

Combined Science
PAPER 4
Higher Tier

Total Marks

Friday 7 June 2024 – Afternoon

Time: 1 hour 10 minutes

In the boxes below, write your name, centre number and candidate number.

Surname					
Other names					
Centre Number					
Candidate Number					

YOU MUST HAVE

Ruler, calculator

YOU WILL BE GIVEN

Diagram Booklet

INSTRUCTIONS

Answer ALL questions.

Answer the questions in the spaces provided in this Question Paper or in the separate Diagram Booklet – there may be more space than you need.

INFORMATION

The total mark for this paper is 60.

The marks for EACH question are shown in brackets – use this as a guide as to how much time to spend on each question.

There may be spare copies of some diagrams.

In questions marked with an ASTERISK (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.

ADVICE

Read each question carefully before you start to answer it.

Try to answer every question.

Check your answers if you have time at the end.

Answer ALL questions.

Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

- 1 A centrifuge can be used to separate the different parts of human blood.**

Look at Figure 1 for Question 1 in the Diagram Booklet. It shows blood separated into different parts.

- (a) (i) Name part X.
(1 mark)**

(continued on the next page)

1(a) continued.

**(ii) Which substance, needed for cellular respiration, is carried by red blood cells?
(1 mark)**

☐ **A carbon dioxide**

☐ **B urea**

☐ **C amino acids**

☐ **D oxygen**

(continued on the next page)

1(a) continued.

**(iii) Name TWO types of
white blood cell.
(2 marks)**

1 _____

2 _____

(continued on the next page)

1 continued.

- (b) (i) When a person donates blood, 470 cm^3 of blood is removed from their body.**

Red blood cells make up 44% by volume of the blood.

Calculate the volume of red blood cells in 470 cm^3 of donated blood.

**Give your answer to the nearest whole number.
(3 marks)**

Answer space continues on the next page.

1(b)(i) continued.

_____ **cm³**

(continued on the next page)

1(b) continued.

- (ii) Before donating blood, a person has a small blood sample taken to check that the blood is healthy.**

**State TWO precautions a doctor should take when collecting this sample.
(2 marks)**

1 _____

2 _____

(Total for Question 1 = 9 marks)

2 (a) Look at Figure 2 for Question 2(a) in the Diagram Booklet. It shows a root hair cell from a plant.

**(i) Name the part labelled X.
(1 mark)**

**(ii) State ONE way that the structure of the root hair cell increases the volume of substances it absorbs.
(1 mark)**

(continued on the next page)

2(a) continued.

**(iii) Explain why root hair cells do not contain chloroplasts.
(3 marks)**

(continued on the next page)

Turn over

2 continued.

(b) A student studied the water plant Elodea.

The student used a light microscope to observe the cells of the plant in tap water and in a 10% salt solution.

Look at Figure 3 for Question 2(b) in the Diagram Booklet. It shows Elodea cells in tap water and in a 10% salt solution.

**(i) Describe TWO ways that the Elodea cells in the 10% salt solution are different from the Elodea cells in tap water.
(2 marks)**

Answer space continues on the next page.

1 _____

Turn over

2(b)(i) continued.

2 _____

(continued on the next page)

2(b) continued.

- (ii) Explain why placing the *Elodea* cells in the 10% salt solution causes the changes seen in Figure 3.
(3 marks)**

(Total for Question 2 = 10 marks)

Turn over

3 (a) A scientist decided to study the variety of living organisms in a garden.

(i) The scientist wanted to use a random sampling technique.

**Devise a plan the scientist could use to randomly sample the number of plant species in the garden.
(3 marks)**

Answer space continues on the next page.

3(a)(i) continued.

(continued on the next page)

3(a) continued.

- (ii) The scientist also measured abiotic factors in the garden.**

The pH of the soil was measured using a pH meter.

**Describe how THREE other abiotic factors could be measured in the garden.
(3 marks)**

Answer space continues on the next page.

1 _____

2 _____

Turn over

3(a)(ii) continued.

3 _____

(continued on the next page)

3(a) continued.

(iii) Mistletoe is a parasite that grows on some trees.

Look at Figure 4 for Question 3(a)(iii) in the Diagram Booklet. It shows a tree with mistletoe growing on it.

**Describe the feeding relationship between the mistletoe and the tree.
(2 marks)**

(continued on the next page)

Turn over

3 continued.

(b) Nitrate fertilisers are used in the garden.

**Explain why nitrate fertilisers are used in gardens.
(2 marks)**

(Total for Question 3 = 10 marks)

4 A student investigated the effect of glucose concentration on the rate of anaerobic respiration in yeast.

(a) The student used five concentrations of glucose: 5%, 10%, 15%, 20% and 25%.

A teaspoon of dried yeast was added to 20 cm³ of the 5% glucose concentration in a measuring cylinder.

A drop of washing up liquid was added and the mixture was stirred.

A reaction occurred and bubbles collected as foam on the surface of the mixture.

The height of the foam was measured after five minutes.

This method was repeated for each concentration of glucose.

(continued on the next page)

Turn over

4(a) continued.

- (i) Describe how to set up a control for this investigation.
(2 marks)**

(continued on the next page)

4(a) continued.

- (ii) State how the scientist could improve this investigation to increase the rate of the reaction.
(1 mark)**

(continued on the next page)

4 continued.

(b) Look at Figure 5 for Question 4(b) in the Diagram Booklet. It shows the results of this investigation.

(i) The student thought one of the results was anomalous.

**Explain which of these results is anomalous.
(2 marks)**

(continued on the next page)

Turn over

4(b) continued.

- (ii) Explain why the height of the foam was greatest for the 25% glucose concentration.
(3 marks)**

Answer space continues on the next page.

Turn over

4(b)(ii) continued.

(Total for Question 4 = 8 marks)

- 5 (a) Look at Figure 6 for Question 5(a) in the Diagram Booklet. It shows a human heart.**
- (i) Draw arrows on Figure 6 to show the direction of blood flow through the left side of the heart. (2 marks)**
- (ii) Name the main blood vessel that carries deoxygenated blood into the heart. (1 mark)**
-
-

(continued on the next page)

5 continued.

(b) Look at Figure 7 for Question 5(b) in the Diagram Booklet. It shows the heart rate and stroke volume of a person when at rest and when doing exercise.

(i) Calculate the difference in cardiac output when at rest and when doing exercise.

**Give your answer to 3 significant figures and include units in your answer.
(4 marks)**

Answer space continues on the next page.

5(b)(i) continued.

answer _____

(continued on the next page)

5(b) continued.

- (ii) Explain why the cardiac output needs to increase during exercise. (4 marks)**

Answer space continues on the next page.

Turn over

5(b)(ii) continued.

(Total for Question 5 = 11 marks)

6 (a) The female contraceptive pill contains hormones to prevent pregnancy.

**(i) Which hormones are in the female combined contraceptive pill?
(1 mark)**

☐ **A FSH and oestrogen**

☐ **B oestrogen and progesterone**

☐ **C progesterone and LH**

☐ **D LH and FSH**

(continued on the next page)

6(a) continued.

- (ii) Explain how the hormones
in contraceptive pills
prevent ovulation.
(3 marks)**

Answer space continues on the next page.

Turn over

6(a)(ii) continued.

(continued on the next page)

6(a) continued.

- (iii) Explain how a barrier method of contraception prevents pregnancy.
(2 marks)**

(continued on the next page)

6 continued.

***(b) Hormones can be used as part of assisted reproductive technology.**

**Explain how assisted reproductive technology (ART) can be used to increase the chances of a woman becoming pregnant.
(6 marks)**

Answer space continues on the next 2 pages.

Turn over

6(b) continued.

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Turn over

6(b) continued.

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(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS
END OF PAPER