IGCSE Cambridge Topical Past Papers

SCIENCE COORDINATE

0654 | Paper 6

2020 — 2024

1 – (0654/62_Summer_2021_Q2) – *B1. Characteristics Of Living Organisms*

Small maggots (insect larvae), as shown in Fig. 2.1, live in damp, warm environments.

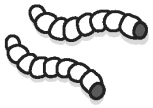

Fig. 2.1

A student wants to find out if maggots are attracted to different colours of light.

Plan an investigation to find out to which colour of light maggots are most attracted.

The student is provided with some maggots which need to be kept alive during the investigation, lamps of different colours and any other common laboratory apparatus.

Include in your plan:

- the apparatus needed
- a brief description of the method, explaining any safety precautions
- the measurements you will make, including how to make them as accurate as possible
- the variables you will control
- how you will use your results to draw a conclusion.

You may include a labelled diagram if you wish.

You may also include a table that can be used to record results if you wish. You are **not** required to include any results.

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..... [7]

1 – (0654/63_Summer_2020_Q1) – *B2. Cells*

Fig. 1.1 shows a shell.

Fig. 1.1

(a) In the box, make an enlarged detailed pencil drawing of the shell.

[3]

(b) **(i)** Draw a straight line to join points **A** and **B** on Fig. 1.1.

This is the actual length of the shell.

Measure and record the length of this line **AB** in millimetres to the nearest millimetre.

actual length of line **AB** on Fig. 1.1 = ... mm [1]

(ii) Mark the points **A** and **B** on your drawing in **(a)**.

Join these points with a line.

Measure and record the length of this line **AB** in millimetres to the nearest millimetre.

length of line **AB** on drawing = ... mm [1]

(iii) Use your measurements in **(b)(i)** and **(b)(ii)** to calculate the magnification *m* of your drawing.

Use the equation shown.

$$m = \frac{\text{length of line } \mathbf{AB} \text{ on drawing}}{\text{actual length of line } \mathbf{AB} \text{ on Fig. 1.1}}$$

m = ... [1]

[Total: 6]

2 – (0654/62_Winter_2020_Q1) – *B2. Cells, B3. Biological Molecules*

A student investigates the movement of molecules through a membrane.

The student uses some Visking tubing which acts like a membrane. This tubing allows small molecules to pass through it but not large molecules.

(a) Procedure

The student:

- ties a knot in one end of the piece of Visking tubing
- adds 2 cm^3 of starch solution into the tubing
- ties the open end to make a bag as shown in Fig. 1.1

Fig. 1.1

- thoroughly rinses the outside of the bag with water
- repeats the procedure with another piece of Visking tubing but adds 2 cm^3 of solution **X** instead of starch solution
- places each bag into iodine solution as shown in Fig. 1.2
- records in Table 1.1 the colour of the solutions in each bag and each beaker every minute for five minutes.

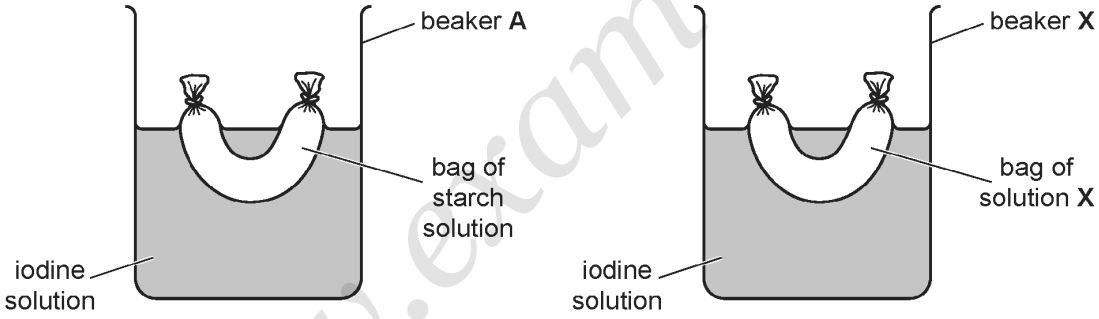

Fig. 1.2

Table 1.1

time /.....	colour of solution in			
	bag of starch solution	beaker **A**	bag of solution **X**	beaker **X**
0	colourless	brown	colourless	brown
1	colourless	brown	colourless	brown
2	colourless	brown	colourless	brown
3	colourless	brown	colourless	brown
4	blue-black	brown	brown	brown
5	blue-black	brown	brown	brown

(i) Complete Table 1.1 by adding the unit for time. [1]

(ii) Name a piece of apparatus suitable for measuring the $2\,cm^3$ of starch solution in the procedure in **(a)**.

..... [1]

(b) Iodine solution is used as a test for starch.

Iodine molecules are small.

Starch molecules are large.

Visking tubing allows small molecules to pass through it but not large molecules.

(i) Use this information and the results in Table 1.1 to explain the observations for the colour of the starch solution inside the bag of starch solution and the colour of the iodine solution in beaker **A**.

bag of starch solution .....

.....

beaker **A** .....

.....

[2]

(ii) Use the information in **(b)** and the results in Table 1.1 to make a conclusion about solution **X**.

..... [1]

(c) **(i)** State the time when the solution in bag **X** changes colour.

time = ... [1]

(ii) Suggest why the colour of the solutions inside bag **A** and bag **X** change colour at the same time.

.....

..... [1]

(d) Suggest why the Visking tubing is rinsed in the procedure in **(a)**.

..... [1]

(e) At higher temperatures molecules move more quickly. A student carries out the procedure in **(a)** and **(b)** at a higher temperature. Suggest how this would affect the results for bag **A**.

..... [1]

(f) The teacher says that solution **X** contains reducing sugar. Describe the test used to confirm the presence of reducing sugar.

test .....

.....

observation for a positive result .....

[3]

[Total: 12]

3 – (0654/62_Winter_2020_Q2) – *B2. Cells, B3. Biological Molecules*

Fig. 2.1 shows a photograph of a slice of cucumber.

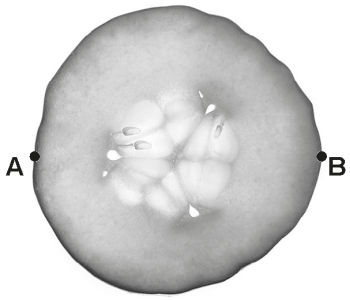

Fig. 2.1

(a) In the box, make an enlarged detailed pencil drawing of the cucumber in Fig. 2.1. [3]

(b) **(i)** Measure the diameter of the cucumber slice in Fig. 2.1 between points **A** and **B**.

Record this diameter in millimetres to the nearest millimetre.

diameter of cucumber slice = ... mm [1]

(ii) Draw a line to show this diameter on your drawing.

Record the length of this line in millimetres to the nearest millimetre.

diameter on drawing = ... mm [1]

(iii) Use your measurements in **(b)(i)** and **(b)(ii)** to calculate the magnification *m* of your drawing. Use the equation shown.

$$m = \frac{\text{diameter on drawing}}{\text{actual diameter}}$$

m = ... [1]

(c) A student tests some cucumber for the presence of protein.

(i) Name the testing solution she uses to test for the presence of protein.

..... [1]

(ii) State the observation for a positive result.

..... [1]

[Total: 8]

4 – (0654/61_Summer_2021_Q1) – *B2. Cells, B7. Transport*

A student investigates the nutrient content of three solutions, **A**, **B** and **C**.

She tests **A**, **B** and **C** separately with Benedict's solution, biuret solution and iodine solution.

(a) Name the test solution which requires use of a hot water-bath.

..... [1]

(b)
- Solution **A** tests positive with iodine solution.
- Solution **B** tests positive with biuret solution.
- Solution **C** tests positive with Benedict's solution.
- Results of all the other tests are negative.

(i) Use this information to record in Table 1.1, the final colours the student observes.

Include the colours for negative results.

Table 1.1

solution	final colour with Benedict's solution	final colour with biuret solution	final colour with iodine solution
A			
B			
C			

[4]

(ii) Use the results to state the nutrient present in each solution.

solution **A** contains .....

solution **B** contains .....

solution **C** contains .....

[3]

(c) Describe a method used to test a liquid for the presence of fats.

Include the observation for a positive result.

method .....

.....

observation ..... [2]

(d) A student investigates the nutrient concentration in two different samples using Benedict's solution. This allows her to compare the concentrations of the nutrient in the two solutions.

(i) Explain how the results will allow the concentrations of the nutrient in the two solutions to be compared.

.....

..... [1]

(ii) State two variables which need to be controlled in this investigation.

variable 1 .....

variable 2 .....

[2]

[Total: 13]

5 - (0654/63_Summer_2021_Q1) - *B2. Cells, B3. Biological Molecules*

Fig. 1.1 shows a slice of pepper.

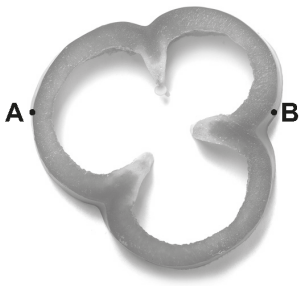

Fig. 1.1

(a) In the box, make an enlarged detailed pencil drawing of the surface of the slice of pepper.

[3]

(b) (i) Draw a line to join points **A** and **B** in Fig. 1.1.

Measure and record the length of this line in millimetres to the nearest millimetre.

length of line **A–B** in Fig. 1.1 = ... mm [1]

(ii) Draw the line **A–B** to show this diameter on your drawing in **(a)**.

Measure and record the length of this line in millimetres to the nearest millimetre.

length of line **A–B** on drawing = ... mm [1]

(iii) Use your measurements in **(b)(i)** and **(b)(ii)** to calculate the magnification *m* of your drawing.

Use the equation shown.

$$m = \frac{\text{length of line A–B on drawing}}{\text{length of line A–B in Fig. 1.1}}$$

m = ... [1]

(c) A student tests some egg white and potato for the presence of nutrients.

(i) The egg white contains protein and no starch.

The potato contains starch and no protein.

Complete Table 1.1 with the final colour observed in each test.

Table 1.1

test solution	final colour observed with egg white	final colour observed with potato
iodine		
biuret		

[4]

(ii) Suggest why it is difficult to test a red pepper using biuret solution.

.....

..... [1]

(d) A student tests the egg white for the presence of fat.

(i) State two substances needed for the fat test.

..... and ..... [1]

(ii) Explain why there should be no flames in the laboratory when doing this test.

..... [1]

[Total: 13]

6 – (0654/61_Winter_2021_Q1) – *B2. Cells*

Fig. 1.1 is a full-size photograph of a flower with some of the petals removed.

Fig. 1.1

(a) (i) In the box, make a large, detailed pencil drawing of the flower.

Include the internal parts of the flower. [3]

(ii) On your drawing, add a labelled line to identify an anther. [1]

(b) (i) **On Fig. 1.1** draw a line to join points **A** and **B**, which shows the width of one petal.

Record this width, **AB**, in millimetres to the nearest millimetre.

width of petal **AB** on Fig. 1.1 = ... mm [1]

(ii) Draw a line to show the same width, **AB**, of the petal on your drawing.

Record this width in millimetres to the nearest millimetre.

width of petal on drawing = ... mm [2]

(iii) Use your measurements in **(b)(i)** and **(b)(ii)** to calculate the magnification ***M*** of your drawing. Use the equation shown.

$$M = \frac{\text{width of petal on drawing}}{\text{width of petal } \mathbf{AB} \text{ on Fig. 1.1}}$$

M = ... [1]

(c) A student takes the real flower shown in Fig. 1.1 and removes the petal **AB**. The student measures the width of this petal.

Suggest why the width of the real petal is larger than the measurement **AB** in **(b)(i)**. You can assume all of the widths have been measured accurately.

..... [1]

(d) The student removes three more petals from the flower.

Their widths are shown in Table 1.1.

Table 1.1

petal	width / mm
1	53
2	55
3	51

Calculate the average width of these three petals.

Show your working.

average width = ... mm [1]

ANSWERS

1 – (0654/62_Summer_2021_Q2) – *B1. Characteristics Of Living Organisms*

1 mark must be from each section, plus any other 2 **Apparatus** suitable container / card or paper with markings ; ruler ; **Method** **use** different colours ; lots of maggots (min 5 if give number) / repeats ; moisture ; gloves / wash hands afterwards to protect from disease / bacteria / pathogens (from maggots) ; ref. animal welfare ; **Measurement** number moved to the lights ; distance moved towards the lights ; **Controlled variables** distance of lamp / intensity / brightness of light ; time ; same size / type / age of maggots ; number of maggots ; temperature ; **Conclusion** bar chart of number to each colour / distance to each colour ; colour of light with most maggots is the one they are most attracted to	**7**

1 – (0654/63_Summer_2020_Q1) – *B2. Cells*

(a)	clear and continuous outline; larger than original; oval shape / four spirals / sections;	**3**
(b)(i)	measurement to nearest mm;	**1**
(b)(ii)	line drawn **and** correct measurement to nearest mm;	**1**
(b)(iii)	correct calculation with correct rounding;	**1**

2 – (0654/62_Winter_2020_Q1) – *B2. Cells, B3. Biological Molecules*

(a)(i)	minute(s) / min(s) ;	**1**
(a)(ii)	syringe ;	**1**
(b)(i)	any one of: (bag) iodine moves in / iodine diffuses / small molecules move in / through ; starch **and** iodine produce blue-black / black / darker colour ; (A) no starch / starch can't move out of the bag / starch can't diffuse / large molecules can't move out / diffuse ;	**2**
(b)(ii)	no starch present ;	**1**
(c)(i)	4 (minutes) / after 3 / between 3 and 4 ;	**1**
(c)(ii)	both iodine / same chemical move / enter at same time / rate / same rate of diffusion	**1**
(d)	avoid contamination / remove starch / remove solution on the surface of the bag AW ;	**1**
(e)	faster ;	**1**
(f)	Benedict's; heat; green / yellow / orange / red	**3**

3 – (0654/62_Winter_2020_Q2) – *B2. Cells, B3. Biological Molecules*

(a)	clear and continuous outline, (but might be shaded) ; larger than original; central detail;	**3**
(b)(i)	43 ± 1;	**1**
(b)(ii)	line drawn **and** correct measurement ;	**1**
(b)(iii)	correct calculation **AND** correct rounding;	**1**
(c)(i)	biuret ;	**1**
(c)(ii)	purple / lilac / mauve / violet AW	**1**

4 – (0654/61_Summer_2021_Q1) – *B2. Cells, B7. Transport*

(a)(i)	clear and continuous outline with single line, correct shape ; greater than half the box ; detail – wavy outer edge and circles ;	**3**
(a)(ii)	**line** to one of the circles **and** labelled X ;	**1**
(a)(iii)	transport of water / transport of red stain ;	**1**
(b)(i)	axes correct way round **and** labelled with quantity and units ; sensible linear scale chosen so points cover at least half of the grid ; plots correct ± half small square;	**3**
(b)(ii)	best-fit line ;	**1**
(b)(iii)	correct reading from graph ; marking on graph ;	**2**
(b)(iv)	as time increases distance increases ;	**1**

5 – (0654/63_Summer_2021_Q1) – *B2. Cells, B3. Biological Molecules*

(a)	clear and continuous outline, 2 single lines ; size at least half of the box in both directions ; detail – 3 lobes ;	3
(b)(i)	36 ;	1
(b)(ii)	draw line **and** measurement correct ;	1
(b)(iii)	calculation correct **and** correctly rounded ;	1
(c)(i)	<table><tr><th>test solution</th><th>final colour observed with egg white</th><th>final colour observed with potato puree</th></tr><tr><td>Iodine solution</td><td>**Brown / orange ;**</td><td>**Blue-black ;**</td></tr><tr><td>Biuret solution</td><td>**Purple ;**</td><td>**Blue ;**</td></tr></table>	4
(c)(ii)	colour of the pepper masks the result ;	1
(d)(i)	water **and** ethanol ;	1
(d)(ii)	ethanol / alcohol flammable ;	1

6 – (0654/61_Winter_2021_Q1) – *B2. Cells*

(a)(i)	size – at least half of the box ; quality – clear and continuous outline ; detail – carpel and stamen ;	3
(a)(ii)	anther labelled ;	1
(b)(i)	48 mm ;	1
(b)(ii)	line drawn ; correct measurement ;	2
(b)(iii)	correct calculation ;	1
(c)	real petals are curved / not flat / flattened to measure ;	1
(d)	53 **and** some working ;	1

7 – (0654/61_Summer_2022_Q1) – *B2. Cells, B3. Biological Molecules, B5. Plant Nutrition*

(a)	clear and continuous outline; size ⩾ half the box ; detail of lobes;	3
(b)(i)	42–45 ;	1
(b)(ii)	line drawn and measurement correct ;	1
(b)(iii)	correct calculation correctly rounded ;	1
(c)(i)	protein ; starch ;	2
(c)(ii)	blue ; blue-black ;	2
(c)(iii)	so it doesn't mask the **colour** of the test / colour change can be seen ;	1
(c)(iv)	no naked flames/heat in water bath and in case of fire and won't burn hands / lab ; goggles to protect eyes in case of fire / from ethanol ; gloves to protect hands in case of fire / hot apparatus / ethanol / burns ; **max 1**	1
(c)(v)	white emulsion ;	1