

Write your name here	
Surname	Other names
Centre Number	Candidate Number
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Edexcel GCE	
Biology	
Advanced	
Unit 5: Energy, Exercise and Coordination	
Monday 17 June 2013 – Afternoon Time: 1 hour 45 minutes	Paper Reference 6BI05/01R
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 ►

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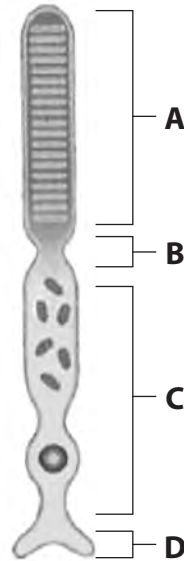
PEARSON

Answer ALL questions.

Some questions must be answered with a cross . 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 retina of the eye is sensitive to light. It contains rod cells.

The diagram below shows a rod cell. Parts of this cell are labelled **A**, **B**, **C** and **D**.



- (a) The table below gives three descriptions of parts of the rod cell. Place a cross in the box to identify the part of the rod cell described.

(3)

Description	Part of the rod cell			
	A	B	C	D
Nearest the pupil of the eye	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Containing the photosensitive pigment	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Has a pre-synaptic membrane	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>



(b) When light reaches a rod cell the voltage across the cell surface membrane can change. This can lead to the formation of an action potential in an optic neurone.

(i) Describe how light causes a change in the voltage across the cell surface membrane of a rod cell.

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(ii) Suggest why a change in voltage across the cell surface membrane of a rod cell may not lead to the formation of an action potential in an optic neurone.

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(Total for Question 1 = 9 marks)



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

(a) Describe how scans from magnetic resonance imaging (MRI) may be used to investigate brain tumours.

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(b) An investigation was carried out to study brain activity when eating chocolate.

Functional magnetic resonance imaging (fMRI) was used to study the brain activity of people eating chocolate.

It was found that certain areas in their brains became more active when they ate chocolate.

(i) Suggest **two** variables that should be taken into account when selecting the people for this investigation.

(1)

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(ii) Suggest how fMRI was able to show that certain areas in the brain became more active when people ate chocolate.

(3)

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(iii) Some of these more active areas were in the cerebral hemispheres of the brain.
The cerebral hemispheres have a number of functions.

State **two** functions associated with the cerebral hemispheres.

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(Total for Question 2 = 8 marks)

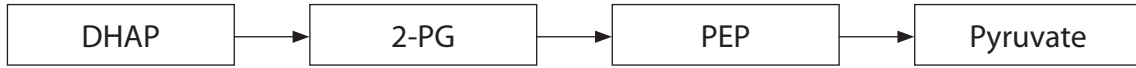




3 Respiration is a metabolic process which consists of many steps.

(a) The diagram below shows three steps in respiration.

Each box represents a different substance and each step involves an enzyme.



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

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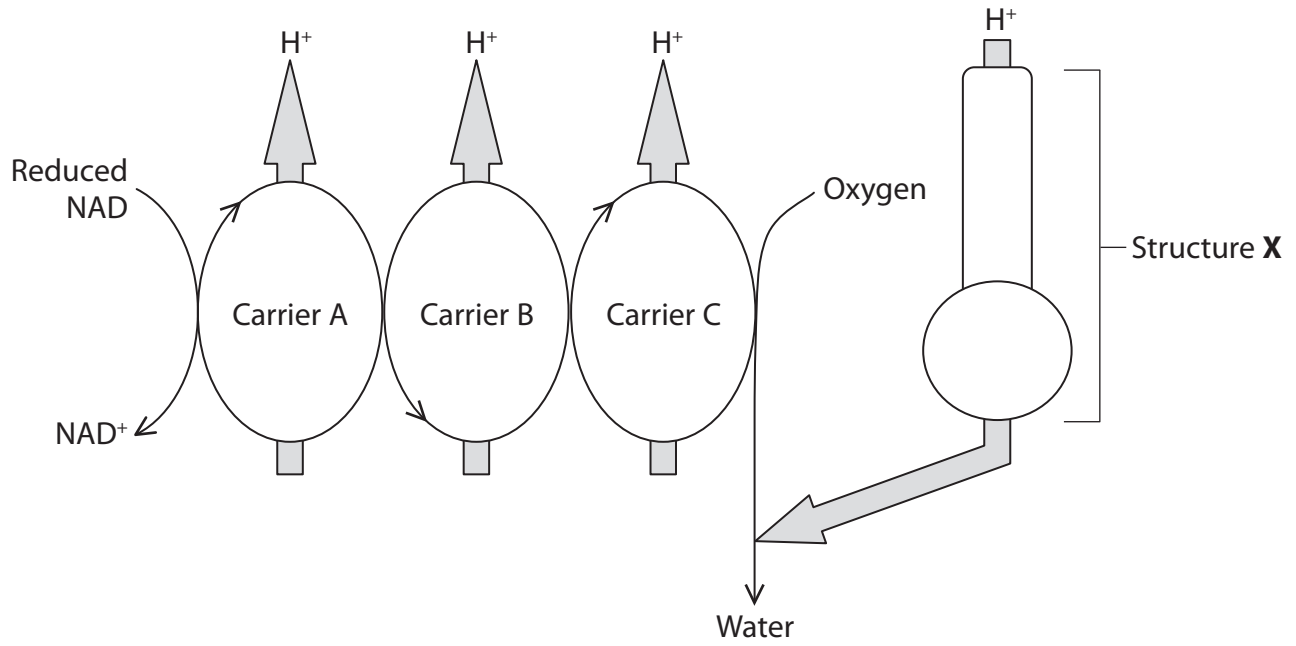
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(b) The diagram below shows the electron transport chain, which is part of aerobic respiration.



(i) Using the diagram and your own knowledge, describe the role of carrier B.

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(ii) Name structure **X** and explain its role in aerobic respiration.

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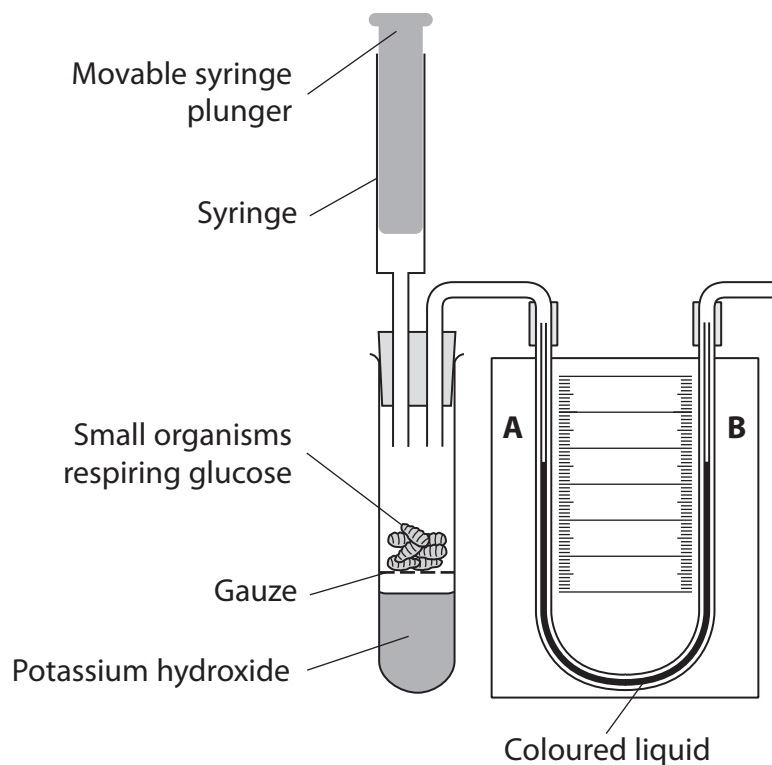
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(c) The diagram below shows a respirometer used to measure the rate of aerobic respiration in small organisms.



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)

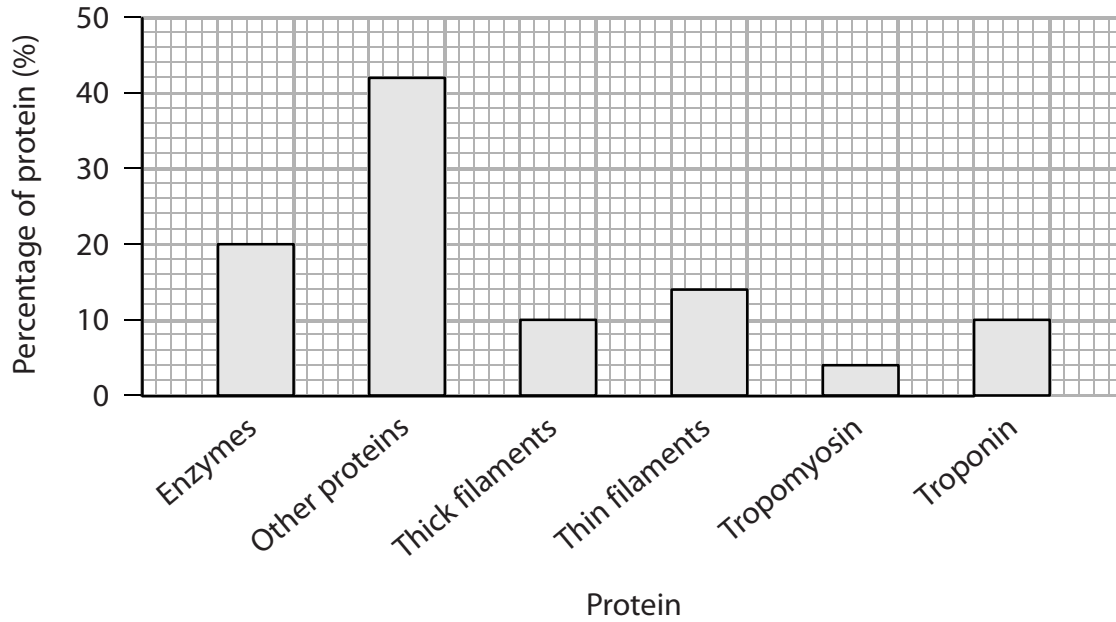
Situation	Movement of coloured liquid		
	towards A	towards B	does not move
Syringe plunger pulled upwards	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Syringe plunger not moved	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Potassium hydroxide is replaced with water and syringe plunger not moved	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

(Total for Question 3 = 13 marks)



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

(a) The percentage of the proteins found in cardiac muscle are shown in the bar chart below.



(i) Using the information in the bar chart, give the percentage of protein that is actin and the percentage that is myosin.

(2)

Actin:%

Myosin:%



(ii) Describe how calcium ions affect troponin as a skeletal muscle fibre contracts.

(2)

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(iii) Some of the 'other proteins' shown in the bar chart are found in the sinoatrial node (SAN).

State the location of the SAN in the heart.

(1)

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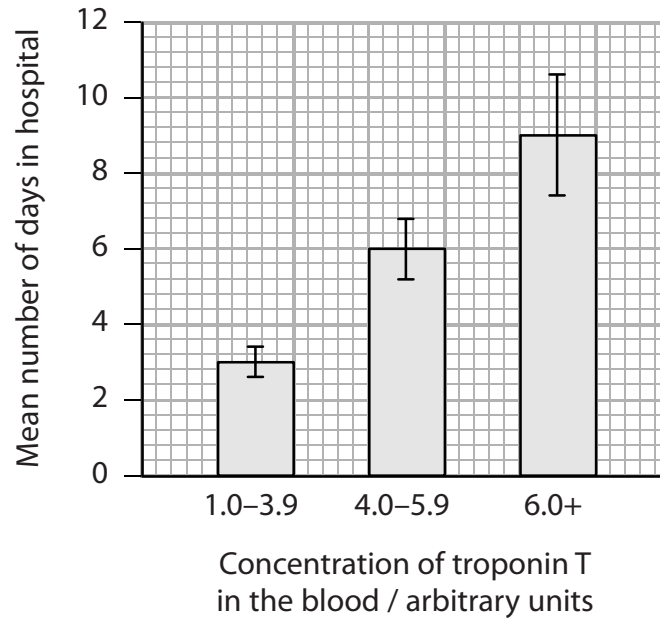


(b) Troponin T is found in cardiac muscle cells. It can leak into the blood if the heart is damaged as a result of cardiovascular disease (CVD).

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

The graph below shows the concentration of troponin T in the blood of patients with CVD.

The graph also shows the mean number of days and the range of time spent in hospital.



(i) Suggest a conclusion that a doctor could draw from these data.

(1)

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(ii) Comment on the validity of the doctor's conclusion.

(2)

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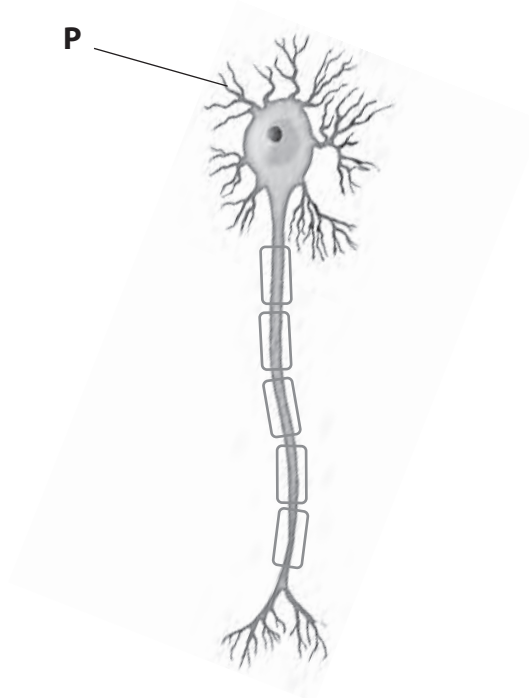
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(Total for Question 4 = 8 marks)



5 (a) The diagram below shows a motor neurone.



(i) Name the structure labelled **P**.

(1)

(ii) Place a cross ☒ in the box to identify the direction of the nerve impulse in the axon of this motor neurone.

(1)

A →

B ↓

C ←

D ↑



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

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

Concentration of eugenol / mmol dm^{-3}	Percentage inhibition of sodium ion movement (%)
0.2	30
0.4	50
0.6	65
1.0	80

- (i) Describe the effect of eugenol on the percentage inhibition of sodium ion movement.

(2)

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- (ii) Using information from the table, calculate the percentage inhibition of sodium ion movement at a concentration of eugenol of 0.8 mmol dm^{-3} .

Show your working.

(2)

Answer%





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

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

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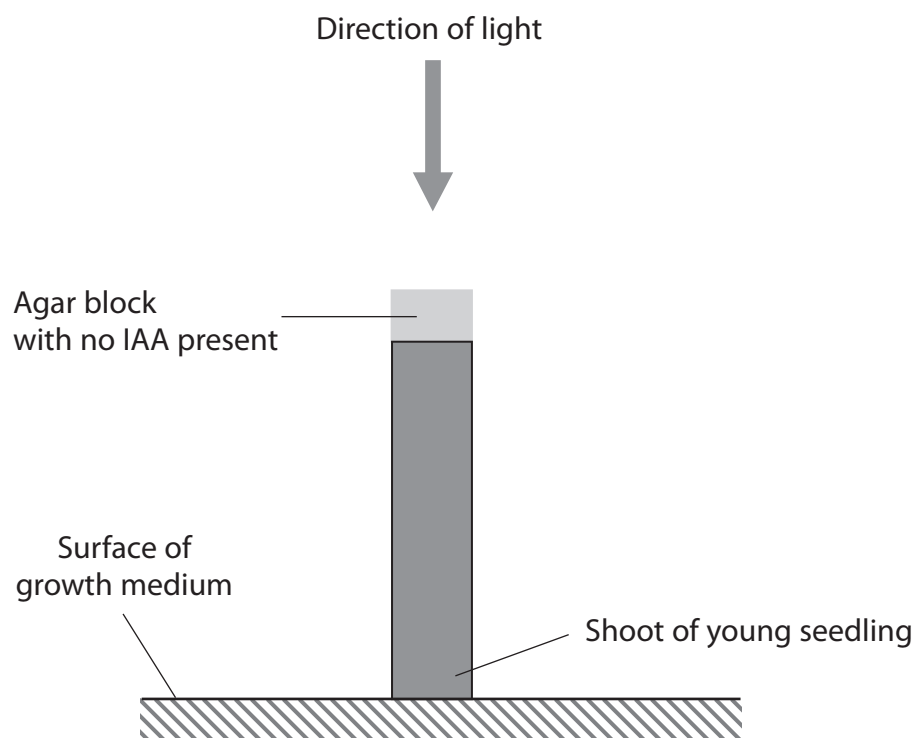
(Total for Question 5 = 12 marks)



6 IAA (auxin) is a plant growth substance.

(a) A student investigated the effect of different concentrations of IAA on shoot growth.

The diagram below shows how she set up her control.



(i) Describe the role of the control in this investigation.

(1)

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P 4 3 3 2 8 A 0 1 7 2 8



(ii) After 48 hours, the student recorded her observations of the growth of the shoots.

From her observations, she concluded that IAA affected growth. She also concluded that a higher concentration of IAA had a greater effect.

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

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(b) IAA can interact with transcription factors to stimulate cells to produce proteins.

Suggest how the presence of IAA can cause cells to produce proteins.

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(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 starch. Starch can be a combination of amylose and amylopectin.

Give **two** structural differences between amylose and amylopectin.

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(b) Explain why a colony of naked mole rats is considered 'a eusocial society' (paragraph 4).

(2)

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(c) Naked mole rats show evidence of poikilothermy (paragraph 5).

(i) Explain what is meant by the term **poikilothermic**.

(1)

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(ii) Suggest how each of the following 'contribute to poikilothermic responses to changing temperature of this mammal'.

(2)

'Lack of an insulating layer'

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'A marked reduction in sweat glands'

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(d) Suggest a mechanism that could have been used to genetically modify cells from mice with cancer-causing genes (paragraph 13).

(2)

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***(e)** Whilst naked mole rats are ‘impervious to chemical pain’ they do feel ‘acute pain such as cuts and burns’ (paragraph 31).

Touching something hot, which could lead to a burn, can cause nerve impulses to travel along myelinated sensory neurones very rapidly.

Explain how myelination increases the speed of transmission of nerve impulses in a sensory neurone.

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(f) Explain how a heart attack can temporarily reduce the oxygen concentration in brain tissue (paragraph 36).

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(g) Using the information in paragraph 48, name **one** hormone **and** state its function. (1)

Hormone:

Function:

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(h) Suggest how a change in the mid region of the sperm may make it non-motile (paragraph 48). (2)

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(i) Disperser naked mole rats 'are laden with fat' (paragraph 50).
Suggest why it may be advantageous for disperser naked mole rats to have high levels of fat. (3)

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(j) Explain the statement that 'a preference by reproductively active females for unfamiliar males is interpreted as inbreeding avoidance' (paragraph 52).

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(k) 'The naked mole rat hasn't yet had its genome sequenced' (paragraph 53).

Explain what is meant by the term **genome sequenced**.

(1)

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- (l) 'With so much to offer science, it is no surprise that naked mole rats are becoming more common in labs' (paragraph 53).

Using information from the article, describe **two** adaptations of naked mole rats. For each adaptation, explain why it could be of interest in a medical research laboratory.

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(Total for Question 7 = 30 marks)

TOTAL FOR PAPER = 90 MARKS

