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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Thursday 11 June 2020

Morning (Time: 1 hour 45 minutes) | Paper Reference **WBI05/01**

Biology

Advanced

Unit 5: Energy, Exercise and Coordination

You must have:
A copy of the scientific article (enclosed), calculator, HB pencil, ruler.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 90.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*
- Candidates may use a calculator.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

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Answer ALL questions.

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 ☒.

1 The heart is required for mass transport in mammals.

(a) Describe how the electrical activity of the heart controls the cardiac cycle.

(3)

(b) Explain how electrocardiograms (ECGs) could be used to diagnose some forms of cardiovascular disease.

(2)

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(c) The human growth factor FGF-I has been used to treat some patients with cardiovascular disease (CVD).

Describe how microorganisms could be genetically modified to produce human FGF-I.

(4)

(Total for Question 1 = 9 marks)

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2 The eye is a sensory organ found in mammals.

(a) Light is detected using photoreceptors located in light-sensitive cells.

Put a cross ☒ in the box that completes each statement about photoreceptors.

(i) Light-sensitive cells are located in the

(1)

- ☒ **A** lens
- ☒ **B** optic nerve
- ☒ **C** pupil
- ☒ **D** retina

(ii) The photoreceptor in light-sensitive cells is located in

(1)

- ☒ **A** membrane bound organelles in the outer segment
- ☒ **B** membrane bound organelles in the synaptic region
- ☒ **C** the cytoplasm of the outer segment
- ☒ **D** the cytoplasm of the synaptic region

(iii) The pigment that forms the photoreceptor in the mammalian eye is

(1)

- ☒ **A** auxin
- ☒ **B** cytochrome
- ☒ **C** phytochrome
- ☒ **D** rhodopsin

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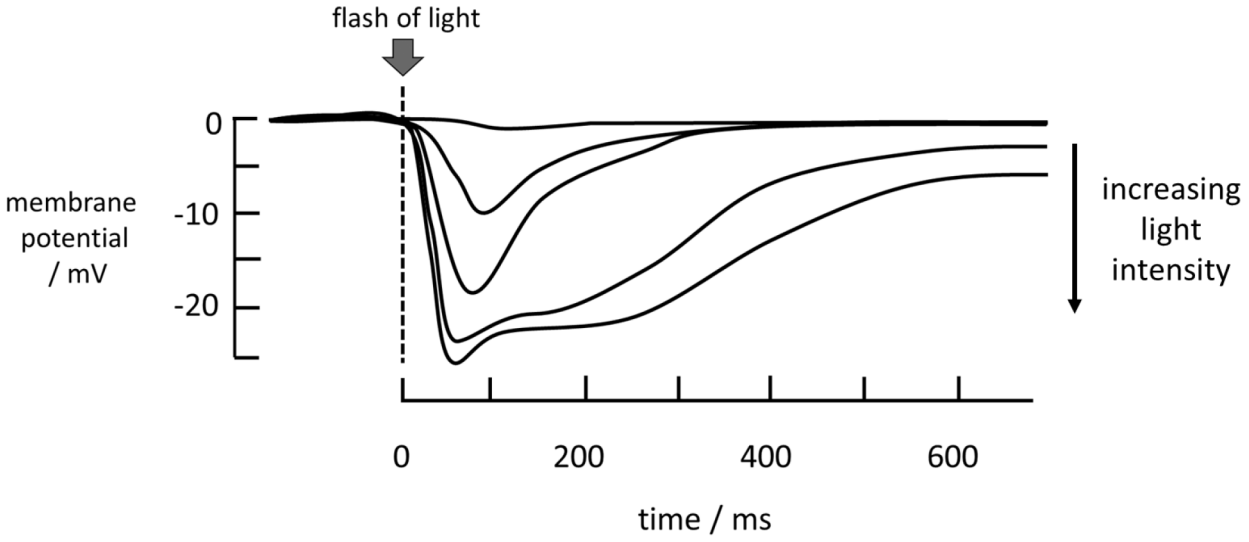
(b) When stimulated by light, the light-sensitive cells become hyperpolarised.

In one investigation, the effect of a flash of light on membrane polarisation of light-sensitive cells was studied.

The graph below shows the results of this investigation.

Each line shows the response to a different light intensity.



(i) Using the information in the graph, describe the effect of light intensity on these light-sensitive cells.

(2)

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(ii) Explain how increasing hyperpolarisation of light-sensitive cells results in impulses that can be interpreted by the brain.

(3)

(Total for Question 2 = 8 marks)

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3 Thermoregulation is a process that mammals use to regulate their body temperature.

(a) Thermoregulation is regulated by the central nervous system.

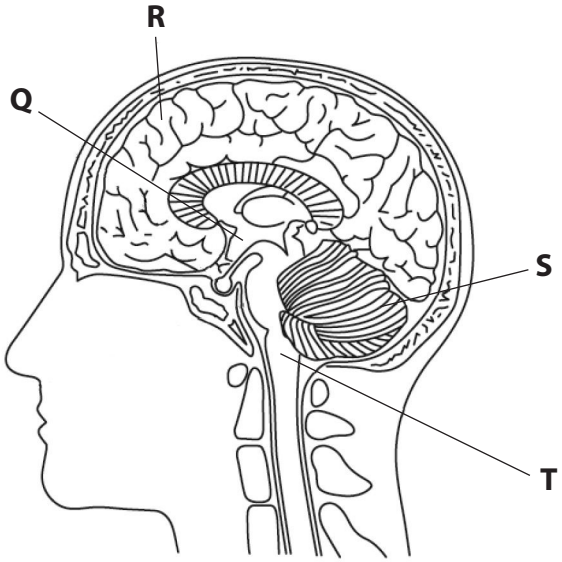
Put a cross ☒ in the box that completes each statement about thermoregulation.

(i) Thermoregulation is an example of

(1)

- ☒ **A** habituation
- ☒ **B** homeostasis
- ☒ **C** photoperiodism
- ☒ **D** respiration

(ii) The diagram shows a section through a human brain.



The structure that coordinates thermoregulation is labelled

(1)

- ☒ **A** Q
- ☒ **B** R
- ☒ **C** S
- ☒ **D** T

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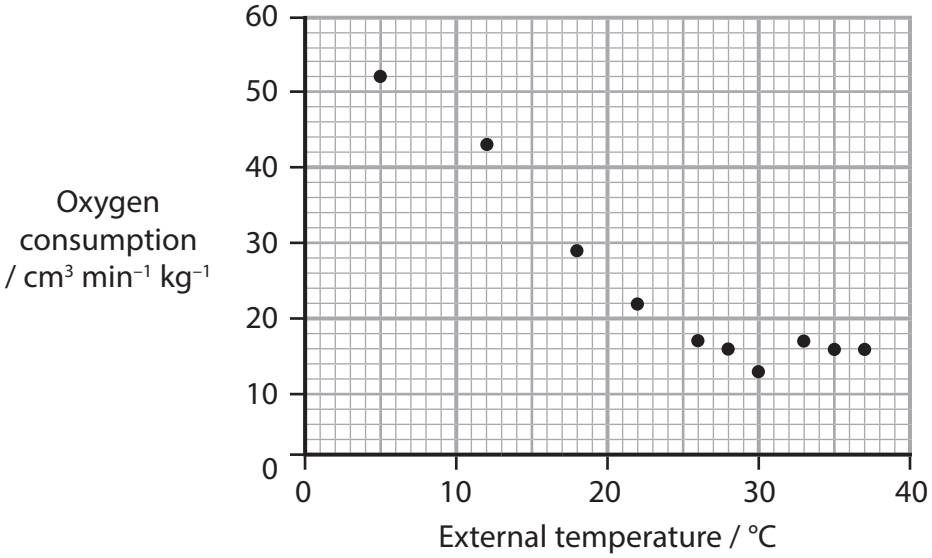
(b) The relationship between oxygen consumption and external temperature has been investigated using mice.

The graph below shows the results of this investigation.



(i) Describe the relationship between oxygen consumption and external temperature.

(2)

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(ii) Explain the effect of external temperature on oxygen consumption.

(3)

(iii) Explain how the results would change if the investigation used a larger mammal.

(2)

(Total for Question 3 = 9 marks)

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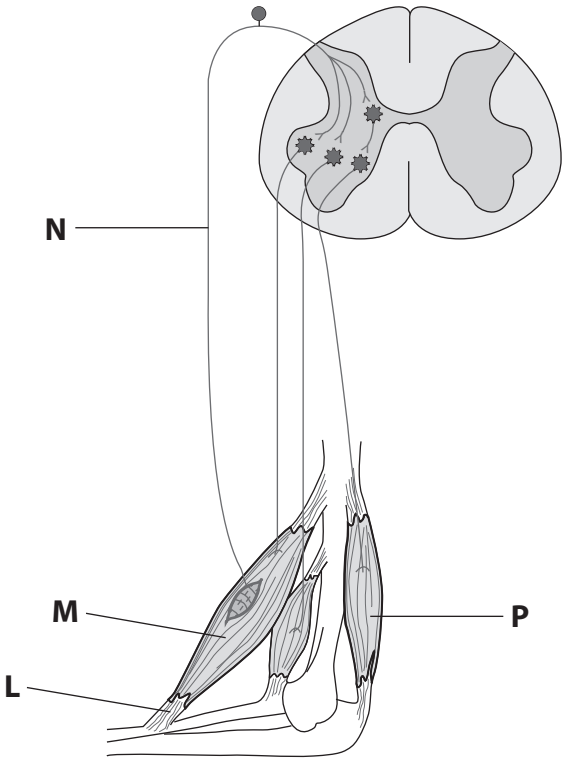
4 Nervous communication is used to control the movement of bones at joints.

(a) The biceps reflex is a stretch reflex involving the muscles and bones in the elbow.

This reflex can be caused by tapping the arm above structure **L**, shown in the diagram below.



(i) Put a cross ☒ in the box next to the row that correctly describes the physical properties of structure **L**.

(1)

		Flexible	High elasticity
☒	**A**	No	No
☒	**B**	No	Yes
☒	**C**	Yes	No
☒	**D**	Yes	Yes

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(ii) Put a cross ☒ in the box next to the row that provides a correct description of the structures labelled **M**, **N** and **P**.

(1)

		N is a	**M** and **P** are
☒	**A**	motor neurone	muscles that contract together
☒	**B**	motor neurone	an antagonistic pair of muscles
☒	**C**	sensory neurone	muscles that contract together
☒	**D**	sensory neurone	an antagonistic pair of muscles

*(b) Describe how an action potential is produced and the resting potential is restored in an axon.

(6)

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(c) Conduction of action potentials along motor neurones has been investigated in people with multiple sclerosis.

In one study, the time taken for an impulse to travel from the brain to the biceps was recorded for a group of people without multiple sclerosis and for a group of people with multiple sclerosis.

The time taken for an impulse to travel from the spinal cord to the biceps was also recorded for these two groups.

The table below shows the results of this study.

Group of people	Mean conduction time to the biceps ± SD / ms	
	From the spinal cord	From the brain
Without multiple sclerosis	5.9 ± 0.5	4.1 ± 0.6
With multiple sclerosis	5.3 ± 0.7	10.8 ± 5.3

(i) Using the data in the table, describe the effect of multiple sclerosis on the speed of conduction of a nerve impulse.

(2)

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(ii) In multiple sclerosis, the immune system destroys the myelin sheath around neurones.

Explain the effect of multiple sclerosis on the speed of conduction of the impulse.

(3)

(Total for Question 4 = 13 marks)

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5 Plants detect and respond to changes in light conditions.

(a) Photoreceptors are involved in germination in some plants.

(i) Put a cross ☒ in the box that completes the statement about photoreceptors.

The photoreceptor in plants is called

(1)

☒ **A** auxin (IAA)

☒ **B** phytochrome

☒ **C** retinal

☒ **D** rhodopsin

(ii) The pincushion plant, *Diapensia lapponica*, is a plant adapted to an arctic habitat.

The table shows the percentage of seeds of *D. lapponica* that germinate under different conditions.

Hours of daylight	Percentage germination (%)			
	0 °C	10 °C	15 °C	20 °C
22	12	98	100	100
13	0	4	4	42
0	0	0	0	0

Put a cross ☒ in the box that identifies a correct statement about the day length and temperature required for germination of *D. lapponica* seeds.

(1)

☒ **A** long day length at temperatures of 10 °C or above

☒ **B** long day length at temperatures of 10 °C or below

☒ **C** short day length at temperatures of 10 °C or above

☒ **D** short day length at temperatures of 10 °C or below

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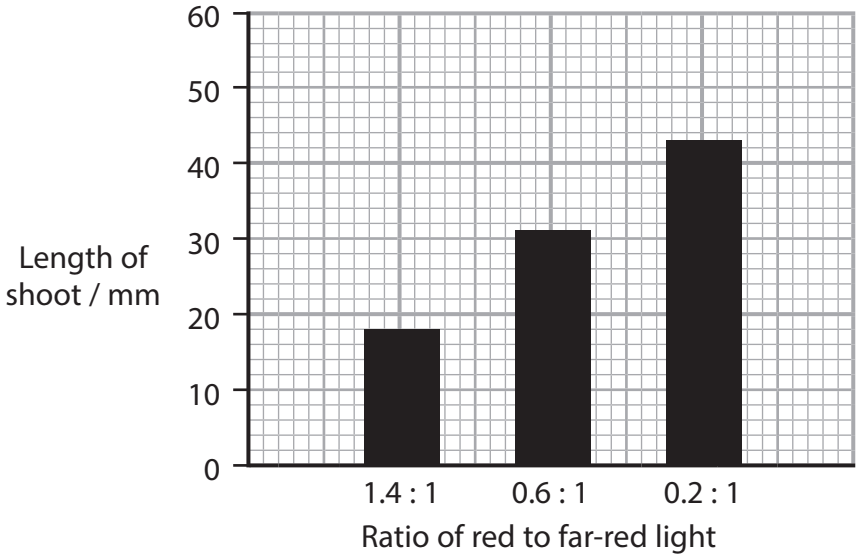
(b) The role of photoreceptors in the growth of plant shoots has been investigated.

Plant shoots were grown in different ratios of red and far-red light.

(i) The graph below shows the effect of different ratios of red to far-red light on the growth of plant shoots.



Calculate the percentage increase in the length of the shoots when the ratio of red to far-red light decreases from 1.4 : 1 to 0.2 : 1.

(2)

Answer ..... %

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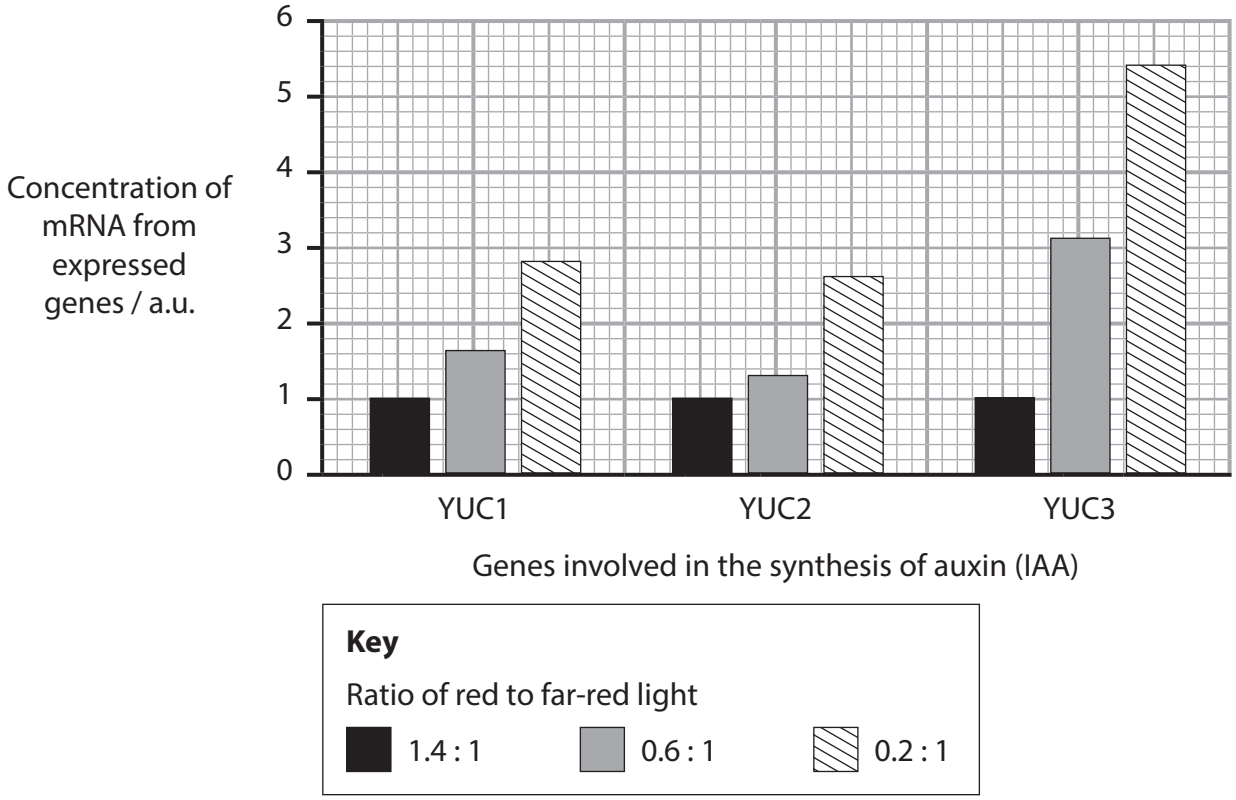
(ii) Three of the genes involved in the synthesis of auxin (IAA) are YUC1, YUC2 and YUC3.

The effect of different ratios of red to far-red light on the expression of these genes has been investigated.

The graph below shows the results of this investigation.



Using the information in the graph, describe the relationship between the ratios of red to far-red light and the expression of these genes.

(2)

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(iii) Using the information in the graph, explain why plant shoots grown in far-red light are taller than plant shoots grown in red light.

(4)

(Total for Question 5 = 10 marks)

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6 Cells produce ATP using anaerobic and aerobic respiration.

(a) In aerobic respiration, organic molecules are oxidised in the Krebs cycle.

Describe how the products of the Krebs cycle are used in the production of ATP.

(5)

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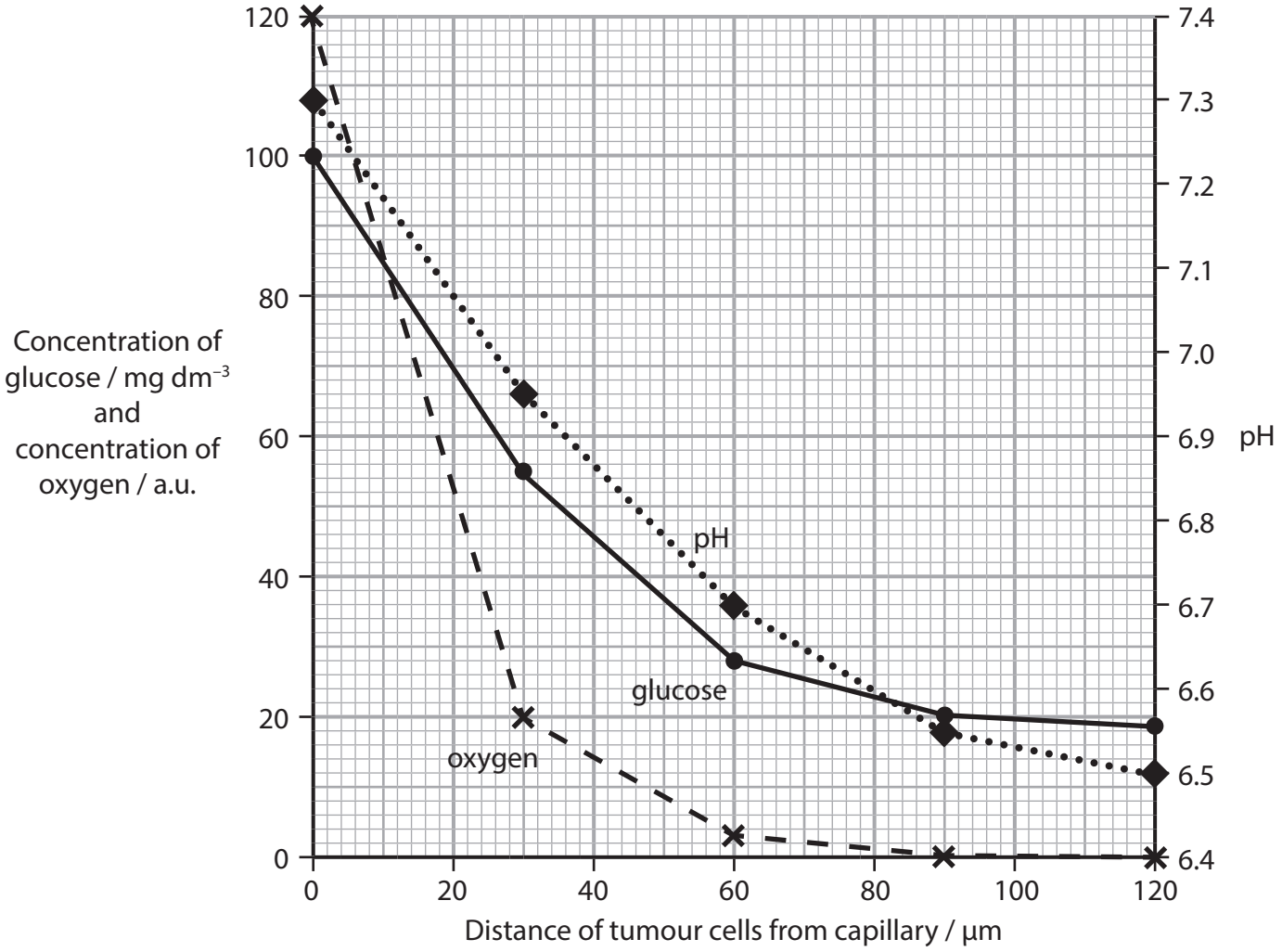
(b) In some tumours, cells grow rapidly and obtain nutrients from capillaries.

In one study, the concentration of glucose, the concentration of oxygen and the pH of fluid around tumour cells was investigated.

The graph below shows some of the results of this study.



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(i) Calculate the percentage decrease in oxygen concentration when the glucose concentration has fallen by 50% of its highest concentration.

(3)

Answer ..... %

(ii) Explain the changes in pH recorded in this study.

(3)

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(Total for Question 6 = 11 marks)

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7 The scientific article you have studied is adapted from *Scientific American*.

Use the information from this article and your own knowledge to answer the following questions.

(a) Explain how the energy in food molecules, such as starch, is used for climbing (paragraph 2).

(3)

(b) Explain how a lineage can 'change over time' (paragraph 3).

(3)

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(c) Explain why occluded (blocked) coronary arteries can result in a heart attack (paragraph 9).

(3)

(d) There are at least five species belonging to the genus *Australopithecus* (paragraph 13).

State what is meant by the term species of *Australopithecus*.

(2)

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(e) Hunting required hominins to have to work harder for their food (paragraph 20).

Explain how hearts of hominins would be adapted to a hunting lifestyle.

(4)

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*(f) Suggest why mutations in genes required to make vitamin C resulted in primate ancestors being unable to make vitamin C (paragraph 23).

(5)

(g) Explain why fish need to move water past the gill structure (paragraph 24).

(2)

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(h) Suggest how endocannabinoids produce the so-called 'runner's high' (paragraph 25).

(2)

(i) Describe how slow twitch muscle fibres are adapted to be 'fatigue-resistant' (paragraph 26).

(3)

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(j) 'Humans have evolved a faster metabolism, providing fuel for increased physical activity' (paragraph 26).

Suggest how human mitochondria are adapted for a faster metabolic rate.

(3)

(Total for Question 7 = 30 marks)

TOTAL FOR PAPER = 90 MARKS

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