Write your name here

Surname	Other names

Centre Number | Candidate Number

Edexcel GCE

Biology

Advanced

Unit 5: Energy, Exercise and Coordination

Monday 17 June 2013 – Afternoon
Time: 1 hour 45 minutes

Paper Reference
6BI05/01

You must have:
A copy of the scientific article adapted from several sources (enclosed)

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.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

P39887A

1/1/1/1/1/1

P 3 9 8 8 7 A 0 1 2 4

PEARSON

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 Rod cells in the eye are linked to the brain by neurones.

(a) Place a cross in the box ☒ to identify the answer that correctly completes each statement.

(i) The pigment in a rod cell is made of opsin and

(1)

☒ **A** retina

☒ **B** retinal

☒ **C** retine

☒ **D** retinol

(ii) When light stimulates a rod cell the pigment changes.
This pigment is

(1)

☒ **A** iodopsin

☒ **B** phytochrome far red

☒ **C** phytochrome red

☒ **D** rhodopsin

(iii) Once the pigment has changed, the concentration of sodium ions inside the rod cell

(1)

☒ **A** decreases

☒ **B** does not change

☒ **C** increases

☒ **D** reaches equilibrium with the outside of the cell

(iv) After changing, the pigment takes time to become functional again.
This is because

(1)

☒ **A** it has to bleach

☒ **B** the membrane has to be polarised

☒ **C** the rod cell needs to reset

☒ **D** two components have to be rejoined

(v) The cell that links a rod cell to a sensory neurone is

(1)

☒ **A** a bipolar neurone

☒ **B** a multipolar neurone

☒ **C** a unipolar neurone

☒ **D** an optic nerve

(b) Decreasing the intensity of light entering the eye causes pupil dilation.
Describe the roles of the circular and radial muscles in pupil dilation.

(2)

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(Total for Question 1 = 7 marks)

2 There are various ways of investigating brain structure and function.

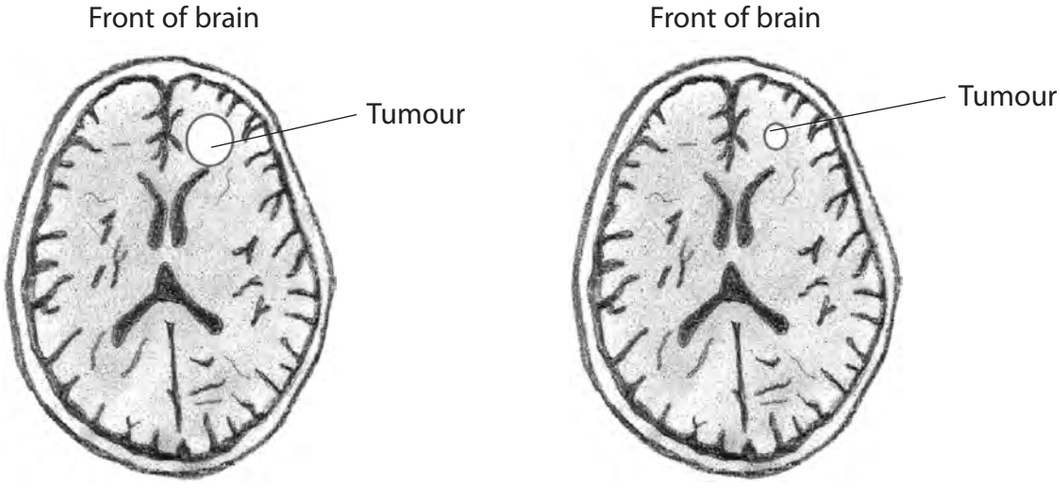
(a) Compare the use of computed tomography (CT) with magnetic resonance imaging (MRI) for studying brain structure.

(3)

(b) Suggest why functional magnetic resonance imaging (fMRI) is considered better than CT for studying brain function.

(2)

(c) The diagrams below show two MRI scans of the brain of a patient with a tumour. Scan 1 was taken before treatment was carried out, and scan 2 after treatment.



Scan 1 before treatment

Scan 2 after treatment

(i) Suggest why the tumour appeared white in the scans.

(2)

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(ii) Using the information in the diagrams, describe the effect of the treatment on this tumour.

(2)

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(iii) Using the information in the diagrams, suggest **two** brain functions that may have improved after treatment. Give a reason for your answer.

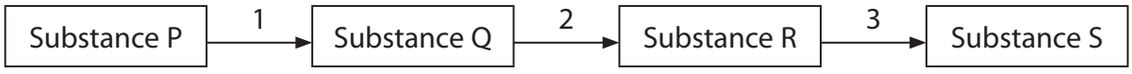
(3)

(Total for Question 2 = 12 marks)

3 Respiration is a metabolic process which consists of many steps.

(a) The diagram below shows a metabolic process consisting of three steps.

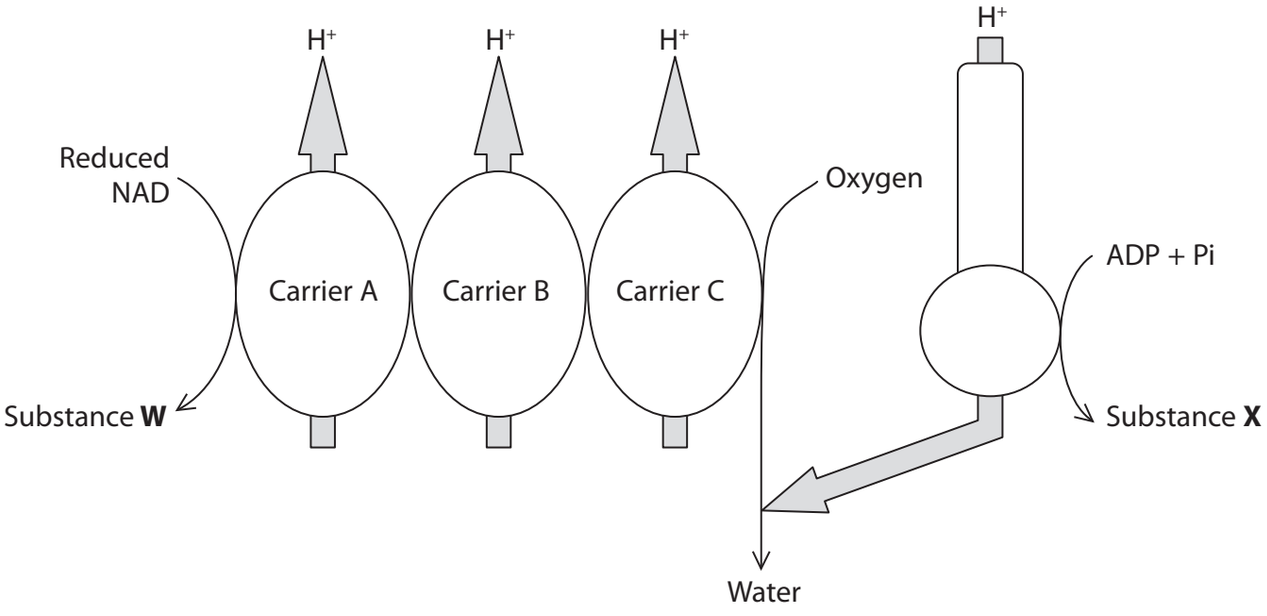
Each letter represents a different substance and each number a different enzyme.



Describe and explain the functions of enzymes in this metabolic process.

(4)

(b) The diagram below shows the electron transport chain, which is part of aerobic respiration.



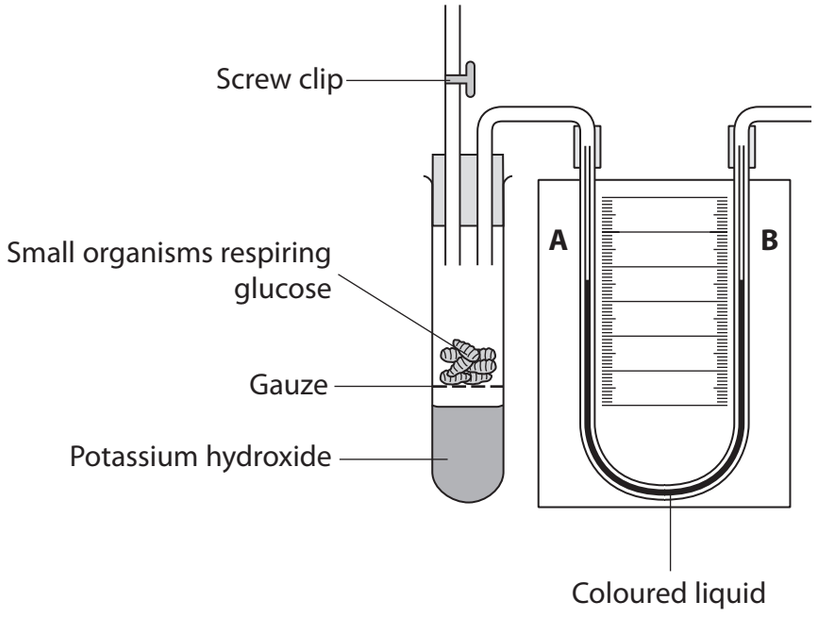
(i) Using the information in the diagram, name substance **W** and explain how it is formed.

(3)

(ii) Name substance **X**.
Explain the link between the formation of substance **X** and the H^+ shown on the diagram.

(3)

(c) The diagram below shows a respirometer used to measure the rate of aerobic respiration in small organisms.



Potassium hydroxide absorbs carbon dioxide.
The table below describes three different situations.
Place a cross in the box ☒ that correctly shows the movement of the coloured liquid in the U-shaped tube for each situation.

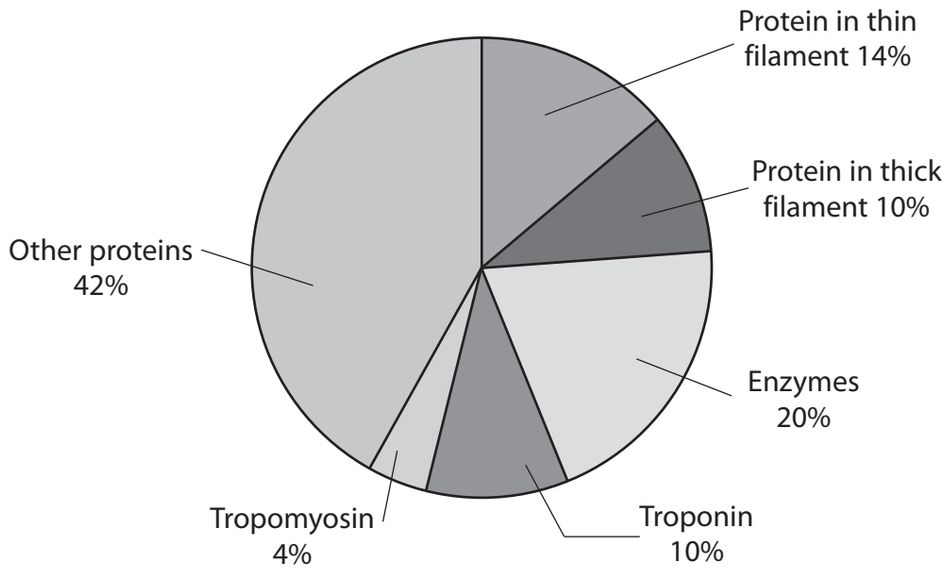
(3)

Situation	Movement of coloured liquid		
	towards A	**towards B**	**does not move**
Screw clip is open	☒	☒	☒
Screw clip is closed	☒	☒	☒
Potassium hydroxide is replaced with water and screw clip is closed	☒	☒	☒

(Total for Question 3 = 13 marks)

4 Skeletal muscle and cardiac muscle have some of the same proteins.

(a) Some of these proteins found in cardiac muscle are shown in the chart below.



(i) Using the chart, name the protein that makes up each of the two types of filament.

(2)

Protein in thin filament .....

Protein in thick filament .....

(ii) Describe the interaction between troponin and tropomyosin when a skeletal muscle fibre contracts.

(2)

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(iii) In the chart, some of the other proteins are neurotransmitter receptors. These are found on the cell surface membrane of cardiac muscle cells in the sinoatrial node (SAN).

Suggest **one** neurotransmitter substance that might bind to these receptors.

(1)

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(b) Troponin T is found in cardiac muscle cells. It can leak into the blood if the heart is damaged as a result of cardiovascular disease.

Testing for troponin T in blood can be used to study patients with damaged hearts.

The table below shows the concentration of troponin T in the blood of patients. The table also shows the mean number of days in hospital and the range of stay.

Concentration of troponin T in the blood / arbitrary units	**Mean number of days of stay in hospital and the range**
6.0 +	9 ± 2.0
4.0 – 5.9	6 ± 1.0
1.0 – 3.9	3 ± 0.5

Using the information in the table suggest what prediction a doctor could make and comment on the reliability of this prediction for patients with damaged hearts.

(3)

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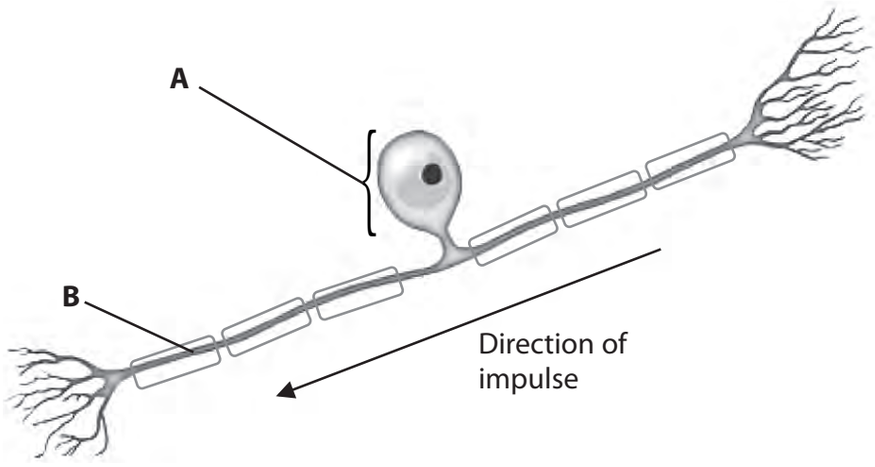
(Total for Question 4 = 8 marks)

5 The diagram below shows a sensory neurone.



(a) Name the structures labelled **A** and **B**.

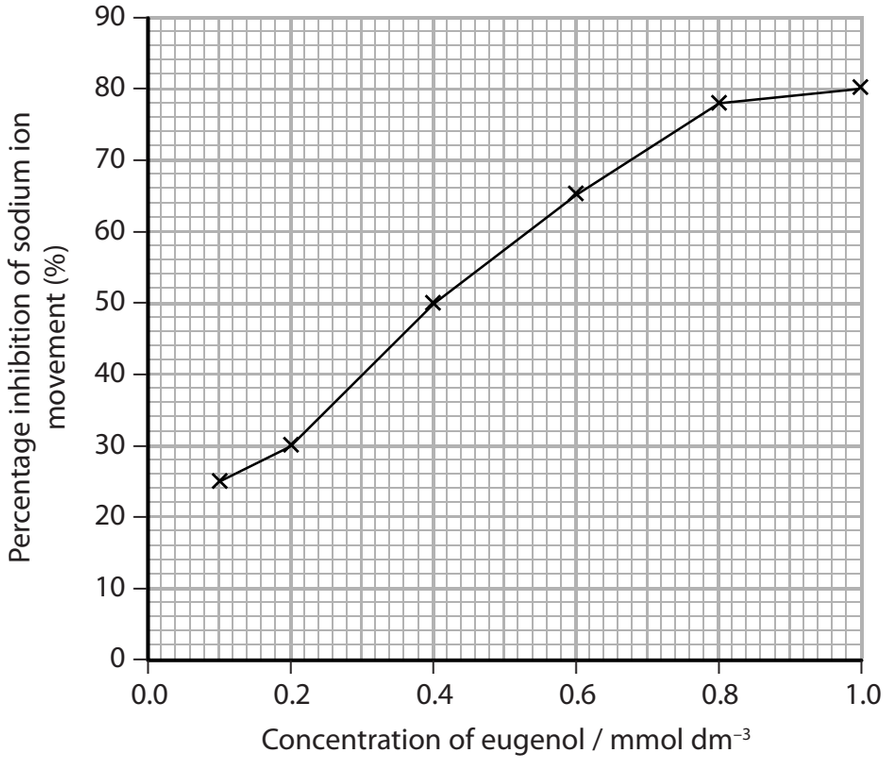
(2)

A .....

B .....

(b) Eugenol is a drug that inhibits the movement of sodium ions and calcium ions through the cell surface membranes of sensory neurones.

The graph below shows the effect of eugenol concentration on the percentage inhibition of sodium ion movement.



(i) Describe the relationship between the concentration of eugenol and the percentage inhibition of sodium ion movement.

(2)

*(ii) Eugenol can be used to reduce pain.

Suggest an explanation for how eugenol affects the movement of calcium ions and reduces pain.

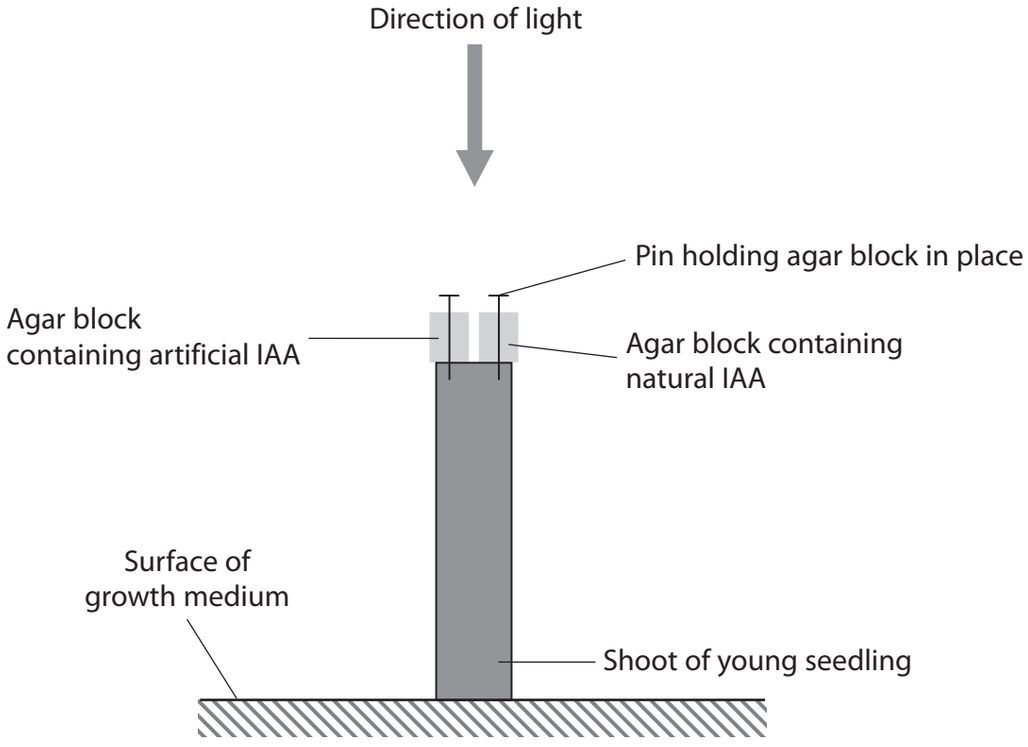
(6)

(Total for Question 5 = 10 marks)

6 IAA (auxin) is a plant growth substance.

(a) A student investigated the effect of natural IAA and artificial IAA on shoot growth.

The diagram below shows how she set up her investigation.



(i) The student also set up a control.

Describe a suitable control for this investigation.

(1)

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(ii) After 48 hours, the student recorded her observations of the growth of the shoots.
From her observations, she concluded that both natural and artificial IAA affected growth. She also concluded that the artificial IAA had a greater effect than the natural IAA.

Suggest what she recorded and explain how the IAA in the agar affected the growth of the shoot.

(5)

(b) IAA is known to bind to transcription factors.

Suggest how IAA can stimulate cells to synthesise proteins.

(4)

(Total for Question 6 = 10 marks)

7 The scientific article you have studied is adapted from several sources.

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

(a) The sweet potato eaten by naked mole rats (paragraph 3) is very rich in cellulose and starch.

Give **two** structural differences between cellulose and starch.

(2)

(b) Naked mole rats show evidence of poikilothermy (paragraph 5) whilst other mammals, such as humans, maintain a nearly constant body temperature.

(i) Describe the role of the human nervous system in returning a slightly raised body temperature to its normal level.

(4)

(ii) Explain how shivering generates heat to return a slightly reduced body temperature to its normal level.

(2)

(c) Suggest how Buffenstein and Horsby introduced cancer-causing genes into cells from naked mole rats (paragraph 13).

(3)

*(d) If we had to breathe the 'rank air' found in the tunnels of naked mole rats, it would leave us 'gasping for air' (paragraph 33).

Describe how the mechanism involved in the control of breathing rate in humans would respond to this 'rank air'.

(5)

(e) Suggest how a study of the naked mole rat could help in the design of prosthetic limbs (paragraph 47).

(2)

(f) Using the information in paragraph 48, name **one** hormone and state its target organ.

(1)

Hormone .....

Target organ .....

(g) Suggest **two** reasons why the structure of the sperm may make it non-motile (paragraph 48).

(2)

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(h) The 'coefficient of band sharing' (paragraph 49) is a measure of the number of bands that different DNA samples have in common. The higher the coefficient the more bands the samples share. The maximum coefficient is 1.00.

Suggest why the coefficient of band sharing ranges from 0.93 to 0.99 within a colony of naked mole rats.

(3)

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(i) Suggest the importance of dispersers in naked mole rat colonies (paragraphs 50, 51 & 52).

(2)

(j) Describe and explain **two** ways in which naked mole rats are adapted to their environment.

(4)

(Total for Question 7 = 30 marks)

TOTAL FOR PAPER = 90 MARKS