

Combined Science

Paper 4

Higher Tier

Total Marks

Monday 1 June 2020 – Afternoon

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.

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 in the Diagram Booklet.

Figure 1 shows the leaves and flowers of water lily plants (*Nymphaea odorata*) on a lake.

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1 continued.

(a) Water lilies have stomata on the upper surface of the leaves.

Explain why water lilies have no stomata on the lower surface of the leaves. (2 marks)

(continued on the next page)

1 continued.

- (b) (i) The white petals of the water lily flowers cannot photosynthesise.**

Which structure in leaf cells is the site of photosynthesis? (1 mark)

- ☐ **A nucleus**
- ☐ **B vacuole**
- ☐ **C mitochondrion**
- ☐ **D chloroplast**

(continued on the next page)

1 continued.

(ii) Glucose is made by photosynthesis.

Glucose is converted to another sugar to be transported in the plant.

What is the name of this sugar? (1 mark)

☐ **A glycerol**

☐ **B ribose**

☐ **C sucrose**

☐ **D starch**

(continued on the next page)

1 continued.

**(iii) Describe how this sugar is transported from the leaves to the flowers of the water lily.
(2 marks)**

(continued on the next page)

1 continued.

(c) Look at Figure 2 for Question 1(c) in the Diagram Booklet.

Figure 2 shows water lilies growing in a lake in Europe.

One water lily plant was brought from America 10 years ago and planted in the lake shown in Figure 2.

Explain why this non-indigenous plant now covers the whole surface of the lake. (3 marks)

(continued on the next page)

Turn over

1 continued.

(TOTAL FOR QUESTION 1 = 9 MARKS)

- 2 A slide of potato cells was viewed using a light microscope.**

Look at Figure 3 for Question 2 in the Diagram Booklet.

Figure 3 is a drawing of the slide showing starch grains in the potato cells.

- (a) (i) Calculate the mean number of starch grains in potato cells P, Q and R. (1 mark)**

_____ starch grains

(continued on the next page)

2 continued.

(ii) Which structures are found in plant cells but are NOT found in animal cells? (1 mark)

- ☐ **A cell membrane, nucleus, chloroplast**
- ☐ **B cell wall, cell membrane, cytoplasm**
- ☐ **C nucleus, large vacuole, chloroplast**
- ☐ **D cell wall, chloroplast, large vacuole**

(continued on the next page)

2 continued.

- (b) A scientist investigated how the length of starch grains in potatoes changed when the potatoes were stored in the dark.**

Look at Figure 4 for Question 2(b) in the Diagram Booklet.

Figure 4 shows a potato after being stored in the dark.

Three potatoes were used in the investigation.

The length of starch grains in potato 1 were measured at the start.

The length of starch grains were measured in potato 2 after 5 weeks in the dark.

The length of starch grains were measured in potato 3 after 10 weeks in the dark.

(continued on the next page)

2 continued.

Look at Figure 5 for Question 2(b)(i) in the Diagram Booklet.

Figure 5 shows the results.

- (i) Calculate the percentage difference in the mean length of starch grains in potato 2 at 5 weeks and in potato 3 at 10 weeks.
(2 marks)**

_____ %

(continued on the next page)

2 continued.

- (ii) State TWO variables the scientist should have controlled to improve this investigation. (2 marks)**

1 _____

2 _____

(continued on the next page)

2 continued.

(iii) The starch grains in the potatoes became smaller as the starch was converted into glucose.

**State why the potatoes need glucose.
(1 mark)**

(continued on the next page)

2 continued.

(iv) Describe how starch is broken down into glucose. (2 marks)

(TOTAL FOR QUESTION 2 = 9 MARKS)

3 Trypsin is a protease enzyme used in the manufacture of food for babies.

**(a) (i) Which food group is digested by trypsin?
(1 mark)**

☐ **A carbohydrates**

☐ **B lipids**

☐ **C fibre**

☐ **D proteins**

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3 continued.

(ii) The food is mashed before the trypsin is added.

Explain the advantage of mashing the food before adding the trypsin. (2 marks)

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3 continued.

- (b) A manufacturer of baby food wanted to find out the optimum pH for trypsin.**

Equal volumes of different pH solutions were placed in six separate test tubes.

5 cm³ of 1% trypsin solution was added to each test tube.

1.5 g of mashed food was placed in each test tube.

The time taken to digest the food was recorded.

- (i) State ONE other variable that should be controlled in this investigation. (1 mark)**

(continued on the next page)

3 continued.

**(ii) State how this variable could be controlled.
(1 mark)**

(continued on the next page)

3 continued.

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

The results are shown in Figure 6.

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

(continued on the next page)

3 continued.

- (ii) At pH 4, the trypsin digested 1·5 g of mashed food at a rate of 0·8 g per minute.**

Calculate the rate of digestion at pH 1.

**Give your answer to one significant figure.
(2 marks)**

_____ g per minute

(continued on the next page)

3 continued.

**(iii) Explain the difference in the rate of reaction at pH 1 and the rate of reaction at pH 4.
(2 marks)**

(TOTAL FOR QUESTION 3 = 11 MARKS)

- 4 (a) Figure 7 shows the time taken for blood to clot at different temperatures.

Figure 7

temperature in °C	time taken for blood to clot in seconds
5	90
15	70
25	55
35	40
45	110

- (i) Using the template for Question 6(a)(i) in the Diagram Booklet draw a graph to show the data in Figure 7. (3 marks)

(continued on the next page)

4 continued.

(ii) Give TWO safety precautions that should be used when handling blood samples. (2 marks)

1 _____

2 _____

(continued on the next page)

4 continued.

(b) (i) Which part of the blood causes blood to start clotting? (1 mark)

☐ **A erythrocytes**

☐ **B lymphocytes**

☐ **C platelets**

☐ **D antibodies**

(ii) Give ONE advantage of a blood clot forming. (1 mark)

(continued on the next page)

4 continued.

(c) Explain how ONE structure of a vein helps the blood return to the heart. (2 marks)

(TOTAL FOR QUESTION 4 = 9 MARKS)

- 5 Look at Figure 8 for Question 5 in the Diagram Booklet.**

Figure 8 shows the heart rate of person A and person B.

Person A does not do any regular exercise.

Person B has been running regularly for one year.

- (a) Both people rested for the first 6 minutes, then did the same high intensity exercise for the next 12 minutes, then rested.**

Compare the heart rates of person A with the heart rates of person B. (4 marks)

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5 continued.

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5 continued.

- (b) The stroke volume for person B before exercising was 61 ml per beat.**

Calculate the cardiac output for person B before exercising.

Give your answer in litres per minute. (3 marks)

_____ litres per minute

(continued on the next page)

5 continued.

- (c) The cardiac output for person A during exercise was 5.5 litres per minute.**

Explain why the heart rate for person A needed to be higher than the heart rate for person B during exercise. (3 marks)

(TOTAL FOR QUESTION 5 = 10 MARKS)

- 6 (a) Hyperthyroidism is caused by an overactive thyroid gland.**

Look at Figure 9 for Question 6(a) in the Diagram Booklet.

Figure 9 shows a person with a normal thyroid gland and a person with hyperthyroidism.

- (i) State ONE effect of hyperthyroidism on the thyroid gland. (1 mark)**

- (ii) The thyroid gland is part of the (1 mark)**

- ☐ **A circulatory system**
- ☐ **B digestive system**
- ☐ **C endocrine system**
- ☐ **D urinary system**

(continued on the next page)

6 continued.

(b) Explain how negative feedback, involving the thyroid gland, controls metabolic rate. (4 marks)

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6 continued.

(continued on the next page)

6 continued.

***(c) Explain how hormones control the menstrual cycle. (6 marks)**

[illegible]

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Turn over

6 continued.

[illegible]

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6 continued.

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(TOTAL FOR QUESTION 6 = 12 MARKS)

TOTAL FOR PAPER = 60 MARKS
END