery of the host cell to produce the peptides required to make new virus particles.

(c) Describe the process of translating mRNA into a protein.

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(4)
(Total 13 marks)

4. (a) Give three ways by which the human body prevents pathogens from entering the blood system.

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(3)

(b) Describe the role of macrophages in:

(i) non-specific immunity

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(3)

(ii) specific immunity.

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(3)
(Total 9 marks)



Student

Topic 7 Exam-style topic test

Answer all questions. Write your answers in the spaces provided in this question paper. Some questions must be answered with a cross in a box (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross.

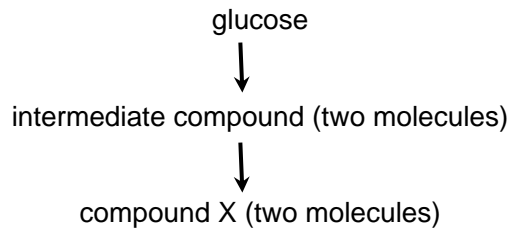
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There are 4 questions in this question paper. The total mark for this test is 30.

You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, taking account of grammar, punctuation and spelling. Answers should be given in a correct biological context.

- 1. All living cells must continuously synthesise ATP as an immediate source of chemical energy for vital functions. Energy needed to synthesise ATP can come from either aerobic or anaerobic respiration. A common pathway in both types of respiration is glycolysis.

The diagram below shows a simplified pathway for glycolysis.



- (a) (i) Name compound X, which is the final product formed during glycolysis.

..... (1)

- (ii) Before it can be split into two molecules, glucose must first be made more reactive. Explain how this activation of glucose occurs.

..... (2)

- (iii) Describe the changes occurring during glycolysis in the conversion of the intermediate compound to compound X.

..... (2)

Turn over



Topic 7 Exam-style topic test

- (b) During anaerobic respiration in muscle cells compound X is converted to lactate.
 - (i) Explain the importance of converting compound X into lactate in anaerobic respiration.

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 (2)

- (ii) Describe the fate of lactate after a period of anaerobic respiration in muscle cells.

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 (2)

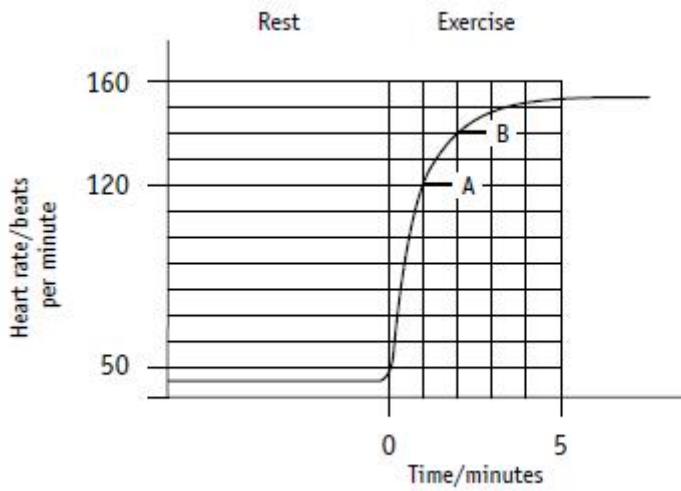
- (iii) Suggest one reason why it is important to remove lactate quickly after a period of anaerobic respiration.

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 (1)

(Total 10 marks)

2. The graph below shows the effect of exercise on heart rate.



- (a) Calculate the percentage increase in the heart rate between points A and B on the graph. Show your working.

Answer

.....%
 (1)



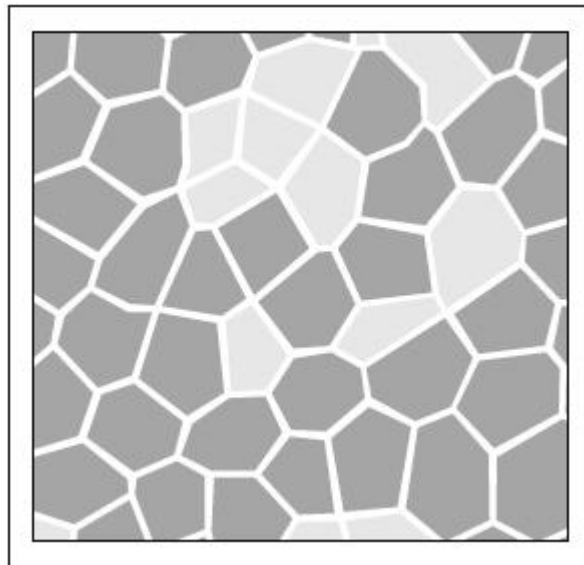
Student

(b) Describe how the changes in heart rate are brought about.

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(5)
(Total 6 marks)

3. 'Give me a muscle biopsy and I'll tell you whether you should be a sprinter or a marathon runner' is a well-known quote from sport physiologists. The picture below represents muscle fibres from a muscle tissue biopsy from a champion runner, Frank Shorter.

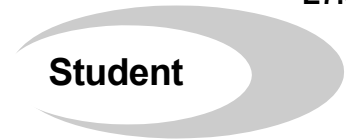


(a) Using evidence from this biopsy, decide whether Frank was a champion sprinter or a champion marathon runner. Explain your answer.

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(3)

Turn over



Student

The table below gives the activity of certain enzymes in muscle fibres used in anaerobic or aerobic respiration.

Fibre type	Enzyme activity/ $\mu\text{mol}^{-1} \text{g}^{-1}$			
	Anaerobic respiration enzymes		Aerobic respiration enzymes	
	Hexokinase	Phosphofructokinase	Citrate synthase	Carnitine palmitoyl transferase
X	2.4	24	41	1.2
Y	0.7	88	18	0.2

(b) (i) Using the information above, explain whether fibre type X is slow-twitch or fast-twitch. Explain your answer.

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(2)

(ii) Other than enzymes, suggest two differences between the structure of muscles in marathon runners and sprinters.

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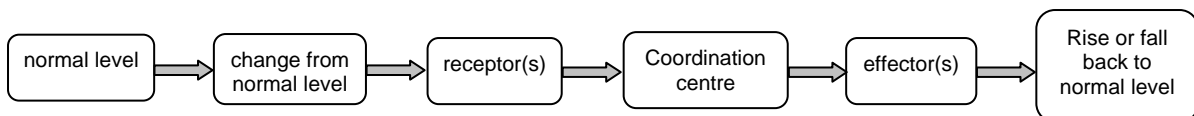
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(2)

(Total 7 marks)

4. Heat energy is a by-product of metabolism. In order to maintain a constant core body temperature, it is important to control the amount of heat produced and lost by the body. Controlling body temperature is an example of homeostasis.

The diagram below illustrates the key stages in a homeostatic control mechanism:



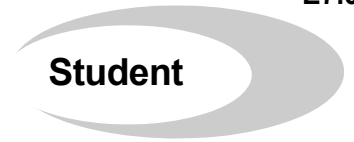
(a) (i) Define the term homeostasis.

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(1)

Topic 7 Exam-style topic test



(ii) Explain the role of negative feedback in the control mechanism shown above.

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(1)

(iii) With reference to each stage shown in the diagram above of a homeostatic control mechanism, explain how body temperature is maintained during a period of intense exercise.

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(5)

(Total 7 marks)



Topic 8 Exam-style topic test

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There are 3 questions in this question paper. The total mark for this test is 30.

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1. Multiple sclerosis (MS) is an autoimmune condition. The immune system of someone with MS identifies their own body's Schwann cells as foreign and attacks them. The myelin sheath is either damaged or completely lost, leaving scars known as lesions or plaques. In addition to myelin loss, there can sometimes be damage to the nerve cell. The specific symptoms and disabilities that a person with MS will experience depends upon which parts of their nervous system are affected and the function of the damaged nerves.

(a) Describe how an impulse is propagated along a myelinated axon.

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(5)

Turn over



Topic 8 Exam-style topic test

(b) Suggest what effect the damage caused by multiple sclerosis will have on the conduction of impulses along an axon.

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(2)

(c) Which type of transmission, myelinated or unmyelinated, would require less ATP? Give a reason for your answer.

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(3)

(d) A person with MS has damage to the neurones in their cerebellum. Suggest what symptom this person might experience as a result of this damage.

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(1)

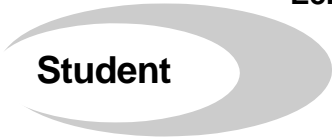
(Total 11 marks)

2. Light rays that enter the retina are finally 'seen' as images by the brain. Damage to the retina can cause impaired vision.

(a) Very bright light can damage the light-sensitive receptors in the retina. Describe the mechanisms involved in ensuring that damage does not occur to these receptors in bright light.

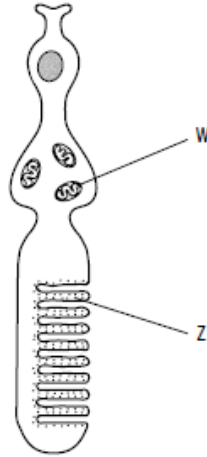
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(3)



Student

(b) The diagram below shows the structure of a single rod cell.



Name the structures labelled W and Z on the diagram.

W

Z

(2)

(c) Describe how light reaching a rod cell can result in an action potential in the optic nerve to the brain.

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(4)

(d) Explain why vision is very poor when first going into a dark area from somewhere brightly lit.

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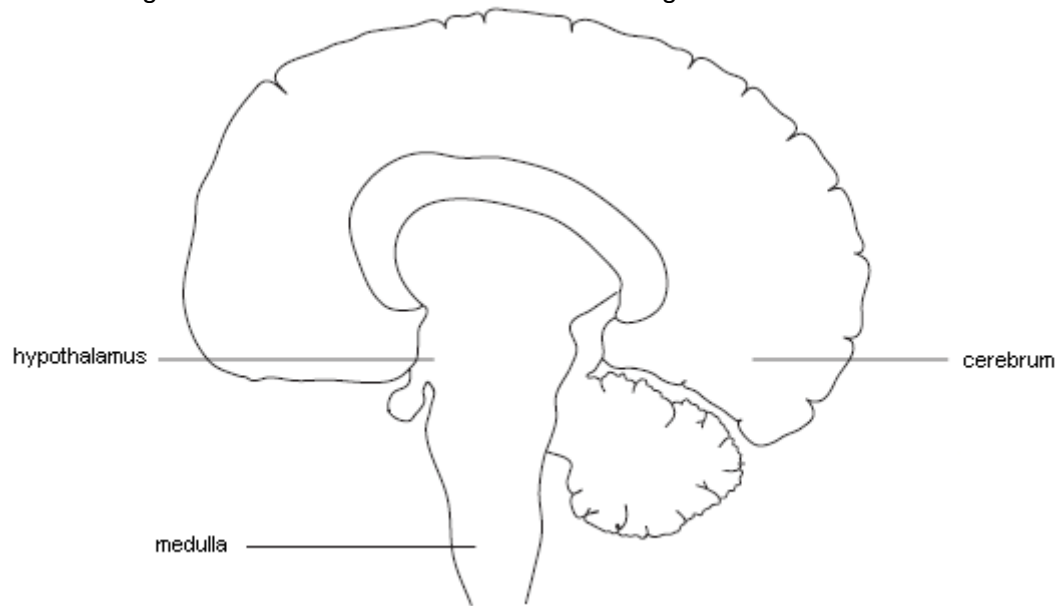
(2)

(Total 11 marks)

Turn over

Topic 8 Exam-style topic test

3. The diagram below shows a vertical section through a human brain.



(a) (i) Put a cross in the box next to the list which correctly describes the functions of the cerebrum

- Decision making / vision / hearing / language / emotions
- Decision making / vision / hearing / language / breathing rate
- Control of breathing rate / heart rate / blood pressure
- Homeostasis / thermoregulation / control of pituitary gland

(1)

(ii) Put a cross in the box next to the list which correctly describes the functions of the hypothalamus

- Decision making / vision / hearing / language / emotions
- Control of breathing rate / heart rate / blood pressure
- Homeostasis / thermoregulation / control of pituitary gland
- Homeostasis / vision / control of pituitary gland

(1)

(iii) Put a cross in the box next to the list which correctly describes the functions of the medulla.

- Decision making / vision / hearing / language / emotions
- Control of breathing rate / heart rate / blood pressure
- Homeostasis / thermoregulation / control of pituitary gland
- Homeostasis / vision / control of pituitary gland

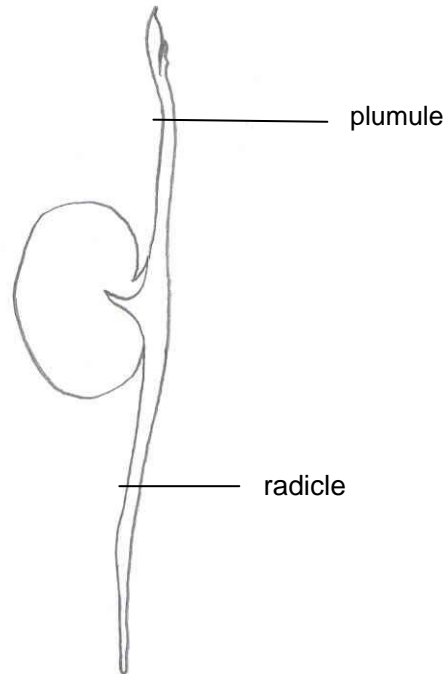
(1)

Topic 8 Exam-style topic test

Student

Plants use chemicals known as plant growth substances for coordination. One example is IAA (indoleacetic acid), which is involved in the response of plants to light, called phototropism.

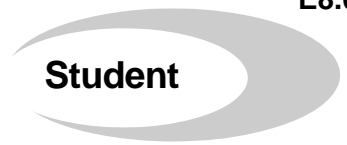
The drawing below shows a broad bean which has recently germinated:



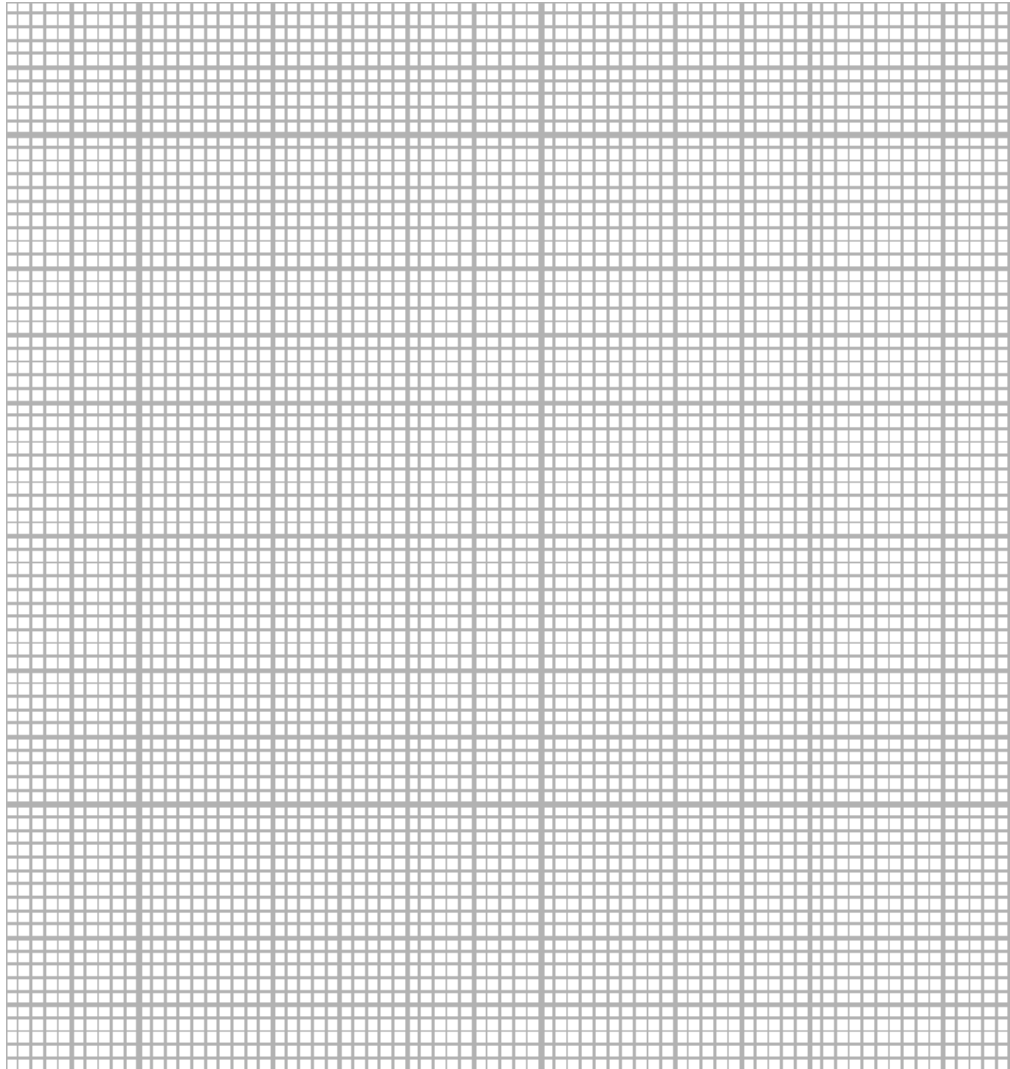
In an experiment a light was shone on to the bean from one side (unilateral illumination). The radicle and the plumule both curved in response to this treatment and the angle of curvature was measured at intervals. The results are shown in the table below:

Time of exposure / hours	Angle of curvature /degrees	
	Plumule	Radicle
0	0	0
2	+7	-3
4	+14	-4
6	+18	-8
8	+23	-11

Data from Freeland, P.W. (1985), Problems in Theoretical Advance Biology, Hodder and Stoughton



(b)(i) Present the data in the table in a suitable graphical form



(3)

(3)

(ii) Compare the response of the radicle and the plumule to light.

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(2)

(Total 8 marks)