AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

Level 3 Certificate/Extended Certificate
APPLIED SCIENCE

Unit 4 The Human Body

Time allowed: 1 hour 30 minutes

Materials
For this paper you must have:
- a calculator.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- 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	
TOTAL	

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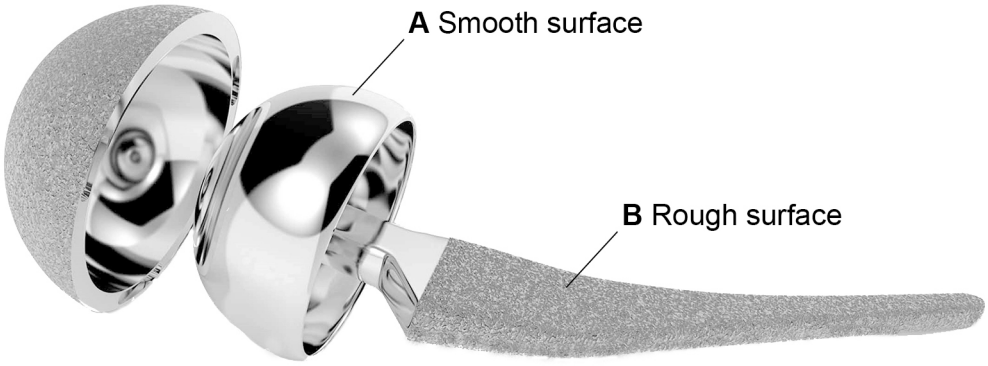
Answer **all** questions.

0 1 There are many different types of joint in the human body.

Natural joints can be replaced with artificial joints.

Figure 1 shows one type of artificial joint.

Figure 1



0 1 . 1 What type of artificial joint is shown in **Figure 1**?

[1 mark]

Tick (✓) **one** box.

Ball and socket ☐

Gliding ☐

Hinge ☐

0 1 . 2 Name **one** joint in the human body that is the same type of joint as **Figure 1**.

[1 mark]

0 1 . 3 Suggest **one** reason why part **A** of the artificial joint has a smooth surface.

[1 mark]

Do not write outside the box

0 1 . 4 Suggest **one** reason why part **B** of the artificial joint has a rough surface.

[1 mark]

0 1 . 5 Artificial joints can be fitted when the natural joint has been damaged.

An example of damage is when the cartilage in the joint wears away.

Suggest **two** symptoms a person would experience if the cartilage in their ankle joint has worn away.

[2 marks]

1

2

0 1 . 6 What is the function of a **ligament** in a synovial joint?

[1 mark]

Tick (✓) **one** box.

- To attach a muscle to bone ☐
- To contain the fluid in the joint ☐
- To hold the bones in place in the joint ☐
- To lubricate the joint ☐
- To supply oxygen to the bone cells ☐

Question 1 continues on the next page

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0 1 . 7 What is the function of a **tendon** in a synovial joint?

[1 mark]

Tick (✓) **one** box.

To attach a muscle to bone ☐

To contain the fluid in the joint ☐

To hold the bones in place in the joint ☐

To lubricate the joint ☐

To supply oxygen to the bone cells ☐

Another type of joint in the human body is a pivot joint.

0 1 . 8 Where would you find a pivot joint in the axial skeleton?

[1 mark]

0 1 . 9 Describe the range of motion in a pivot joint.

[1 mark]

10

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0 2 A balanced diet is needed to maintain a healthy human body.

Vitamin D is a lipid-soluble vitamin. Lipid-soluble vitamins are stored in the liver.

0 2 . 1 Give **one** other function of the liver in the digestive system.

[1 mark]

Tick (✓) **one** box.

To produce bile ☐

To produce digestive enzymes ☐

To produce hydrochloric acid ☐

To produce saliva ☐

0 2 . 2 In which part of the digestive system does the absorption of vitamin D take place?

[1 mark]

_____

0 2 . 3 Give **three** features of an effective absorption surface in the human body.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

0 2 . 4 A balanced diet includes macronutrients and micronutrients.

What is the difference between macronutrients and micronutrients?

[1 mark]

_____

_____

Question 2 continues on the next page

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Low levels of vitamin D have been linked to an increased risk of depression.

0 2 . 5 Give **two** symptoms of vitamin D deficiency.

Do **not** refer to depression in your answer.

[2 marks]

1 _____

_____

2 _____

_____

0 2 . 6 Name **one** neurotransmitter that is linked with depression.

[1 mark]

_____

Do not write outside the box

Scientists studied the links between:

- vitamin D levels and the risk of depression
- ageing and vitamin D levels.

The study considered data over a period of **7 years**.

The vitamin D level in each person was measured at the start of the study and at the end of the study. The people were put into groups based on their vitamin D level at the start of the study.

Table 1 shows the data for two of the groups from the study.

Table 1

Group	Mean vitamin D level / arbitrary units		Percentage of people in the group with an increased risk of depression / %
	At the start of the study	At the end of the study	
Group 1: Vitamin D levels greater than 50 arbitrary units	73.1	71.6	21.9
Group 2: Vitamin D levels less than 50 arbitrary units	32.2	30.8	48.7

0 2 . 7 Give **two** conclusions you can make from **Table 1**.

[2 marks]

1 _____

_____

2 _____

_____

0 2 . 8 Vitamin D levels were lower when measured in the winter compared with the vitamin D levels measured in the summer.

Suggest why.

[1 mark]

_____

_____

12

Turn over ►

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0 3 Oxygen is carried in the bloodstream.

0 3 . 1 Describe how to use a pulse oximeter to measure oxygen saturation.

[1 mark]

0 3 . 2 Complete the equation below to show how oxygen is transported around the body.

[1 mark]

_____ + _____ ⇌ oxyhaemoglobin

0 3 . 3 What is a sphygmomanometer used to measure?

[1 mark]

Question 3 continues on the next page

Oxygen saturation of haemoglobin depends on the partial pressure of oxygen.

Table 2 shows oxygen saturation data.

Table 2

Partial pressure of oxygen / mm Hg	Percentage saturation of haemoglobin / %
10	13
15	17
20	30
25	46
30	59
40	77
50	86
60	92
70	94
80	96
90	97
100	98

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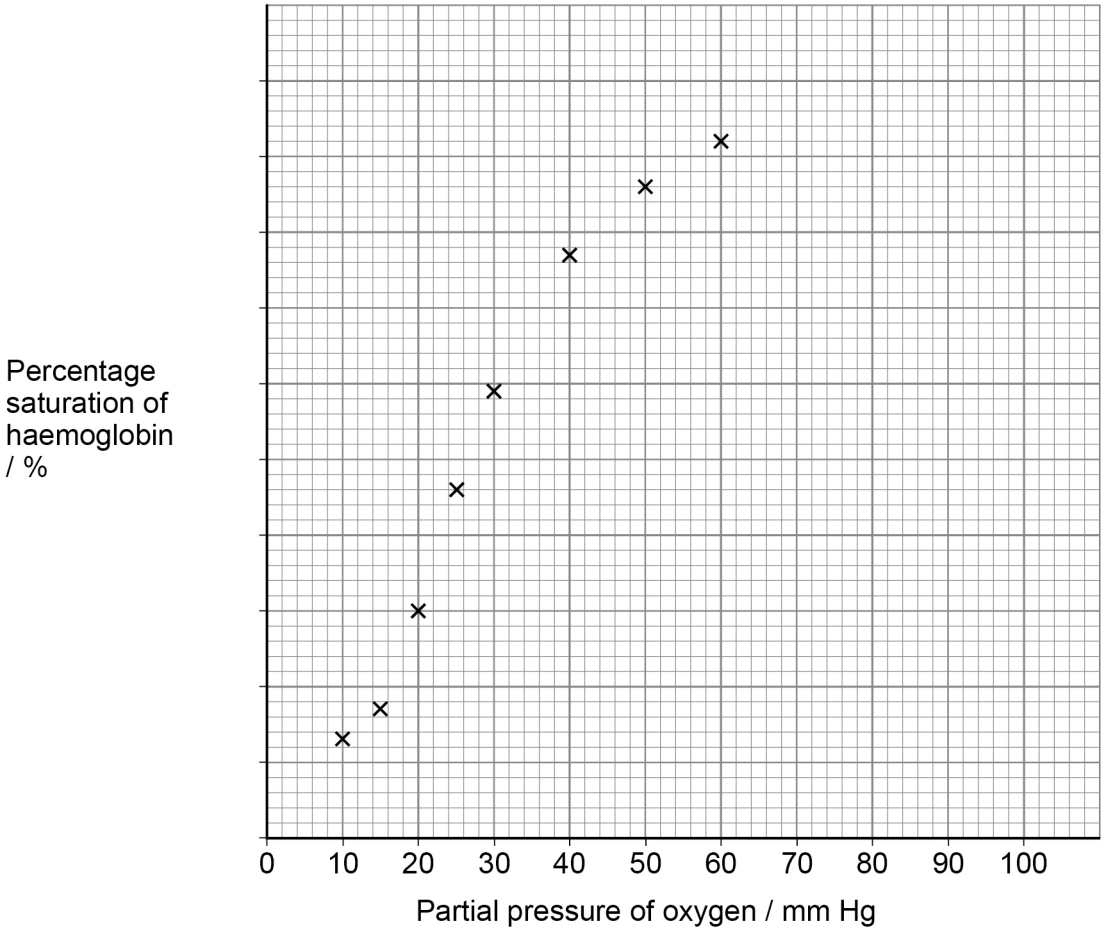
0 3 . 4 Complete **Figure 2**.

You should:

- add the scale to the y axis
- plot the remaining data from **Table 2**
- draw a line of best fit.

[3 marks]

Figure 2



0 3 . 5 At what partial pressure is the oxygen saturation of haemoglobin 75%?

[1 mark]

Partial pressure = _____ mm Hg

Question 3 continues on the next page

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0 3 . 6 Which substance causes the Bohr effect?

[1 mark]

Tick (✓) **one** box.

Calcium ☐

Carbon dioxide ☐

Oxygen ☐

Phosphate ☐

0 3 . 7 Sketch a line on **Figure 2** on page 11 to show what would happen to the oxygen dissociation graph when the Bohr effect happens.

[2 marks]

0 3 . 8 Why is the rate of increase in oxygen saturation of haemoglobin low at low partial pressures of oxygen?

[1 mark]

Tick (✓) **one** box.

All oxygen molecules bind to haemoglobin at the same rate. ☐

It is easiest for the final oxygen molecule to bind to haemoglobin. ☐

It is hardest for the first oxygen molecule to bind to haemoglobin. ☐

0 3 . 9 Suggest **one** way that the number of red blood cells in a person can be increased.

[1 mark]

_____

_____

12

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0 4 A personal trainer is working with a client to improve the client's fitness.

On four days of the week the client does strength training, using weights.

The client has a nutrition plan to guide their eating.

0 4 . 1 The nutrition plan has a higher protein intake on training days compared with rest days.

Explain why the suggested protein intake is higher on a training day.

[2 marks]

0 4 . 2 Give **two** sources of protein the client could include in their diet on a training day.

[2 marks]

1

2

0 4 . 3 Give **two** sources of carbohydrate the client could include on a day with no training to make sure their fat intake is not too high.

[2 marks]

1

2

Question 4 continues on the next page

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0 4 . 4 On a training day, the client lifts heavy weights. The client intended to repeat each exercise 15 times, but only managed to do 9.

Figure 3 shows one of the exercises.

Figure 3

The personal trainer explains that the client can only repeat each exercise 9 times because fast-twitch muscle fibres are used during the exercises.

Explain why a person can only repeat each exercise a small number of times when using fast-twitch muscle fibres.

[3 marks]

Do not write outside the box

0 4 . 5 The client starts taking creatine phosphate supplements.

Explain how creatine phosphate is used in muscle cells during exercise.

[3 marks]

12

Turn over for the next question

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0 5 Synapses are found between neurones.

Many medical drugs are effective at synapses.

Alzheimer's is a disorder that is linked to the lack of a specific neurotransmitter in the brain.

The neurotransmitter linked to Alzheimer's is acetylcholine.

0 5 . 1 What is a neurotransmitter?

[1 mark]

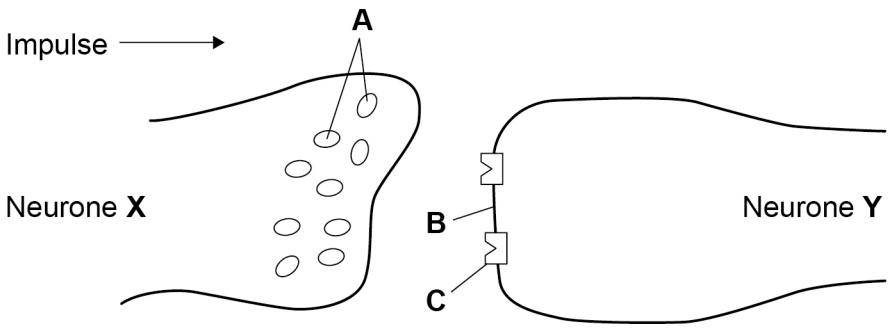
0 5 . 2 Alzheimer's causes memory loss.

Which lobe in the cerebral cortex is associated with memory?

[1 mark]

Figure 4 shows a synapse from a healthy person.

Figure 4



0 5 . 3 Name parts **A**, **B** and **C**.

[3 marks]

A

B

C

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0 5 . 4 When acetylcholine is released from Neurone **X**, not all of the other neurones in the brain can respond.

Suggest why some neurones **cannot** respond to acetylcholine.

[1 mark]

0 5 . 5 Acetylcholine must be recycled after it has been released from Neurone **Y**.

Describe how acetylcholine is recycled so it is ready to be used again.

[4 marks]

Question 5 continues on the next page

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0 5 . 6 The brain of a person with Alzheimer's has a lower concentration of the acetylcholine neurotransmitter than the brain of a person without Alzheimer's.

There are two main ways that drugs to treat Alzheimer's can work in the synapses of a person's brain.

Explain the **two different** ways a drug can work in a synapse to treat the symptoms of Alzheimer's.

[4 marks]

1 _____

_____

_____

_____

2 _____

_____

_____

_____

14

END OF QUESTIONS

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