

Combined Science
PAPER 4
Foundation Tier

Total Marks

Time: 1 hour 10 minutes plus your additional time allowance

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

Surname					
Other names					
Centre Number					
Candidate Number					

YOU MUST HAVE

Calculator, ruler

YOU WILL BE GIVEN

Diagram Booklet

INSTRUCTIONS

Answer ALL questions.

Answer the questions in the spaces provided – there may be more space than you need.

Calculators may be used.

Any diagrams may NOT be accurately drawn, unless otherwise indicated.

You must show all your working out with your answer clearly identified at the end of your solution.

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.

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.

Turn over

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 Look at Figure 1 for Question 1(a)(i) in the Diagram Booklet. It shows human blood seen using a light microscope.**

- (a) (i) The organelle labelled X controls the activities of the white blood cell.**

**What is the name of organelle X?
(1 mark)**

- ☐ **A mitochondrion**
- ☐ **B ribosome**
- ☐ **C chromosome**
- ☐ **D nucleus**

(continued on the next page)

1 continued.

- (ii) Use words from the the list below to complete the sentences.
(2 marks)**

gas

haemoglobin

hormone

liquid

platelet

solid

Red blood cells contain the substance

_____ .

Blood plasma is a _____ .

(continued on the next page)

1 continued.

**(iii) Describe TWO ways that white blood cells protect the body from disease.
(2 marks)**

1 _____

2 _____

(continued on the next page)

1 continued.

(b) Look at Figure 2 for Question 1(b) in the Diagram Booklet. It shows a white blood cell on a 100 μm scale.

**State the width of the white blood cell.
(1 mark)**

_____ μm

(continued on the next page)

1 continued.

- (c) Look at Figure 1 for Question 1(c) in the Diagram Booklet. It shows human blood seen using a light microscope.**

**Explain why using an electron microscope shows the structures in the white blood cells more clearly.
(2 marks)**

(Total for Question 1 = 8 marks)

- 2 (a) There are three levels of organisation in an ecosystem.**

**Which order shows the levels of organisation from lowest to highest?
(1 mark)**

- ☐ **A community, population, organism**
- ☐ **B community, organism, population**
- ☐ **C organism, community, population**
- ☐ **D organism, population, community**

(continued on the next page)

2 continued.

(b) Look at Figure 3 for Question 2(b) in the Diagram Booklet. It shows food webs for two gardens.

Slug pellets are put on the soil around the lettuce plants in garden A and garden B.

Slug pellets kill slugs.

(i) A scientist predicts that the number of caterpillars will decrease in garden A.

**Give ONE reason why the number of caterpillars will decrease in garden A.
(1 mark)**

(continued on the next page)

2 continued.

- (ii) The scientist predicts that the number of caterpillars will increase in garden B.**

**Give ONE reason why the number of caterpillars will increase in garden B.
(1 mark)**

(continued on the next page)

2 continued.

(iii) Look at Figure 4 for Question 2(b)(iii) in the Diagram Booklet. It shows the population of slugs in garden A for five years.

Slug pellets were used during the first year.

Describe the trend in the slug population from year 1 to year 5.

(2 marks)

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2 continued.

- (c) (i) Flatworms from New Zealand that eat slugs are now living in the UK.**

**Which term describes a species from one country that is living in another country?
(1 mark)**

- ☐ **A pathogenic**
- ☐ **B non-pathogenic**
- ☐ **C indigenous**
- ☐ **D non-indigenous**

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2 continued.

- (ii) Tiny white animals called mites can be found crawling all over the skin of slugs.**

The mites feed on blood.

**Explain why these mites are classed as parasites.
(2 marks)**

(Total for Question 2 = 8 marks)

3 (a) Endocrine glands make hormones.

Which endocrine gland is situated in the head and is attached to the brain?

(1 mark)

- ☐ **A adrenal**
- ☐ **B pancreas**
- ☐ **C pituitary**
- ☐ **D thyroid**

Diabetics cannot effectively control the concentration of glucose in their blood.

(b) Person A has type 1 diabetes.

Person B has type 2 diabetes.

Look at the diagram for Question 3(b) in the Diagram Booklet. Draw one straight line from each person to the cause of their type of diabetes.

(2 marks)

(continued on the next page)

3 continued.

- (c) A scientist investigated how the waist to hip ratio affected the probability of developing type 2 diabetes.**

The scientist chose 100 females in each of five waist to hip ratio groups and recorded if they developed type 2 diabetes.

Look at Figure 6 for Question 3(c) in the Diagram Booklet. It shows the results.

- (i) Describe the trend shown in Figure 6.**

**Use data from Figure 6 in your answer.
(2 marks)**

(continued on the next page)

Turn over

3 continued.

- (ii) A female has a waist measurement of 78.3 cm and a hip measurement of 90.0 cm.**

**Calculate the waist to hip ratio for this female and use Figure 6 to estimate the probability that she will develop type 2 diabetes.
(2 marks)**

probability_____%

(continued on the next page)

3 continued.

- (d) (i) The scientist also measured the BMI of the females.**

BMI and waist to hip ratio are two factors that affect the probability of females developing type 2 diabetes.

**State TWO other factors about the females in the study that would affect the probability of them developing type 2 diabetes.
(2 marks)**

1 _____

2 _____

(continued on the next page)

3 continued.

- (ii) State why an athlete may have a high BMI but still have a low probability of developing type 2 diabetes.
(1 mark)**

(Total for Question 3 = 10 marks)

4 (a) Look at Figure 7 for Question 4(a) in the Diagram Booklet. It shows a single-celled pond organism (**Amoeba proteus**).

(i) Which row of the table allows the net diffusion of oxygen into **Amoeba proteus**?
(1 mark)

	concentration of oxygen in water in ppm	concentration of oxygen in Amoeba proteus in ppm
<input type="checkbox"/> A	4	4
<input type="checkbox"/> B	10	10
<input type="checkbox"/> C	4	10
<input type="checkbox"/> D	10	4

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4 continued.

- (ii) *Amoeba proteus* uses oxygen for aerobic respiration.**

Look at the equation for Question 4(a)(ii) in the Diagram Booklet. Complete the equation for aerobic respiration.

(1 mark)

(continued on the next page)

4 continued.

(b) Humans breathe faster when they exercise.

- (i) Which TWO changes allow the rate of respiration in the muscle to increase?
(1 mark)

	heart rate	amount of glucose delivered to the muscles
<input type="checkbox"/> A	increases	increases
<input type="checkbox"/> B	increases	decreases
<input type="checkbox"/> C	decreases	increases
<input type="checkbox"/> D	decreases	decreases

(continued on the next page)

4 continued.

- (ii) Look at Figure 8 for Question 4(b)(ii) in the Diagram Booklet. It shows breathing data for a human at rest and when running at 5 metres per second on a running machine.**

Calculate the mean volume of air breathed per minute when running at 5 metres per second.

**Give your answer to one decimal place.
(2 marks)**

_____ dm³ per minute

(continued on the next page)

4 continued.

- (iii) Devise an investigation to compare the mean number of breaths per minute for men, with the mean number of breaths per minute for women, when running at 5 metres per second on a running machine.
(4 marks)**

(continued on the next page)

Turn over

4 continued.

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4 continued.

- (c) Whilst running, the leg muscles of an athlete tightened up, causing cramp.**

Name the product of anaerobic respiration that can cause cramp.

(1 mark)

(Total for Question 4 = 10 marks)

- 5 Trees are growing in an area of woodland. Between the trees, dead leaves cover the woodland floor and small green plants are growing in the ground.

(a) The leaves of the small plants are green.

Describe how these plants make glucose.
(2 marks)

(continued on the next page)

5 continued.

- (b) Name a group of organisms that break down the dead leaves and release mineral ions into the soil.
(1 mark)**

(continued on the next page)

5 continued.

- (c) The mineral ions are absorbed from the soil into the roots of plants.**

Describe how these mineral ions are transported from the roots to the leaves of the plants.

(2 marks)

(continued on the next page)

5 continued.

- (d) A scientist recorded the mean light intensity and the mean number of small plants per m^2 for six 25m^2 areas of the woodland.**

Look at Figure 10 for Question 5(d) in the Diagram Booklet. It shows the results.

- (i) Explain the effect of light intensity on the number of small plants per m^2 .
(2 marks)**

(continued on the next page)

5 continued.

- (ii) State ONE variable the scientist should have controlled to make sure the light intensity measurements could be compared.
(1 mark)**

(continued on the next page)

5 continued.

- (e) The scientist selects an area near the edge of the woodland where many stinging nettles are growing.**

This area is partly shaded by the trees.

Describe how the scientist should use a belt transect to investigate how light intensity affects the growth of stinging nettles.

(3 marks)

(continued on the next page)

Turn over

5 continued.

(Total for Question 5 = 11 marks)

- 6 (a) Look at Figure 11 for Question 6(a) in the Diagram Booklet. It shows ciliated epithelial cells from the airways of a human as seen using a light microscope.**

(i) Draw the cell labelled A in the space below.

**Label THREE parts of this cell on your diagram.
(4 marks)**

(continued on the next page)

6 continued.

- (ii) State the function of the ciliated epithelial cells in the airways of the human breathing system.
(1 mark)**

(continued on the next page)

6 continued.

- (b) Look at Figure 12 for Question 6(b) in the Diagram Booklet. It shows equipment used to investigate the rate of respiration in maggots.**

As the maggots respire, the drop of coloured liquid moves towards the test tube.

Look at Figure 13 for Question 6(b) in the Diagram Booklet. It shows the position of the drop of coloured liquid after ten minutes.

Use information from Figures 12 and 13 to calculate the mean rate of respiration of the maggots in mm per minute.

(2 marks)

_____ mm per minute

(continued on the next page)

Turn over

6 continued.

***(c) Explain how alveoli in human lungs are adapted for gas exchange.**

**Include the names of the gases that are being exchanged.
(6 marks)**

6 continued.

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(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS
END OF PAPER