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I declare this is my own work.

Level 3 Certificate/Extended Certificate

APPLIED SCIENCE

Unit 4 The Human Body

ASC4

Time allowed: 1 hour 30 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]



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 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.

DO NOT TURN OVER UNTIL TOLD TO DO SO





0 4

Answer ALL questions.

01

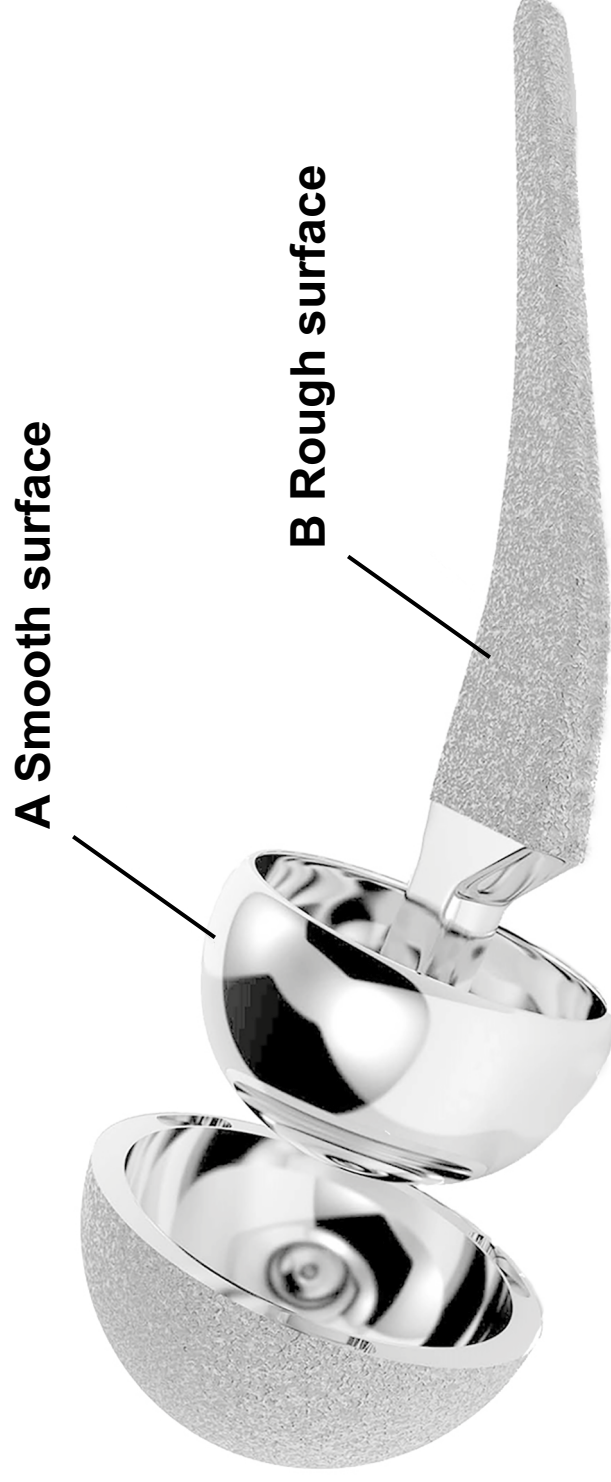
There are many different types of joint in the human body.

Natural joints can be replaced with artificial joints.

FIGURE 1 shows one type of artificial joint.

FIGURE 1

4



01.1

**What type of artificial joint is shown in FIGURE 1?
[1 mark]**

Tick (✓) ONE box.

☐

Ball and socket

☐

Gliding

☐

Hinge

01.2

**Name ONE joint in the human body that is the same type
of joint as FIGURE 1. [1 mark]**

[Turn over]



01.3

Suggest ONE reason why part A of the artificial joint has a smooth surface. [1 mark]

01.4

Suggest ONE reason why part B of the artificial joint has a rough surface. [1 mark]



01.5

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 _____

[Turn over]



01.6

**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



01.7

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

[Turn over]



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

01.8

Where would you find a pivot joint in the axial skeleton?
[1 mark]

01.9

Describe the range of motion in a pivot joint. [1 mark]

10



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[Turn over]



02

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.

02.1

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



02.2

In which part of the digestive system does the absorption of vitamin D take place? [1 mark]

02.3

Give THREE features of an effective absorption surface in the human body. [3 marks]

1

2

3

[Turn over]



02.4

A balanced diet includes macronutrients and micronutrients.

What is the difference between macronutrients and micronutrients? [1 mark]



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

02.5

Give TWO symptoms of vitamin D deficiency. Do NOT refer to depression in your answer. [2 marks]

1

2

02.6

Name ONE neurotransmitter that is linked with depression. [1 mark]

[Turn over]



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



02.7

Give TWO conclusions you can make from TABLE 1.
[2 marks]

1 _____

2 _____

02.8

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]



03

Oxygen is carried in the bloodstream.

03.1

Describe how to use a pulse oximeter to measure oxygen saturation. [1 mark]

03.2

Complete the equation below to show how oxygen is transported around the body. [1 mark]

_____ + _____ \rightleftharpoons oxyhaemoglobin

03.3

What is a sphygmomanometer used to measure? [1 mark]



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

[Turn over]



03.4

Complete FIGURE 2 opposite.

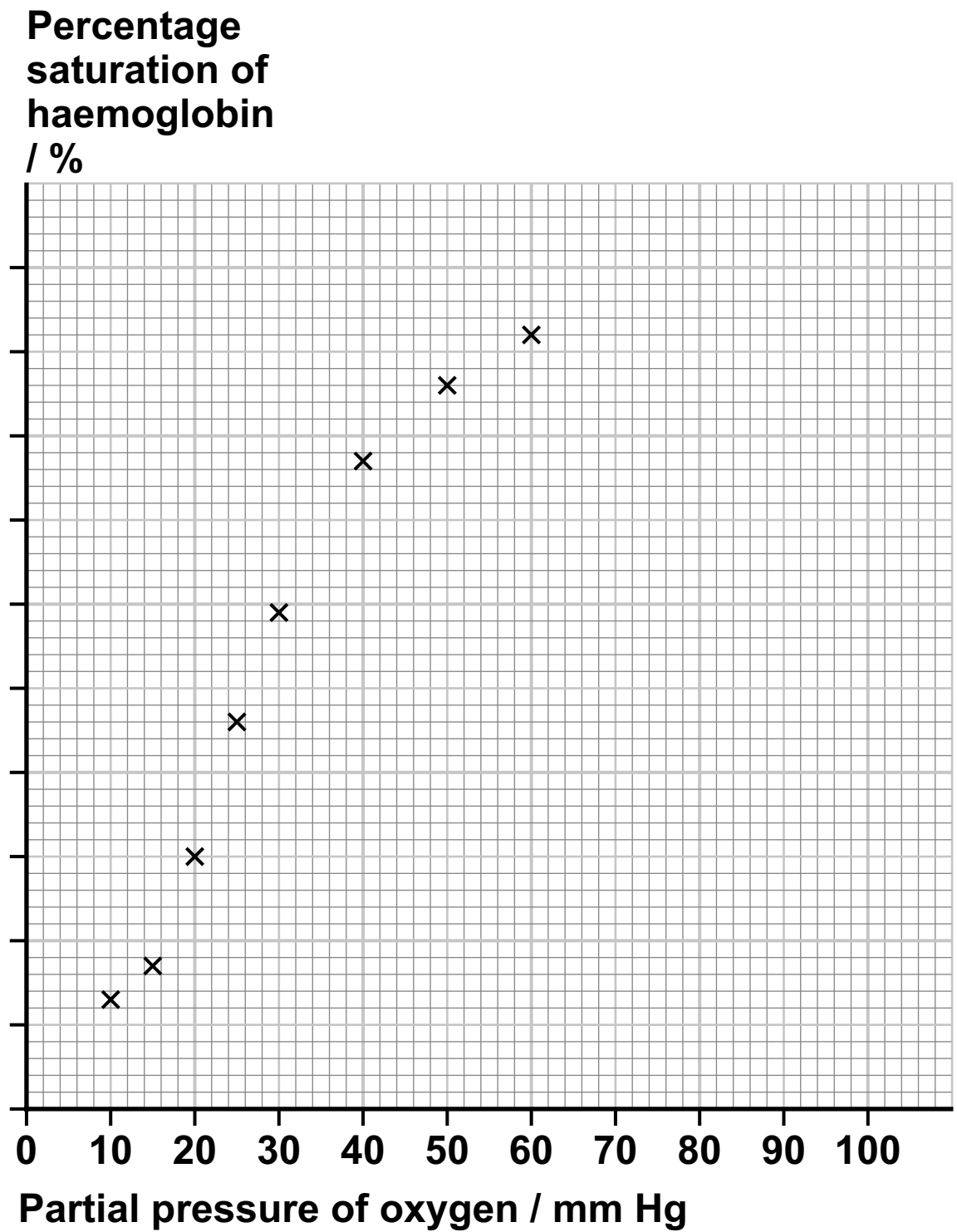
You should:

- **add the scale to the y axis**
- **plot the remaining data from TABLE 2 on page 19**
- **draw a line of best fit.**

[3 marks]



FIGURE 2



[Turn over]



03.5

At what partial pressure is the oxygen saturation of haemoglobin 75%? [1 mark]

Partial pressure = _____ mm Hg

03.6

Which substance causes the Bohr effect? [1 mark]

Tick (✓) ONE box.

☐

Calcium

☐

Carbon dioxide

☐

Oxygen

☐

Phosphate



03.7

Sketch a line on FIGURE 2 on page 21 to show what would happen to the oxygen dissociation graph when the Bohr effect happens. [2 marks]

03.8

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.

[Turn over]



03.9

Suggest ONE way that the number of red blood cells in a person can be increased. [1 mark]

12



04

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.

04.1

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]

[Turn over]



04.2

Give TWO sources of protein the client could include in their diet on a training day. [2 marks]

1 _____

2 _____



04.3

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 _____

[Turn over]



04.4

**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]

[Turn over]



04.5

The client starts taking creatine phosphate supplements.

Explain how creatine phosphate is used in muscle cells during exercise. [3 marks]

12



05

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.

05.1

What is a neurotransmitter? [1 mark]

05.2

Alzheimer's causes memory loss.

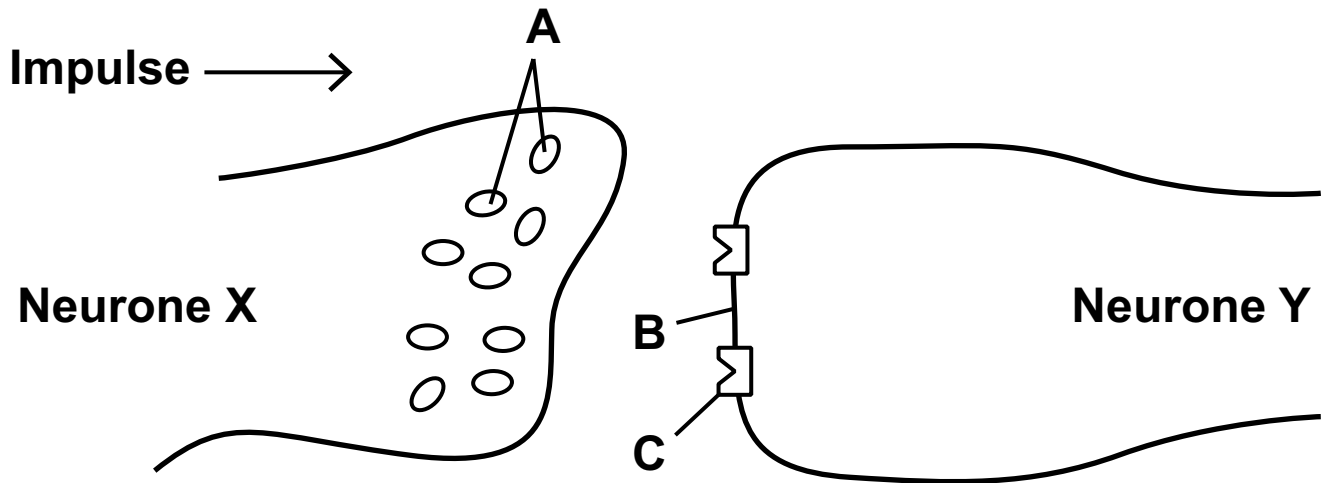
Which lobe in the cerebral cortex is associated with memory? [1 mark]

[Turn over]



FIGURE 4 shows a synapse from a healthy person.

FIGURE 4



05.3

Name parts A, B and C. [3 marks]

A _____

B _____

C _____



05.4

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]

[Turn over]



05.5

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]



BLANK PAGE

[Turn over]



05.6

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

Additional page, if required.

Write the question numbers in the left-hand margin.

[illegible]

Additional page, if required.

Write the question numbers in the left-hand margin.

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Question	Mark
1	
2	
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TOTAL	

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