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

Thursday 16 January 2020 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.
- 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.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
TOTAL	

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

Advice

Read each question carefully.

Answer **all** questions.

Do not write outside the box

0 1 Knowledge of the skeletal system is important to professionals in sports industries.

0 1 . 1 Give **two** functions of the skeleton.

[2 marks]

1 _____

_____

2 _____

_____

0 1 . 2 The ends of bones are covered with a material that protects the bone from impact.

What is the name of this material?

Tick (✓) **one** box.

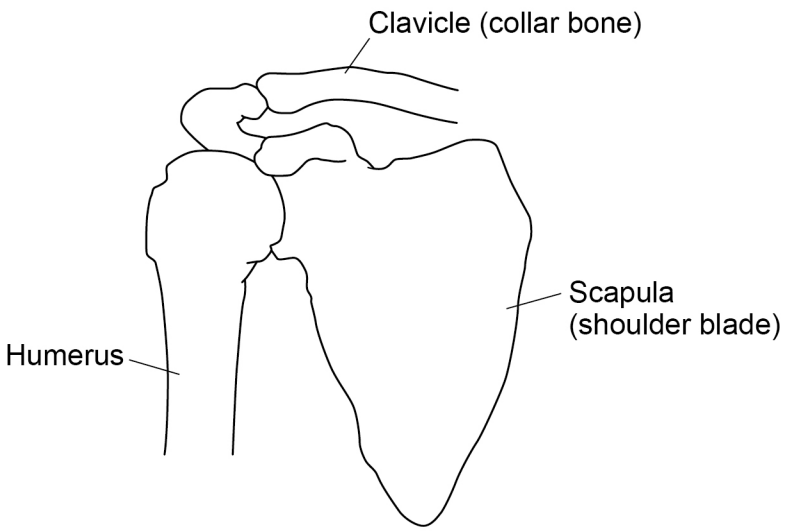
[1 mark]

- Bone marrow ☐
- Cartilage ☐
- Ligament ☐
- Synovial membrane ☐

Do not write outside the box

Figure 1 shows a shoulder joint.

Figure 1



0 1 . 3 What type of joint is shown between the humerus and the scapula?

[1 mark]

_____

0 1 . 4 What type of joint can only move in one plane?

[1 mark]

_____

0 1 . 5 The humerus is part of the appendicular skeleton.

Name **two** bones in the **axial** skeleton.

[2 marks]

1 _____

2 _____

7

Turn over for the next question

Do not write outside the box

0 2 Approximately 3 million people in the UK live with depression.

0 2 . 1 Depression is linked to a lack of a neurotransmitter in the brain.

Name the neurotransmitter that is lacking in the brain of someone with depression.

[1 mark]

0 2 . 2 Give **two** symptoms of depression.

[2 marks]

1

2

There may be a link between obesity and depression.

A diet high in lipids and sugars can cause obesity.

0 2 . 3 Give **two** uses of lipids in the human body.

[2 marks]

1

2

Do not write outside the box

Scientists studied the possible link between body mass index (BMI) and depression.

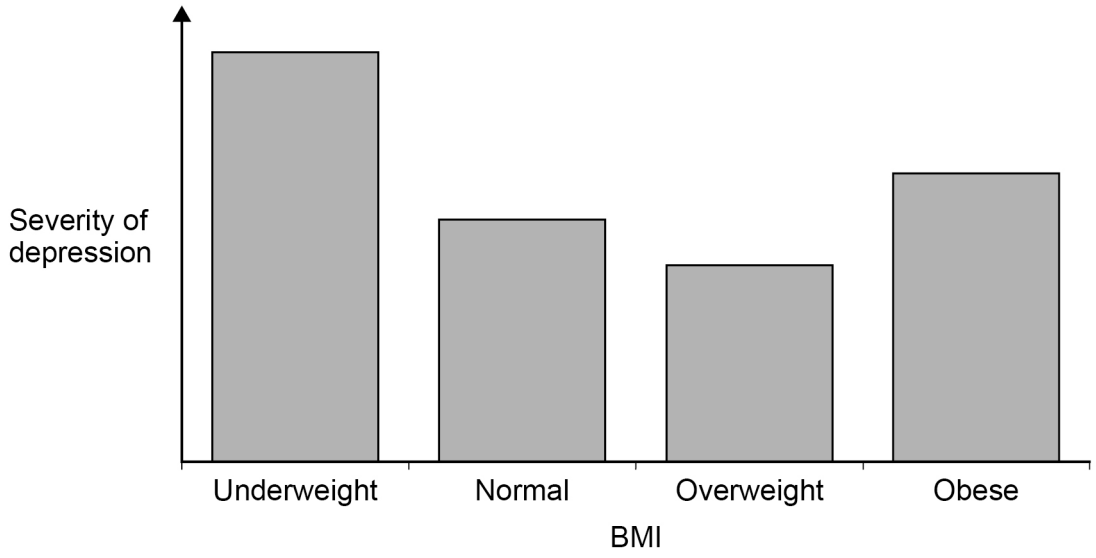
BMI helps to show if a person has a healthy mass for their height.

The study included data from more than 40 000 volunteers. The volunteers were aged between 18 and 90 years. The study took 6 years to complete.

A standard questionnaire was used to assess the severity of depression. The questionnaire was completed by the volunteers.

Figure 2 shows the scientists' results.

Figure 2



0 2 . 4 How could the study be improved so that a more valid conclusion can be made?

Do **not** refer to the number of volunteers in the study or the time taken for the study.

[1 mark]

0 2 . 5 Give **two** conclusions you can make from **Figure 2**.

[2 marks]

1

2

Question 2 continues on the next page

Do not write outside the box

Parkinson's disease is affected by a lack of a different neurotransmitter in the brain.

0 2 . 6 Which **two** are symptoms of Parkinson's disease?

Tick (✓) **two** boxes.

[2 marks]

- Decrease in blood cholesterol ☐
- Muscle stiffness ☐
- Reduced absorption of salt ☐
- Tremors in the hands ☐
- Weakened teeth ☐

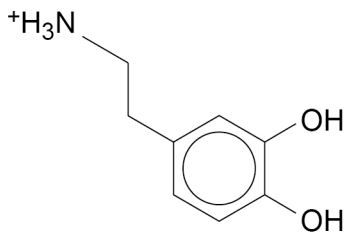
Do not write outside the box

0 2 . 7 People with Parkinson's disease do **not** have enough dopamine in their brain.

Figure 3 shows the chemical structure of dopamine.

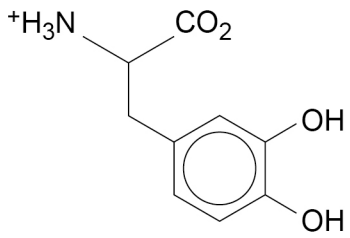
Figure 4 shows the chemical structure of drug **B**. Drug **B** is used to treat Parkinson's disease.

Figure 3



Dopamine

Figure 4



Drug B

Suggest an explanation for how drug **B** helps treat the symptoms of Parkinson's disease.

[2 marks]

12

Turn over for the next question

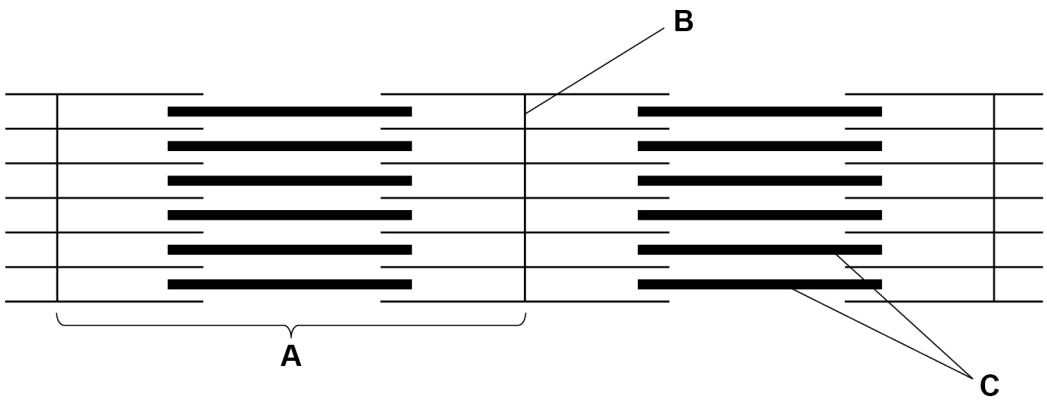
Do not write outside the box

0 3 The contraction of muscles is described by the sliding filament theory.

Muscles are made of myofibrils.

Figure 5 shows part of a myofibril.

Figure 5



0 3 . 1 Name **A**, **B** and **C** in **Figure 5**.

[3 marks]

A _____

B _____

C _____

0 3 . 2 Explain what happens to **A** when the muscle contracts.

[2 marks]

_____

_____

_____

_____

Do not write outside the box

0 3 . 3 When a muscle contracts, actinomyosin cross bridges form and break repeatedly.

How fast do the actinomyosin cross bridges form and break?

Tick (✓) **one** box.

[1 mark]

- 100 times per microsecond ☐
- 100 times per millisecond ☐
- 100 times per minute ☐
- 100 times per second ☐

0 3 . 4 Energy is needed to break cross bridges.

Where does this energy come from?

[1 mark]

0 3 . 5 Describe the role of calcium ions in muscle contraction.

[3 marks]

Question 3 continues on the next page

Do not write outside the box

0 3 . 6 When action potentials arrive at a muscle, the muscle contracts.

Describe what happens to the calcium ions when the action potentials stop arriving at the muscle.

[2 marks]

0 3 . 7 Muscles are made of fast-twitch fibres and slow-twitch fibres.

Which **three** are features of **slow-twitch** fibres?

Tick (✓) **three** boxes.

[3 marks]

- Does not store glycogen ☐
- Functions over long periods of time ☐
- Has a high density of mitochondria ☐
- Has a very good blood supply ☐
- Large stores of creatine phosphate ☐
- Respires anaerobically ☐

Do not write outside the box

0 3 . 8 Some athletes take creatine supplements.

Describe how creatine phosphate is regenerated during aerobic respiration.

[2 marks]

17

Turn over for the next question

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

0 4 This question is about the nervous system.

0 4 . 1 A woman is taken to a hospital with a suspected overdose of the drug pilocarpine.

Pilocarpine stimulates the parasympathetic nervous system.

Describe how an overdose of pilocarpine might affect the woman's pupils and breathing rate.

[2 marks]

Effect on pupils _____

_____

Effect on breathing rate _____

_____

0 4 . 2 A man is taken to a hospital with a head injury.

The man cannot maintain his breathing rate and heart rate.

Which part of the brain has probably been damaged?

Tick (✓) **one** box.

[1 mark]

Brain stem ☐

Cerebellum ☐

Cerebral cortex ☐

Hypothalamus ☐

0 4 . 3 Give **one** function of the frontal lobe in the brain.

[1 mark]

_____

_____

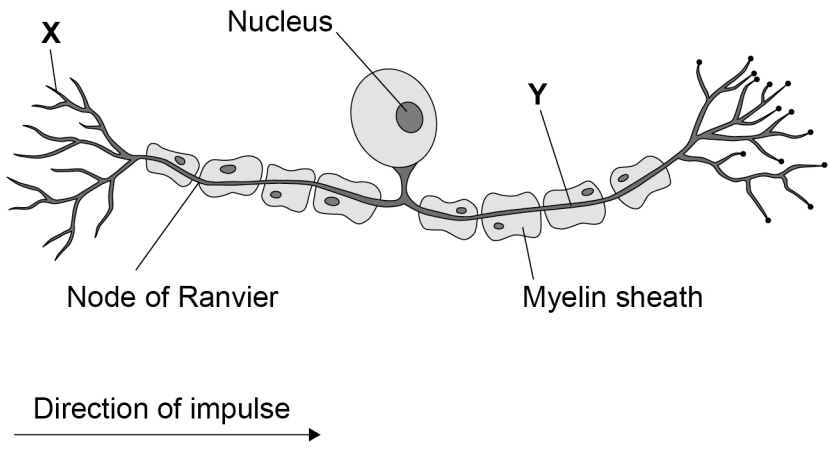
Question 4 continues on the next page

Do not write outside the box

The nervous system contains different types of neurone.

Figure 6 shows one type of neurone.

Figure 6



0 4 . 4 Name parts **X** and **Y** in **Figure 6**.

[2 marks]

X _____

Y _____

0 4 . 5 What type of neurone does **Figure 6** show?

[1 mark]

_____

0 4 . 6 How does a sodium-potassium pump maintain the resting potential of a neurone?

Tick (✓) **one** box.

[1 mark]

Moves potassium ions and sodium ions into the cell. ☐

Moves potassium ions and sodium ions out of the cell. ☐

Moves potassium ions into the cell and sodium ions out of the cell. ☐

Moves sodium ions into the cell and potassium ions out of the cell. ☐

Do not write outside the box

0 4 . 7 During an action potential a neurone depolarises. During depolarisation the potential across the membrane changes from –70 mV to +40 mV.

Explain what causes the change in membrane potential during depolarisation.

[3 marks]

0 4 . 8 Look at the structure of the neurone in **Figure 6**.

Explain how the structure enables conduction of impulses at very high speeds.

[2 marks]

13

Turn over for the next question

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

0 5 Many cyclists drink sports drinks when they are competing.

Sports drinks contain a mixture of:

- water
- carbohydrates
- salts.

Sports drinks' manufacturers often claim the carbohydrates give the cyclists an energy boost.

0 5 . 1 Sodium chloride (sodium ions) can be added to the sports drinks to increase uptake of glucose from the small intestine.

Explain how sodium chloride (sodium ions) increases uptake of glucose from the small intestine.

[3 marks]

Question 5 continues on the next page

A scientist investigated the effectiveness of different drinks on the uptake of glucose into the bloodstream of four cyclists.

Each cyclist drank one of four drinks and their blood glucose concentration was measured every 30 minutes. All of the cyclists were cycling at a constant speed during the investigation.

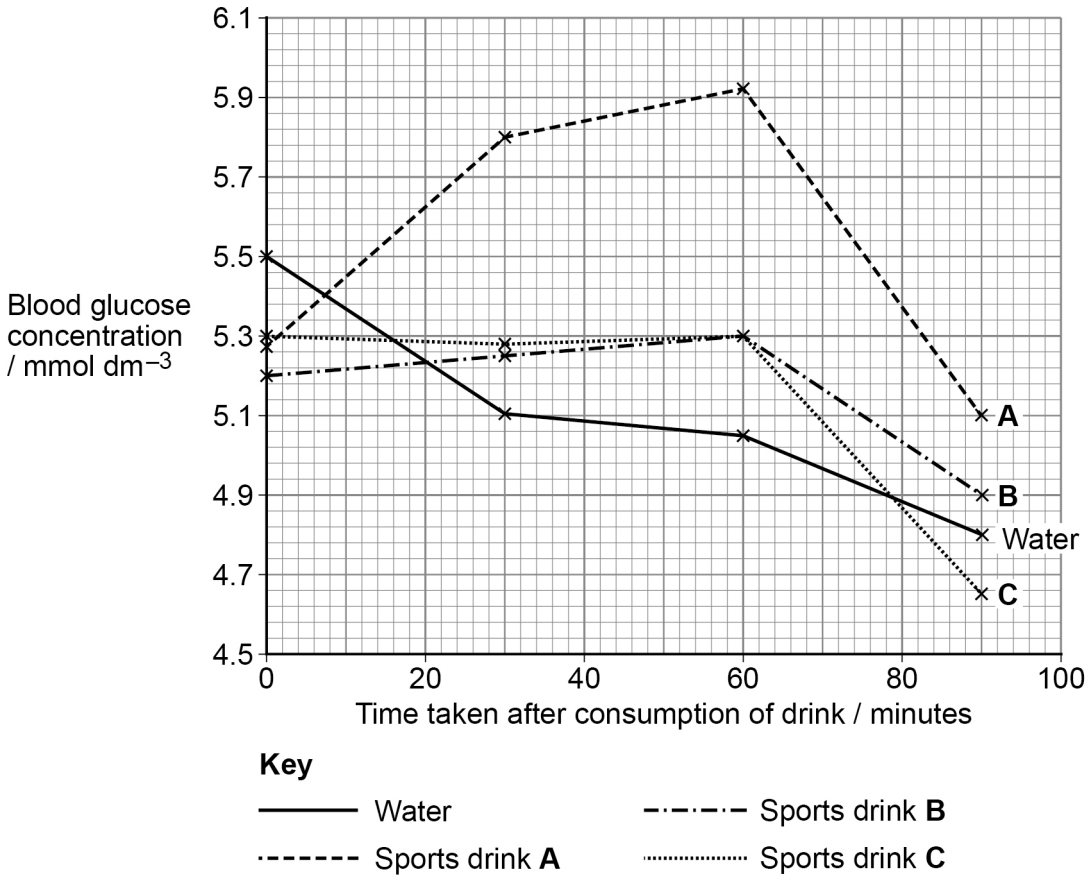
Table 1 shows information about the composition of the different drinks.

Table 1

Drink	**Glucose / g dm^{-3}**	**Sodium chloride / g dm^{-3}**	**Vitamin B / mg dm^{-3}**	**Protein / g dm^{-3}**
Water	0.0	0.0	0.0	0.0
Sports drink **A**	40.2	1.32	0.0	0.0
Sports drink **B**	36.0	0.23	11.0	0.0
Sports drink **C**	29.0	0.0	10.7	4.0

Figure 7 shows some of the scientist's results.

Figure 7



Do not write outside the box

0 5 . 2 A student studied the scientist's results and made the following conclusion:

sodium chloride increases the uptake of glucose.

Give **two** pieces of evidence from **Figure 7** and **Table 1** that support the student's conclusion.

[2 marks]

1 _____

_____

2 _____

_____

0 5 . 3 Give **two** reasons why the student's conclusion may **not** be valid.

Use **Figure 7** and **Table 1**.

[2 marks]

1 _____

_____

2 _____

_____

0 5 . 4 Calculate the percentage decrease in blood glucose concentration after 90 minutes for the cyclist who drank water.

[3 marks]

Percentage decrease = _____ %

0 5 . 5 Suggest **one** reason why protein is added to drink **C**.

[1 mark]

_____

END OF QUESTIONS

11

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED