Cambridge Assessment International Education

Example Responses – Paper 3

Cambridge O Level
Biology 5090

For examination from 2023

Cambridge Pathway

Contents

Introduction

The main aim of this booklet is to exemplify standards for those teaching Cambridge O Level Biology 5090.

This booklet contains responses to all questions from June 2023 Paper 32, which have been written by a Cambridge examiner. Responses are accompanied by a brief commentary highlighting common errors and misconceptions where they are relevant.

The question papers and mark schemes are available to download from the School Support Hub

5090 June 2023 Question Paper 32

5090 June 2023 Mark Scheme 32

5090 June 2023 Instructions 32

Past exam resources and other teaching and learning resources are available from the School Support Hub

Question 1

In order to plan the best use of your time, read through all the questions on this paper carefully before starting work.

1 You are going to investigate the movement of water by osmosis using potato tissue. You are provided with:

- four cylinders of potato tissue with equal diameters
- four different concentrations of sodium chloride (salt) solution at room temperature
- four test-tubes
- sharp knife
- white tile
- marker pen/pencil
- paper towels
- stop-watch/timer
- ruler.

Use the following method:

- label the test-tubes 0.0%, 2.0%, 4.0% and 6.0%
- on the white tile, cut each of the four cylinders of potato to exactly 40 mm in length
- place one potato cylinder in each test-tube
- pour the concentration of salt solution matching the label into each test-tube so that the potato cylinders are covered as shown in Fig. 1.1

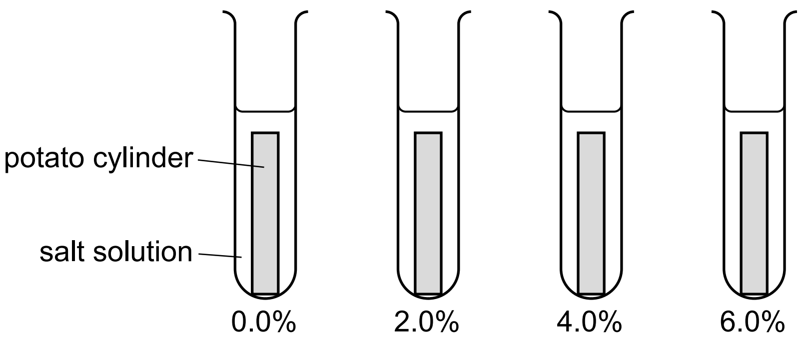


Fig. 1.1

- start the timer and leave the potato cylinders in the solutions for 40 minutes

After 40 minutes you are going to remove the potato cylinders from the test-tubes, measure their final lengths and calculate any change in length.

While waiting you may continue with Question 1(b) and Question 2.

- after 40 minutes pour off the salt solution from each test-tube into the container labelled **waste** but leave each potato cylinder in its test-tube.

(a) **(i)** Complete the column headings in Table 1.1. [3]

Table 1.1

percentage concentration of salt solution	starting length / mm	final length / mm	change in length / mm
0.0	40		
2.0	40		
4.0	40		
6.0	40		

Examiner comment

A few responses did not include units.

(ii) For each potato cylinder:

- remove the potato cylinder from its test-tube
- measure its length
- record this final length in Table 1.1. [4]

percentage concentration of salt solution	starting length / mm	final length / mm	change in length / mm
0.0	40	43	
2.0	40	39	
4.0	40	37	
6.0	40	36	

Examiner comment

- Most candidates completed the table with their measurements, but some answers included units in the data cells.
- Some candidates recorded their measurements in centimetres despite the starting lengths being shown as millimetres.

(iii) Calculate the change in length of each potato cylinder and record it in Table 1.1. [2]

percentage concentration of salt solution	starting length / mm	final length / mm	change in length / mm
0.0	40	43	+3
2.0	40	39	−1
4.0	40	37	−3
6.0	40	36	−4

Examiner comment

The changes in length were generally calculated correctly and most indicated the decreases in length by indicating the negative values, although a few candidates indicated the positive values for the increases in length.

(iv) Water can move into and out of potato cells by osmosis. Salt cannot move into and out of potato cells.

Use this information to explain the results in the test-tube containing 6.0% salt solution.

water moves out of the potato cells causing a decrease in the mass of the potato cylinder

[2]

Examiner comment

To explain the results fully, candidates needed to note the consequential decrease in mass of the potato cylinder.

(v) Explain why it is important that all the potato cylinders were cut to the same length at the start of the investigation.

the potato cylinders should have the same length at the start so that a valid comparison can be made [1]

Examiner comment

- Some candidates explained that it was important to make sure that the only variable that changed was the percentage concentration of salt solution and these answers were also accepted, as were those that referred to being able to compare the results.
- Answers referring to accuracy, reliability or precision were not accepted as these terms have different meanings to validity.
- References to fair tests were ignored because they were too vague.

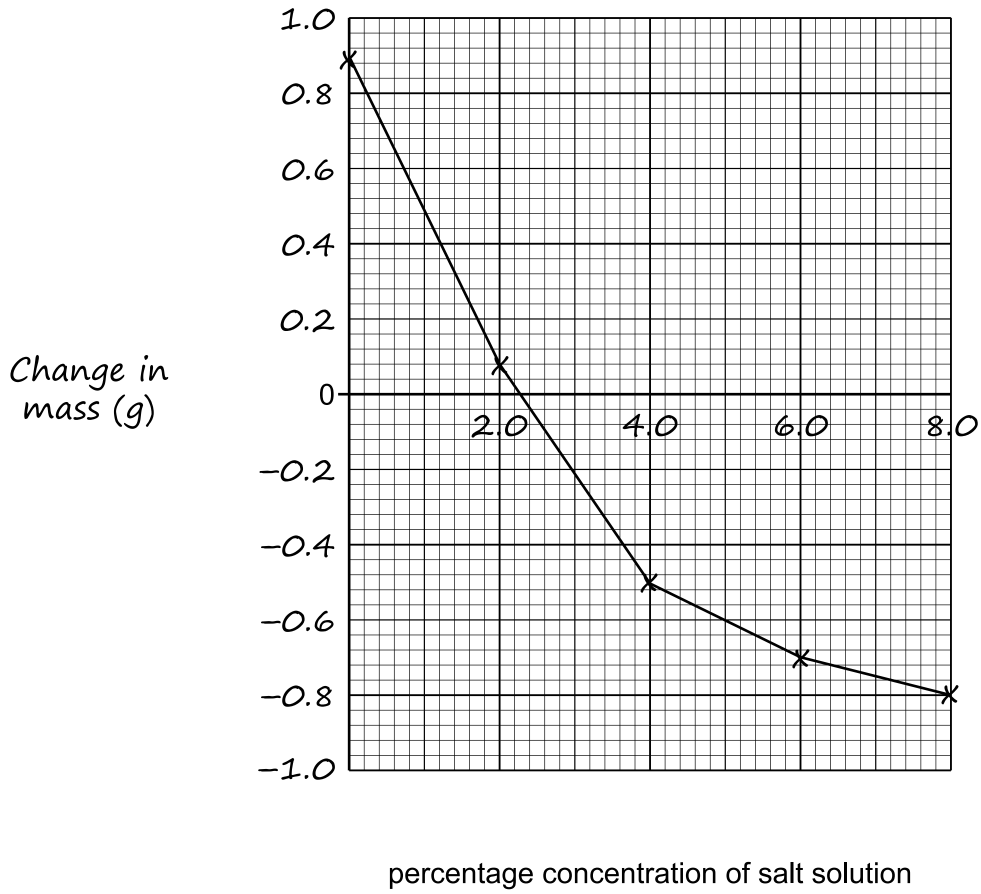
(b) A student used a similar method to investigate the movement of water by osmosis in potato cylinders. Instead of length, changes in **mass** were measured for each potato cylinder. The cylinders each had the same mass when first placed in the salt solutions.

Fig. 1.2 shows the results in the student's notebook:

percentage concentration of salt solution	change in mass / g
0.0	+ 0.9
2.0	+ 0.1
4.0	– 0.5
6.0	– 0.7
8.0	– 0.8

Fig. 1.2

(i) Use the data in Fig. 1.2 to construct a graph of percentage concentration of salt solution used against change in mass. Join your points with ruled lines. [5]



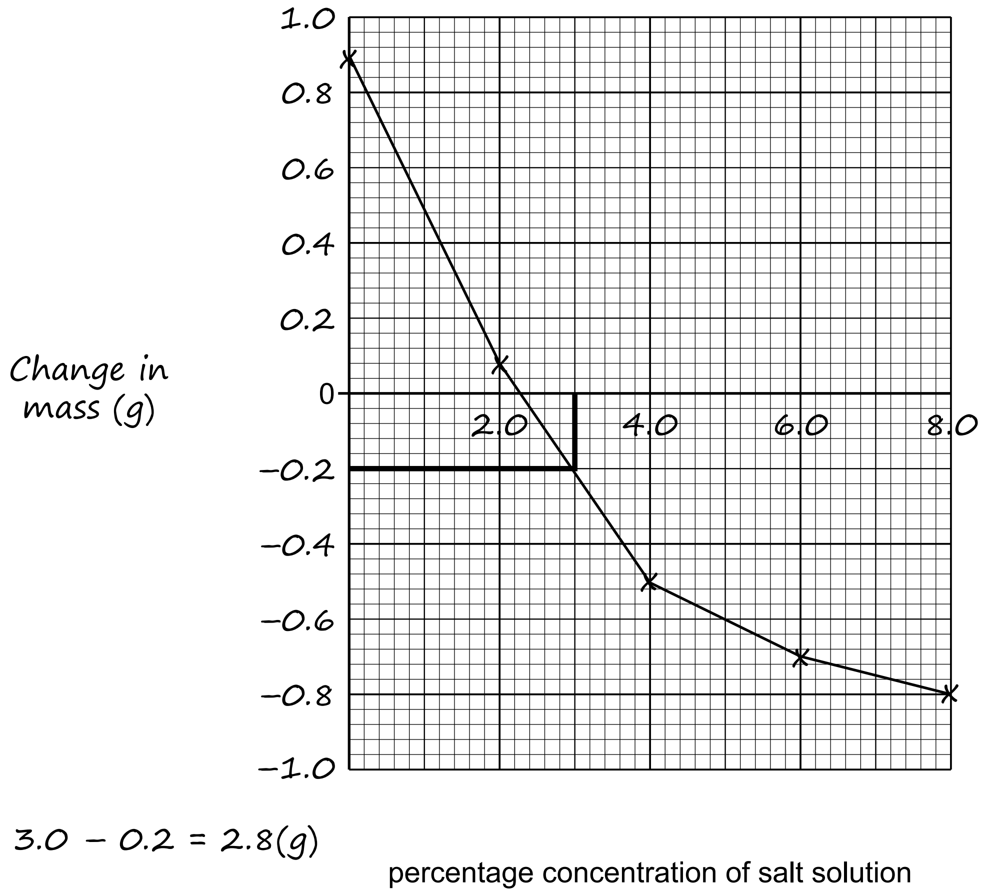
Examiner comment

- Candidates needed to label the axes fully, including units. The data plotted was change in mass, so a label of just ‘mass’ was not correct. Some responses did not include the units (g).
- In many instances, the scale on the y-axis was too small so the data points did not cover at least half the available space.
- Some candidates incorrectly labelled the scale on the y-axis as 0.6, 0.8, 0.1, rather than 0.6, 0.8, 1.0 and a few scales were non-linear.
- Some candidates were confused by the negative values on the y-axis scale. While the positive half of the scale was usually correct – starting at 0 and going up the axis, candidates sometimes started the negative values at the bottom of the graph (with another 0), rather than working downwards from the 0 already marked.
- Candidates were asked to join the points plotted with ruled lines, so lines of best fit and curves were not acceptable.

(ii) Each potato cylinder had a starting mass of 3.0 g.

Use your graph to determine the **final mass** of a potato cylinder placed in 3.0% salt solution. Show your working on your graph.

final mass ....2.8.......... g [2]



Examiner comment

- Many candidates correctly used the graph to predict the change in mass in a 3 % salt solution. As required by the question, this working needed to be clearly shown with at least one line from the axis to the graph line; often this was omitted.
- The question asked for the final mass of the potato cylinder to be determined, so this required candidates to subtract their graph reading from the initial mass of 3.0 g. Some candidates did not do this and instead gave the graph reading alone as their answer.
- Candidates needed to read the question carefully to determine what was being asked.

(c) **(i)** The concentrations of salt solution were made by using different volumes of a 10.0% salt solution and distilled water.

Calculate the volumes of 10.0% salt solution and distilled water needed to make 10 cm^3 of a 4.0% salt solution.

volume of distilled water ....6 cm^3..........

volume of 10.0% salt solution ....4 cm^3..........

[2]

Examiner comment

- Candidates needed to calculate the volumes required and give units. Many did not give any units or in some cases gave contradictory units, e.g. cm^3 for one value and % for the other.
- The most commonly seen incorrect values were 9.6 cm^3 of salt solution and 0.4 cm^3 of distilled water or vice versa.
- A simple ratio of 4 cm^3 of salt solution to 6 cm^3 of distilled water would be required to reduce the concentration of 10 % salt solution to 4 %.

(ii) The student dried the potato cylinders before obtaining their final mass. Explain why this was important.

the potato cylinders were dried so that the excess solution on the outside of the potato was removed and its mass was not included in the final mass [2]

Examiner comment

- Some incorrect answers implied that solution from within the potato was being removed or that the external solution was removed to stop any further reaction / osmosis.
- Some responses referred to dry mass which has its own specific meaning and was not relevant in this investigation.
- Some answers stated that the cylinders were dried to remove the excess salt solution, but did not explain that this extra solution would add to the mass.

(d) (i) Design an investigation to determine the concentration of salt solution in which movement of water into and out of potato tissue is equal.

Your investigation should be based on the method described on page 2 but using changes in **mass** of the potato tissue and not changes in length.

Give full experimental details.

Take 5 test-tubes and label each with a different concentration of salt solution i.e. 0 %, 2 %, 4 %, 6 %, 8 %.

Cut 5 potato cylinders of equal mass from the same potato and place 1 cylinder in each tube.

Add 20 cm^3 of the matching concentration of salt solution to each tube so the cylinders are fully covered.

Leave the potato cylinders in the solutions for 40 minutes then remove each cylinder from the tube and dry.

Measure the mass of each cylinder and calculate the change in mass.

Plot a graph of change in mass against concentration of salt solution. [6]

The concentration of salt solution in which movement into and out of the potato tissue is equal is the concentration where there is no change in mass.

Examiner comment

- Many responses referred to keeping the length of the potato cylinders the same, rather than the mass.
- Few candidates noted the need to control variables such as the same type or age of potato or the volume of salt solution used.
- Precision was required when suggesting values for constant variables; for example many candidates stated that the cylinders should be left in the solutions for 'about 40 minutes', instead of stating the more precise time of '40 minutes'.
- Most took measurements at the beginning and end of the experiment (whether it be of mass or length), but many did not explain how these measurements could be used to answer the initial question, e.g. to determine the concentration of salt solution in which movement into and out of the potato tissue is equal.

(ii) Identify the dependent variable in the investigation you have designed.

mass of the potato cylinder [1]

[Total: 30]

Examiner comment

- Many candidates gave the independent variable, % concentration of salt solution.
- Some candidates gave a constant variable, time.

Question 2

2 Fig. 2.1 is a photograph of a leaf from a potato plant.

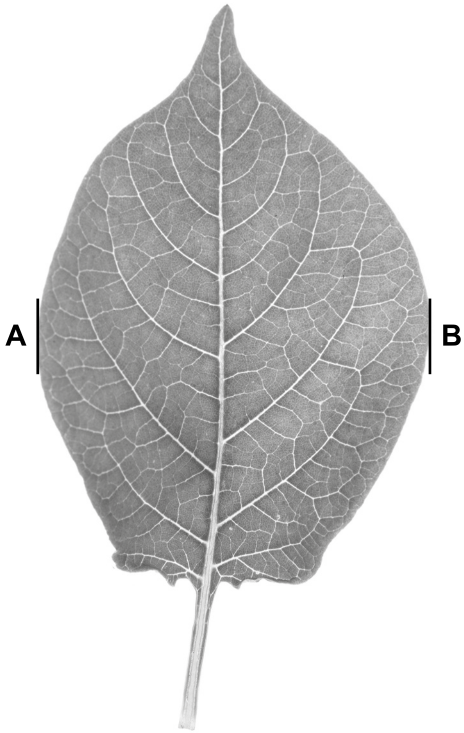
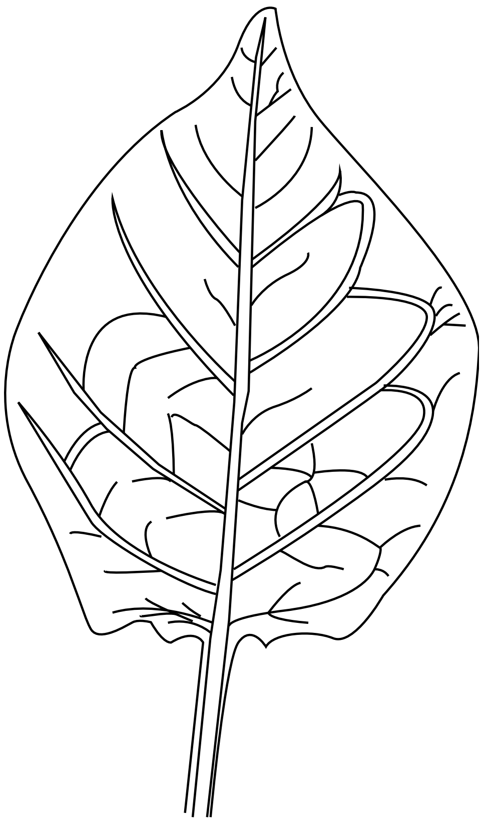


Fig. 2.1

(a) In the space below make a large drawing of the leaf as it appears in Fig. 2.1.



[3]

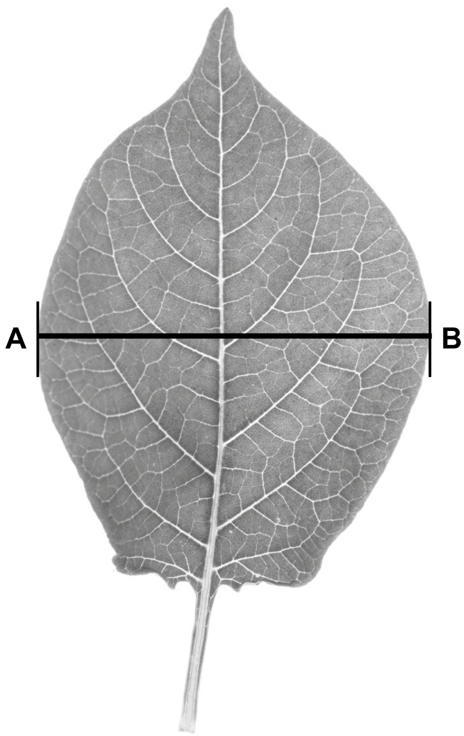
Examiner comment

- Some drawings were shaded or the outline was sketchily drawn. Occasionally the midrib was drawn using a ruled line. None of these were acceptable for the first marking point.
- The shape of the leaf in some drawings was not an accurate representation of the shape in Fig. 2.1.
- Some detail of the leaf venation should have been included, but in some cases only the outline was drawn or the outline and the midrib.
- The midrib needed to be drawn with a double line.
- The veins extending from the midrib were not arranged in a symmetrical pattern, but some were drawn as being symmetrical.
- Some of the sketchier drawings suggested that the veins extended beyond the leaf margin.

(b) **(i)** Draw a straight line on the photograph to join **A** and **B**.

Measure and record the length of this line.

length of line **A–B** ....52.................... mm [1]



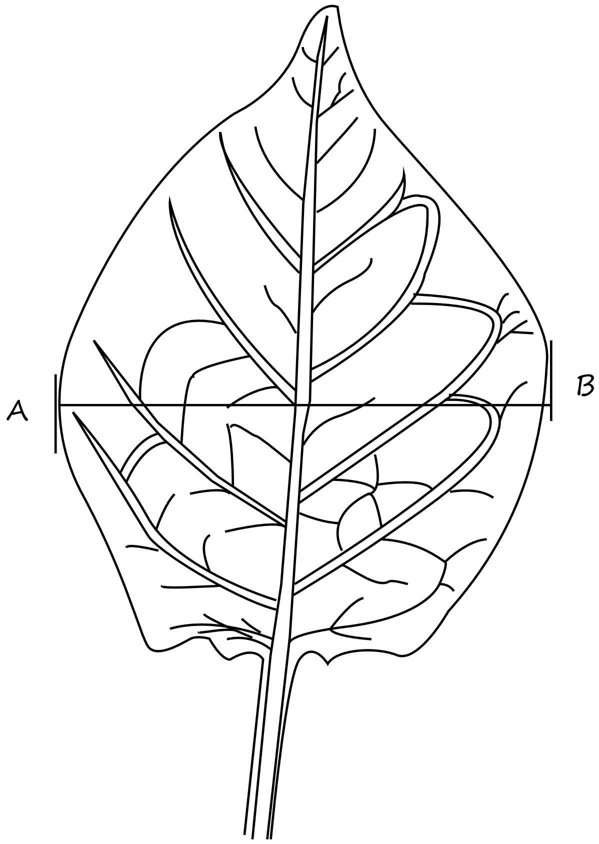
Examiner comment

- Some expressed the answer in cm, although the unit given was mm.
- Some incorrectly tried to convert cm to mm and answers such as 0.52 mm or 520 mm were given.

(ii) On your drawing, draw a line at the same location as the line **A**–**B**.

Measure and record the length of this line.

length of line on drawing ....65 mm.......... [2]



Examiner comment

- Candidates needed to follow the instructions carefully. Many candidates did not draw the line on their drawing of the leaf.
- Units had not been given on the answer line, so the answer needed to include appropriate units – either cm or mm. Many responses did not include units.

(iii) Use your measurements in **(b)(i)** and **(ii)** to calculate the magnification of your drawing compared to the photograph. Give your answer to 1 decimal place.

Space for working.

65 mm ÷ 52 mm

magnification x 1.3

magnification × ....1.25.......... [2]

Examiner comment

- The most common error was to invert the expression, i.e. 52 ÷ 65.
- Many candidates multiplied the answer by 100.
- Some answers included units, which is incorrect for a magnification.
- The question asked for the answer to be expressed to one decimal place, but many candidates did not do this.

(c) Fig. 2.2 is a photograph of a leaf from a sweet potato plant.

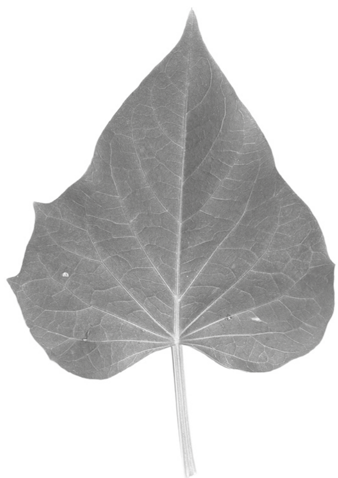


Fig. 2.2

Describe **one visible** difference and **one visible** similarity in the structure of the potato leaf in Fig. 2.1 and the sweet potato leaf in Fig. 2.2.

difference the potato leaf has an oval shape whereas the sweet potato leaf is heart-shaped

similarity both are pointed at the apex

[2]

Examiner comment

- There were a number of visible differences between the two leaves that would have been acceptable but any differences given should have been comparative. A common response was to describe the shape of one leaf but not the other.
- Differences can sometimes be comparative without having to describe both leaves when they share a common feature, e.g. the apex of the sweet potato leaf is more pointed (than that of the potato).
- Since there was no indication of magnification given it was not possible to compare the relative sizes of the two leaves, and this was a common incorrect response.
- The question asked for visible differences and similarities. More candidates were able to describe a similarity than a difference, but not all similarities given were visible. For example, 'both have chlorophyll' could not be determined from the Figures.

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