

**Combined Science**  
**PAPER 4**  
**Higher Tier**

Total Marks
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**Time: 1 hour 10 minutes plus your additional time allowance**

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

<b>Surname</b>					
<b>Other names</b>					
<b>Centre Number</b>					
<b>Candidate Number</b>					

## **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.**

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

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**1 continued.**

- (b) 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)**

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**1 continued.**

- (c) A scientist recorded the mean light intensity and the mean number of small plants per  $\text{m}^2$  for six  $25\text{m}^2$  areas of the woodland.**

**Look at Figure 2 for Question 1(c) in the Diagram Booklet. It shows the results.**

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

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**1 continued.**

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

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- (d) 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)**

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**Turn over**

**1 continued.**

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**(Total for Question 1 = 9 marks)**

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- 2 (a) Look at Figure 3 for Question 2(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)**

**2 continued.**

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

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**2 continued.**

- (b) Look at Figure 4 for Question 2(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 5 for Question 2(b) in the Diagram Booklet. It shows the position of the drop of coloured liquid after ten minutes.**

- (i) Use information from Figures 4 and 5 to calculate the mean rate of respiration of the maggots in mm per minute.  
(2 marks)**

**\_\_\_\_\_ mm per minute**

**(continued on the next page)**

**2 continued.**

**(ii) Describe a control for this investigation.  
(2 marks)**

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**(Total for Question 2 = 9 marks)**

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- 3 Look at Figure 6 for Question 3(a) in the Diagram Booklet. It shows the structure and actual size of red blood cells (erythrocytes).**

- (a) (i) Calculate the image size of the top view of this red blood cell if this cell is magnified 400 $\times$ .  
(2 marks)**

**Give your answer in mm.**

\_\_\_\_\_ mm

**(continued on the next page)**

**3 continued.**

- (ii) Explain how the shape of a red blood cell is related to its function.  
(3 marks)**

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**3 continued.**

**(iii) State the role of haemoglobin inside the red blood cell.  
(1 mark)**

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**3 continued.**

**(b) Some blood transfusions contain red blood cells.**

**Red blood cells are stored in a solution containing 5·0% glucose and 0·9% salt.**

**Explain why red blood cells cannot be stored in pure water.**

**(3 marks)**

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**3 continued.**

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**(Total for Question 3 = 9 marks)**

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**4 (a) Methods of contraception include use of hormones and barrier methods.**

**(i) Which form of contraception is a barrier method?  
(1 mark)**

- ☐ **A oral contraception**
- ☐ **B female condom**
- ☐ **C rhythm (calendar) method**
- ☐ **D contraceptive implant**

**(ii) State why a barrier method of contraception may be used in addition to a hormonal method.  
(1 mark)**

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**4 continued.**

**(b) The combined contraceptive pill contains the hormones oestrogen and progesterone.**

**(i) State the endocrine gland that releases oestrogen.**

**(1 mark)**

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**(ii) Explain how high levels of oestrogen and progesterone in the combined contraceptive pill work together to prevent pregnancy.**

**(4 marks)**

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**Turn over**

**4 continued.**

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**4 continued.**

- (c) Hormones can also be used to treat infertility.  
Explain how clomifene therapy and IVF can  
improve female fertility.  
(4 marks)**

**clomifene therapy**

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**IVF**

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**Turn over**

**4 continued.**

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**(Total for Question 4 = 11 marks)**

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- 5 (a) A hospital patient was tested for diabetes.

A nurse recorded his mass and height.

Figure 7 shows these measurements.

**Figure 7**

mass in kg	height in metres
124	1.8

Calculate the BMI of this patient using the information in Figure 7.

(2 marks)

BMI = \_\_\_\_\_

(continued on the next page)

**5 continued.**

**(b) Blood samples were taken from this patient every four hours.**

**Look at Figure 8 for Question 5(b) in the Diagram Booklet. The glucose concentrations were recorded in Figure 8.**

**(i) Describe the trends shown in this data.  
(3 marks)**

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**5 continued.**

- (ii) This patient was diagnosed as being type 2 diabetic.**

**Explain why the blood glucose concentration of this patient remained high from 4 hours to 8 hours.  
(3 marks)**

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**5 continued.**

**(iii) This patient did some exercise during these 24 hours.**

**Explain how the data in Figure 8 shows that this exercise occurred after 8 hours but before 12 hours.**

**(3 marks)**

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**(Total for Question 5 = 11 marks)**

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**Turn over**

**6 Exercise causes changes in the circulation of the blood.**

**In an investigation, the change in blood flow to different parts of the body during exercise was measured.**

**All the volunteers used in the study were healthy females of the same age.**

**Look at Figure 9 for Question 6(a)(i) in the Diagram Booklet. It shows some of the results of this investigation.**

**(continued on the next page)**

**6 continued.**

- (a) (i) During exercise, the blood flow to the stomach changes.**

**Calculate the percentage change in blood flow to the stomach in response to exercise.**

**(3 marks)**

**Give your answer to the nearest whole number.**

\_\_\_\_\_ %

**(continued on the next page)**

**6 continued.**

- (ii) Look at Figure 10 for Question 6(a)(ii) in the Diagram Booklet. It shows all of the results of this investigation.**

**Suggest TWO other variables that should be controlled in this investigation.  
(2 marks)**

**1** \_\_\_\_\_

\_\_\_\_\_

**2** \_\_\_\_\_

\_\_\_\_\_

**(continued on the next page)**

**6 continued.**

**\*(iii) Explain the changes in blood flow, shown in Figure 10, that are caused by exercise.  
(6 marks)**

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**6 continued.**

[illegible]

**(Total for Question 6 = 11 marks)**

**TOTAL FOR PAPER = 60 MARKS**  
**END OF PAPER**