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Centre number

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# Level 3 Certificate/Extended Certificate APPLIED SCIENCE

## Unit 4 The Human Body

Thursday 17 January 2019    Afternoon    Time allowed: 1 hour 30 minutes

### Materials

For this paper you must have:

- a calculator.

### Instructions

- Use black ink or black ball-point pen.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

### Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.

### Advice

Read each question carefully.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
<b>TOTAL</b>	



J A N 1 9 A S C 4 0 1

Answer **all** questions.

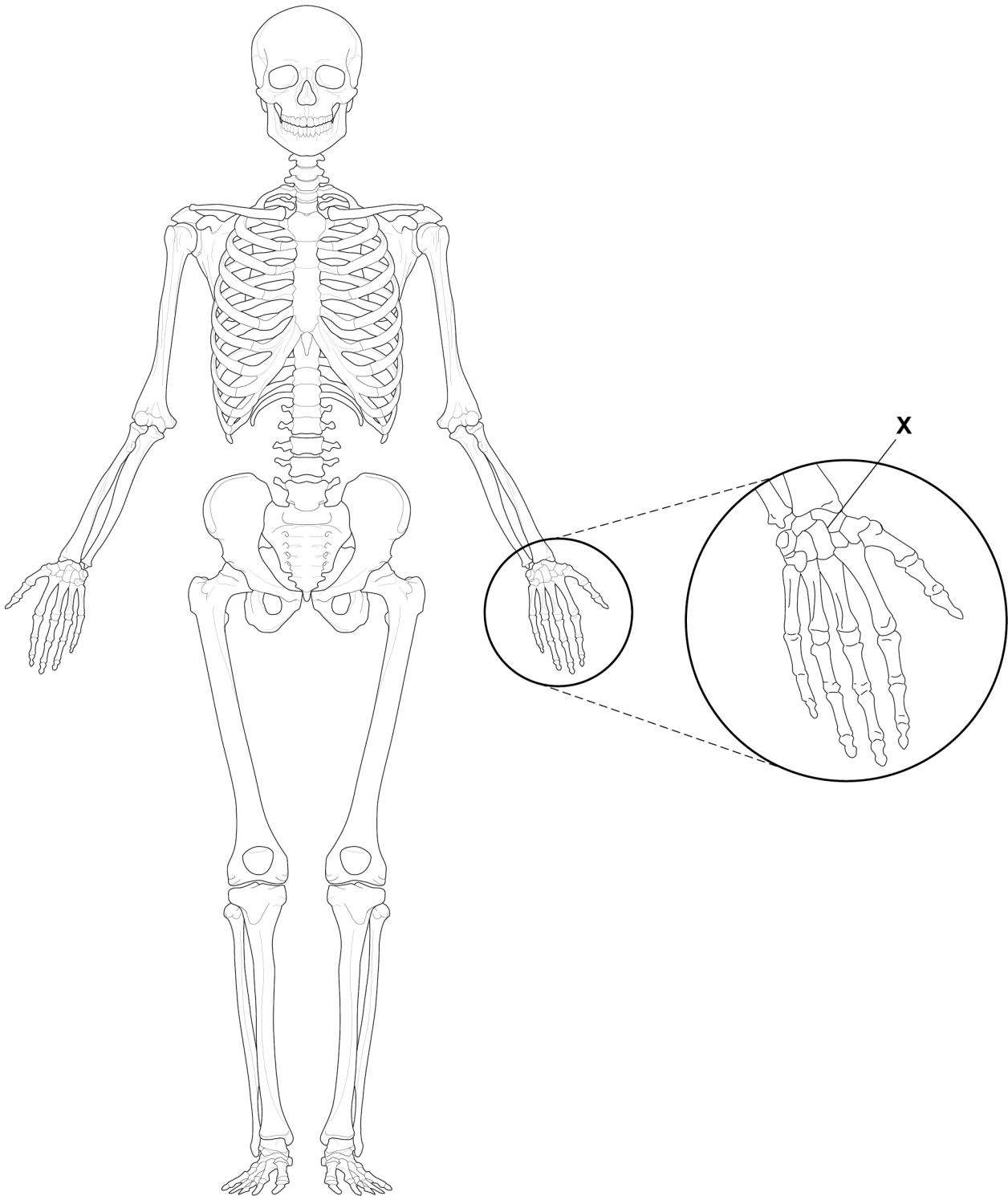
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0 1

Sports scientists study the musculoskeletal system and its movement.

**Figure 1** shows the human skeleton.

**Figure 1**



**0 1 . 1** Name the type of joint labelled **X** in **Figure 1**. **[1 mark]**

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**0 1 . 2** On **Figure 1**, label one of the bones of the axial skeleton with a letter **Y**. **[1 mark]**

**0 1 . 3** Which type of joint can only move in one plane? **[1 mark]**

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**0 1 . 4** The skeleton allows us to move.  
What are **two** other functions of the skeleton?  
Tick (✓) **two** boxes. **[2 marks]**

Absorption of glucose

Blood cell production

Control of breathing rate

Creatine phosphate production

Protection

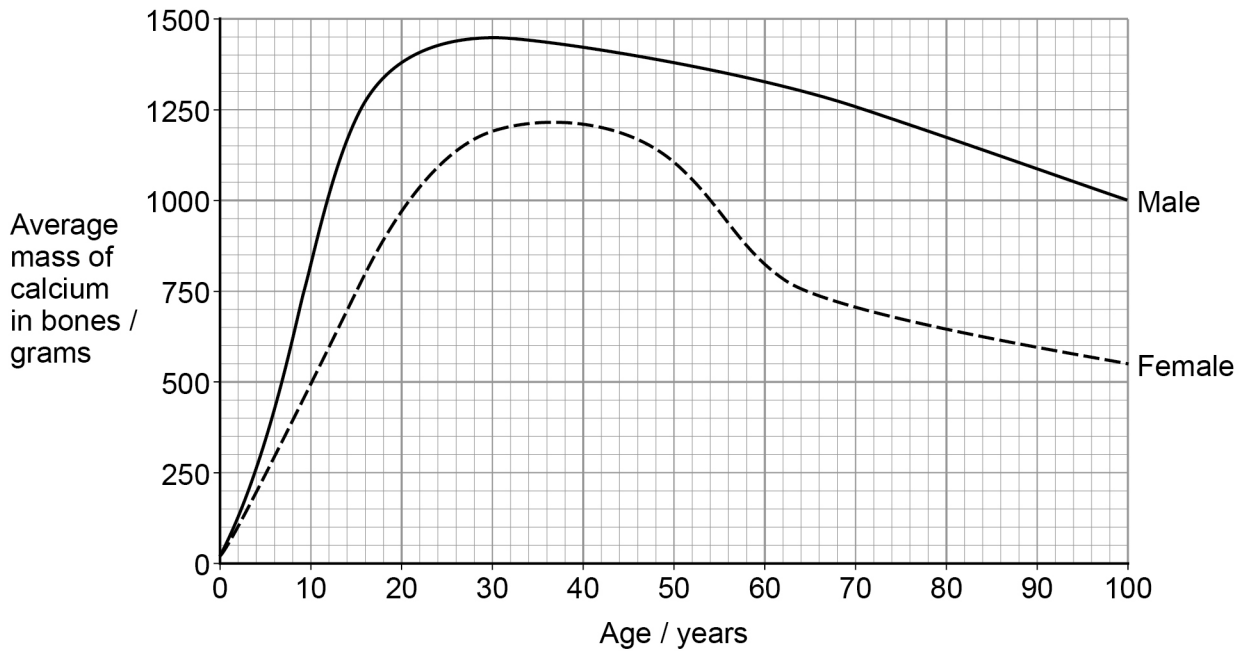
**Question 1 continues on the next page**

**Turn over ►**



Figure 2 shows how the average mass of calcium in bones changes with age.

Figure 2



0 1 . 5

The average mass of calcium in the bones of males decreases between the ages of 30 and 100 years.

Calculate the percentage decrease.

[3 marks]

Percentage decrease in mass of calcium = \_\_\_\_\_

0 1 . 6

Name the process that breaks down old bone.

[1 mark]

\_\_\_\_\_



**0 1 . 7** **Figure 2** shows patterns of bone growth.

Describe the patterns in the changes in the average mass of calcium in bones of males and females.

**[3 marks]**

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**0 1 . 8** Explain why females over the age of 60 may be more likely to break their bones than males over the age of 60.

Use information from **Figure 2**.

**[2 marks]**

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14

**Turn over for the next question**

**Turn over ►**



0	2
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The percentage of fast-twitch muscle fibres and slow-twitch muscle fibres in the human body changes over time.

Exercising can affect the percentages of the different muscle fibres.

0	2	.	1
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The percentage of fast-twitch muscle fibres in a sprinter is higher than the percentage in a marathon runner.

Give **two** features of fast-twitch muscle fibres.

**[2 marks]**

1 \_\_\_\_\_

\_\_\_\_\_

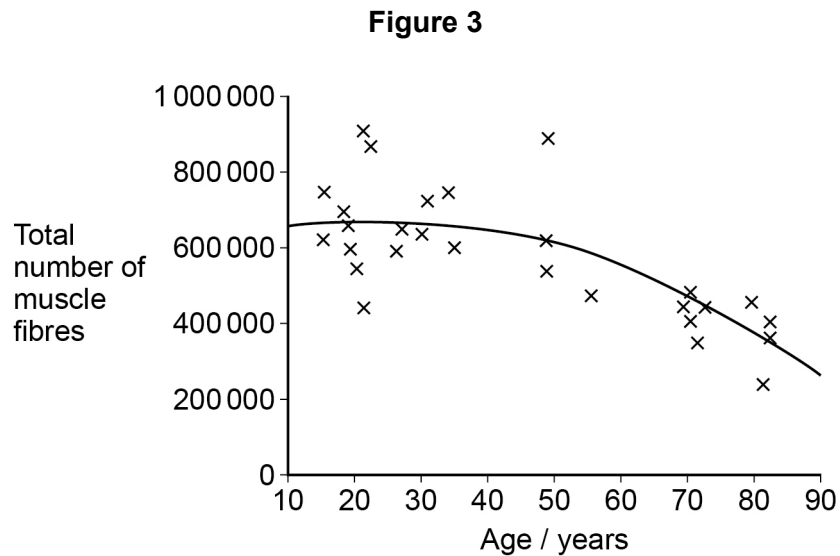
2 \_\_\_\_\_

\_\_\_\_\_



**Figure 3** shows how the total number of muscle fibres changes with age.

Each point represents one person's data.



**0 2 . 2** Give **two** conclusions you can make using the information in **Figure 3**.

[2 marks]

- 1 \_\_\_\_\_
- \_\_\_\_\_
- 2 \_\_\_\_\_
- \_\_\_\_\_

**0 2 . 3** The percentage of fast-twitch muscle fibres decreases as a person gets older.

Suggest a reason why.

[1 mark]

- \_\_\_\_\_
- \_\_\_\_\_

**0 2 . 4** Slow-twitch muscle fibres have an oxygen-binding protein that is similar to haemoglobin.

What is the name of this protein?

[1 mark]

- \_\_\_\_\_

Turn over ►



0 3

Nutritionists can help people improve their diet to avoid deficiency diseases.

**Table 1** shows some daily recommended allowances.

**Table 1**

	Energy / kJ	Protein / g per kg of body weight	Iron / mg	Vitamin D / $\mu\text{g}$
Girl aged 1–3 years	5 500	1.10	7.0	5.0
Girl aged 14–18 years	11 500	0.85	8.0	5.0
Woman	10 000	0.80	18.0	5.0
Pregnant woman	10 400	1.20	27.0	5.0

0 3 . 1

A pregnant woman eats a chicken sandwich.

**Figure 4** shows the nutritional information for the chicken sandwich.

**Figure 4**

<b>Nutritional Information</b>	
<b>Amount Per Serving</b>	
Energy/kJ	1715
<b>Total Fat (g)</b>	12
Saturated Fat (g)	5
Trans Fat (g)	-
<b>Cholesterol (mg)</b>	80
<b>Sodium (mg)</b>	1350
<b>Total Carbohydrate (g)</b>	37
Dietary fibre (g)	3
Sugars (g)	9
<b>Protein (g)</b>	37

Calculate what percentage of the pregnant woman's daily energy allowance is provided by the chicken sandwich.

Use information from **Table 1** and **Figure 4**.

**[1 mark]**

Percentage = \_\_\_\_\_





- 0 3 . 2** Explain why girls aged 14–18 years need a different mass of protein than girls aged 1–3 years.

Use information from **Table 1**.

**[2 marks]**

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- 0 3 . 3** Which disease is caused by a lack of vitamin **D**?  
Tick (✓) **one** box.

**[1 mark]**

Anaemia	<input type="checkbox"/>
Hyponatraemia	<input type="checkbox"/>
Rickets	<input type="checkbox"/>
Scurvy	<input type="checkbox"/>

- 0 3 . 4** The pregnant woman is deficient in vitamin **D**.

Name **two** foods that have a high vitamin **D** content.

**[2 marks]**

1 \_\_\_\_\_

2 \_\_\_\_\_

**Question 3 continues on the next page**

**Turn over ►**



**0 3 . 5** The pregnant woman is told to reduce her salt intake because she has high blood pressure.

Give **two** symptoms of high blood pressure.

**[2 marks]**

1 \_\_\_\_\_

2 \_\_\_\_\_

**0 3 . 6** The nutritional information label in **Figure 4** shows how much carbohydrate the chicken sandwich contains.

Give **one** use of carbohydrate in the human body.

**[1 mark]**

\_\_\_\_\_

\_\_\_\_\_



0 3 . 7 The nutrients from digestion are absorbed into the bloodstream in the small intestine.

**Figure 5** shows a section of the small intestine seen through a microscope.

**Figure 5**



Give **two** adaptations of the small intestine that help to speed up the rate of absorption into the blood.

**[2 marks]**

- 1 \_\_\_\_\_
- \_\_\_\_\_
- 2 \_\_\_\_\_
- \_\_\_\_\_

11

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**Turn over ►**



0 4

The nervous system coordinates many activities in the human body.

The nervous system is organised into different areas with different functions.

0 4 . 1

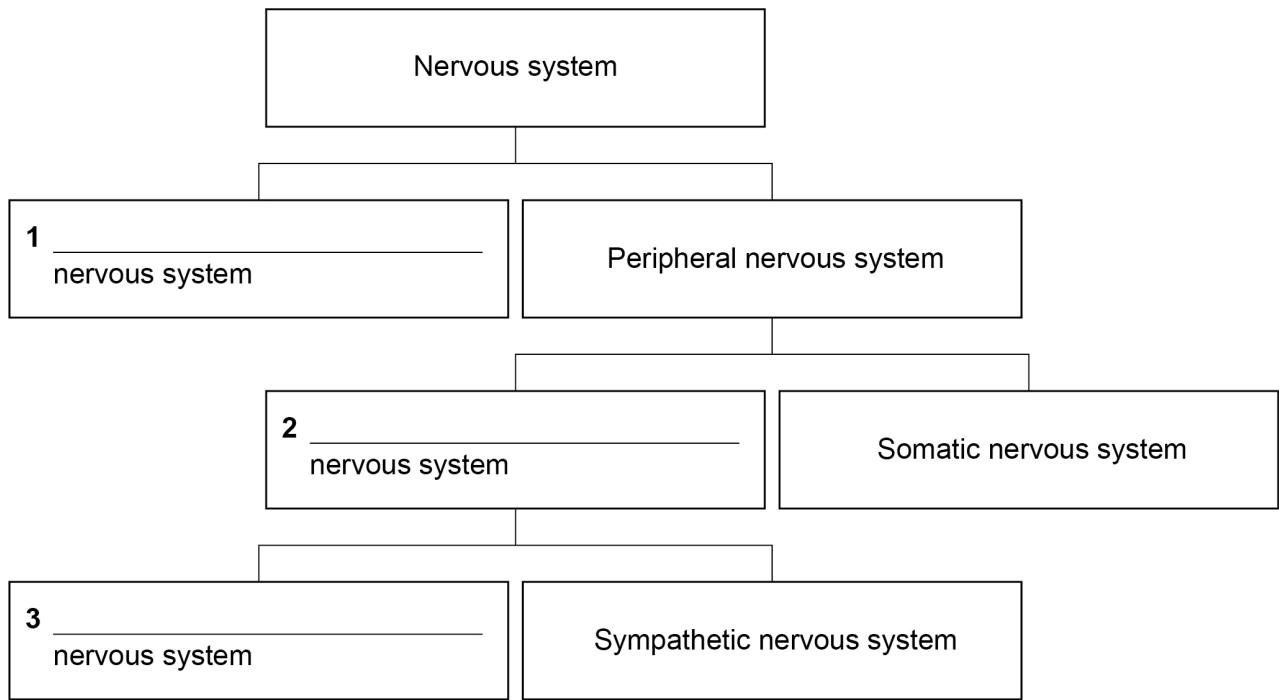
**Figure 6** shows the organisation of the nervous system.

Complete **Figure 6**.

Write your answers on lines **1, 2** and **3**.

[3 marks]

**Figure 6**



0 4 . 2

What is the role of the somatic nervous system?

[1 mark]

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0 4 . 3

Give **two** effects of stimulating the sympathetic nervous system.

[2 marks]

1 \_\_\_\_\_

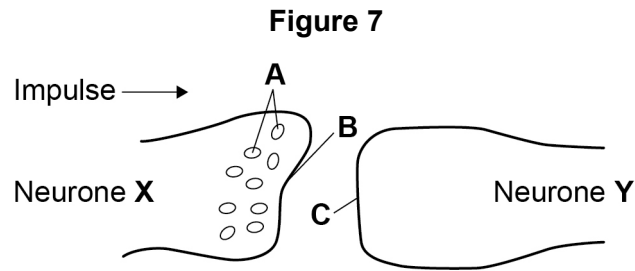
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2 \_\_\_\_\_

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Figure 7 shows a synapse between two neurones.



0 4 . 4

Name parts **A**, **B**, and **C**.

[3 marks]

**A** \_\_\_\_\_

**B** \_\_\_\_\_

**C** \_\_\_\_\_

0 4 . 5

When a nerve impulse reaches the end of neurone **X**, a neurotransmitter is released.

Describe how the neurotransmitter causes a nerve impulse to start in neurone **Y**.

[2 marks]

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0 4 . 6

Describe what happens to the neurotransmitter after a new impulse starts in neurone **Y**.

[3 marks]

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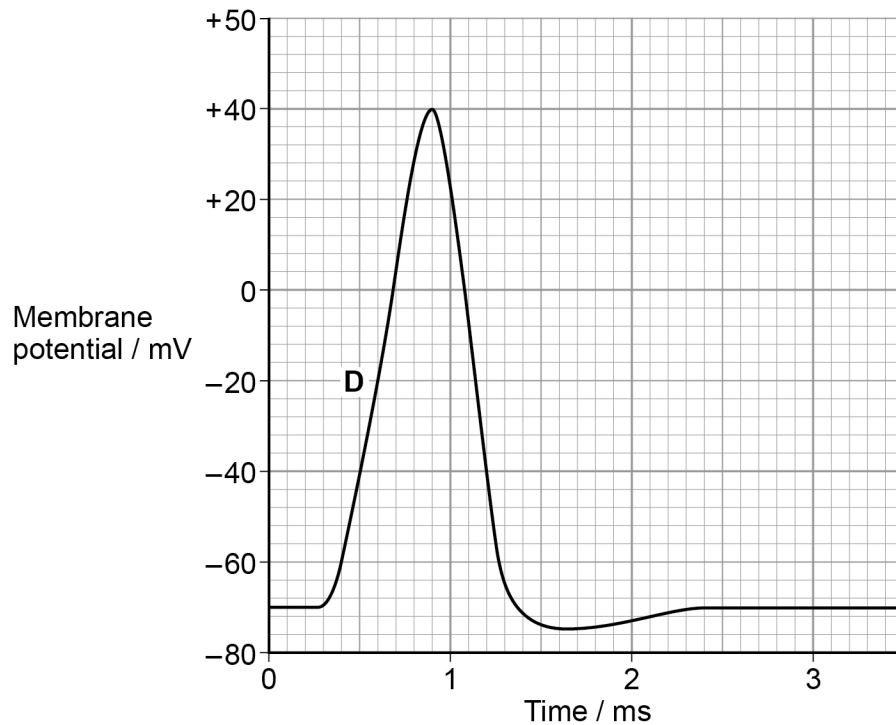
Question 4 continues on the next page

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**Figure 8** shows changes in the membrane potential of neurone **Y** during one action potential.

**Figure 8**



**0 4 . 7** During section **D** on **Figure 8** the neurone depolarises.

Calculate the overall change in membrane potential during depolarisation.

[1 mark]

Change in membrane potential = \_\_\_\_\_ mV

**0 4 . 8** During depolarisation of the neurone, ion channels open and close.

Which ion channels are open during depolarisation?

Tick (✓) **one** box.

[1 mark]

Potassium only

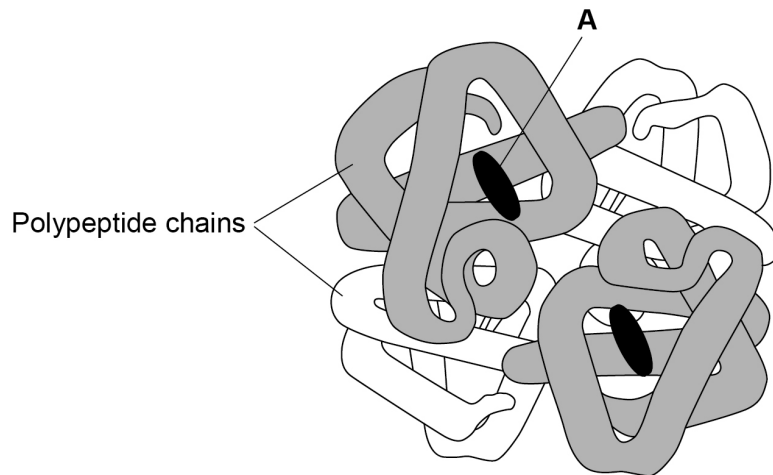
Sodium and potassium

Sodium only



0 5

Haemoglobin is made of protein. **Figure 9** shows the structure of haemoglobin.

**Figure 9**

0 5 . 1

Which ion is found in **A**?

Tick (✓) **one** box.

**[1 mark]** $\text{Ca}^{2+}$  $\text{Fe}^{2+}$  $\text{K}^+$  $\text{Na}^+$ 

0 5 . 2

How many molecules of oxygen ( $\text{O}_2$ ) can be carried by one molecule of haemoglobin?

Tick (✓) **one** box.

**[1 mark]**

1

2

4

16

**Question 5 continues on the next page**

**Turn over ►**



A man goes to hospital. The man is dizzy, vomiting and short of breath.

At the hospital his oxygen saturation level and blood pressure are measured.

0 5 . 3

Name **one** non-invasive way of measuring oxygen saturation.

[1 mark]

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0 5 . 4

Name **one** piece of equipment used to measure blood pressure.

[1 mark]

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0 5 . 5

The man's oxygen saturation level is 92%.

What can you conclude from this value?

[1 mark]

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0 5 . 6

A doctor thinks the man may have carbon monoxide poisoning.

Carbon monoxide binds to haemoglobin to form carboxyhaemoglobin.

People who smoke often suffer from symptoms of carbon monoxide poisoning.

The man has a blood test to measure the concentration of carboxyhaemoglobin in his blood.

**Table 2** shows the concentration of carboxyhaemoglobin in different people.

**Table 2**

	Concentration of carboxyhaemoglobin / arbitrary units
Normal level in a non-smoker	1
Level when symptoms of poisoning begin	10
Level in a heavy smoker	15
Level when coma and death are likely	>40

Suggest what you would expect the level of carboxyhaemoglobin concentration to be for a non-smoker who lives with a smoker.

Give a reason for your answer.

Use information in **Table 2**.

**[2 marks]**

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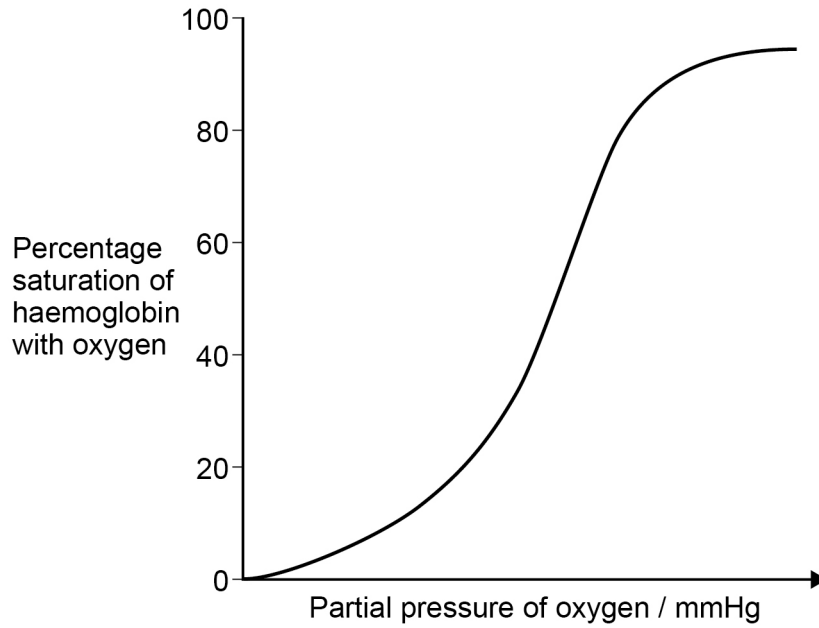
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**Figure 10** shows a normal oxygen dissociation curve for haemoglobin at rest.

**Figure 10**



0 5 . 7

Explain how the difference in pH in an active muscle compared with the pH in the lungs increases the efficiency of oxygen transport.

**[3 marks]**

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**0 5 . 8** Some athletes train at high altitude.

Explain how training at high altitude affects oxygen transportation.

**[3 marks]**

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**13**

**END OF QUESTIONS**



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