Cambridge Assessment International Education

Example Responses – Paper 5

Cambridge IGCSE™ / IGCSE (9–1) Biology 0610 / 0970

For examination from 2023

Cambridge Pathway

Contents

Introduction

The main aim of this booklet is to exemplify standards for those teaching Cambridge IGCSE / IGCSE (9-1) Biology 0610 / 0970.

This booklet contains responses to all questions from June 2023 Paper 51, 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

0610 / 0970 June 2023 Question Paper 51

0610 / 0970 June 2023 Mark Scheme 51

0610 / 0970 June 2023 Instructions 51

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

Question 1

1 You are going to investigate the effect of temperature on the rate of respiration in yeast cells.

When yeast cells respire they release carbon dioxide gas.

Read all the instructions but DO NOT DO THEM until you have drawn a table for your results in the space provided in 1(a)(i).

You should use the safety equipment provided while you are doing the practical work.

Step 1 Stir the yeast suspension with the glass rod and fill the syringe with 10 cm^3 of yeast suspension. Ensure you place the syringe nozzle under any foam that is present on top of the yeast suspension so that the foam is not drawn up into the syringe.

Step 2 You have been provided with a small piece of modelling clay. Shape the modelling clay around the end of the syringe plunger as shown in Fig. 1.1. It is important that the modelling clay is firmly attached to the plunger so that it does **not** fall off.

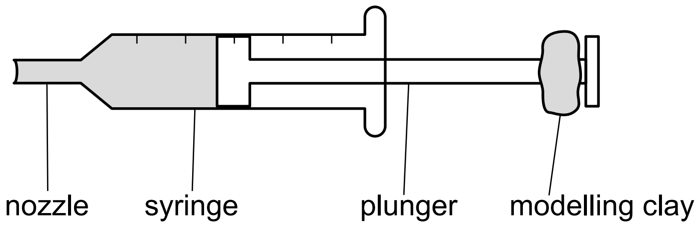


Fig. 1.1

Step 3 Gently lower the syringe into the measuring cylinder, as shown in Fig. 1.2. If necessary, reshape your modelling clay so that it fits inside the cylinder but do **not** remove any modelling clay.

Step 4 Fill the measuring cylinder with cold water. Do **not** let the water in the measuring cylinder overflow.

The nozzle of the syringe should be below the surface of the water in the measuring cylinder.

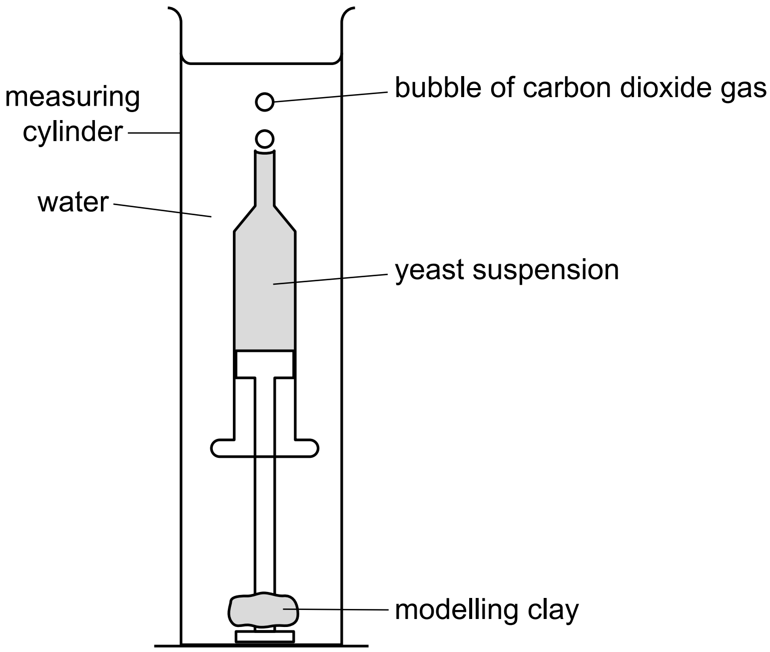


Fig. 1.2

Step 5 Measure the temperature of the water in the measuring cylinder.

Record this measurement in your table in **1(a)(i)**.

Step 6 Start the stop-clock and wait for two minutes.

Step 7 Reset the stop-clock to zero.

Step 8 Start the stop-clock again and count the number of bubbles produced by the yeast in three minutes.

Record this number in your table in **1(a)(i)**.

Step 9 Carefully pour the cold water in the measuring cylinder into the waste container. The syringe containing the yeast suspension should remain in the measuring cylinder.

Step 10 Raise your hand when you are ready for hot water to be poured into your measuring cylinder. Ensure that the water level is above the nozzle of the syringe but **not** overflowing.

Step 11 Repeat steps 5 to 8.

(a) **(i)** Prepare a table to record your results in the space provided.

temperature / °C	number of bubbles
42	54
18	12

[4]

Examiner comment

- The numbers recorded would vary as these were the candidate's own results, but the trend needed to be correct, with more bubbles at the higher temperature.
- Some candidates included units in the data cells, usually °C, or did not put units for temperature in the headings, or gave 'bubbles' rather than 'number of bubbles' for the heading.

(ii) State a conclusion for your results.

the higher the temperature the greater the rate of respiration

....

.... [1]

Examiner comment

The conclusion needed to relate the independent variable to the dependent variable and be consistent with the results. The aim of the investigation is often stated at the start of the method. The dependent variable was measured by counting bubbles, but the dependent variable itself was the rate of respiration. Many candidates concluded that the higher the temperature, the higher the number of bubbles produced, but did not relate this to the rate of respiration.

(iii) Using your results, calculate the rate of bubble production for the yeast suspension in cold water and in hot water.

rate of bubble production in cold water *18* .... bubbles per minute

rate of bubble production in hot water *4* .... bubbles per minute

[1]

Examiner comment

- The values given would vary, but the candidate should have divided their values for the number of bubbles by 3.
- Some candidates divided the number of bubbles by 2 minutes, or 60 seconds.

(iv) State the independent variable in this investigation.

temperature

....

.... [1]

Examiner comment

- Some candidates gave constant variables such as time or volume of yeast.
- A few candidates gave the dependent variable, number of bubbles, instead.

(v) State **one** variable that was kept constant in this investigation.

volume (15 cm^3) of yeast

[1]

Examiner comment

- Step 4 of the investigation stated that the water level in the measuring cylinder should be above the syringe nozzle, but did not say that the volume of water must be constant.
- Answers needed to be as precise as possible. When giving time as a constant variable, the answer needed to refer to what the time was for. In this case, the answer needed to give the 'time for equilibration' or the 'time for counting bubbles' as the answer.

(vi) Suggest why you were instructed to wait for two minutes in step 6 before starting to count the number of bubbles.

the yeast was left for two minutes to allow the temperature of the yeast to become the same as the water temperature

[1]

Examiner comment

Some candidates thought that this waiting time was needed so the yeast could start respiring or start producing bubbles. Yeast will always be respiring so this is not true.

(vii) Suggest why counting bubbles is **not** an accurate method of determining the rate of respiration in yeast.

counting bubbles is not an accurate method of determining the rate of respiration as the bubbles are different sizes so contain different volumes of gas

[1]

Examiner comment

- Answers that referred to the difficulty in counting bubbles were also accepted.
- Some candidates referred to human error or subjectivity, but did not link this to errors in counting.

(b) Measuring the volume of a gas is more accurate than counting bubbles. Using a gas syringe is one method of collecting and measuring a volume of gas.

Fig. 1.3 shows part of the apparatus that can be used to measure the volume of a gas by a **different** method.

Complete the diagram in Fig. 1.3 by drawing and labelling the **two** pieces of apparatus that are missing.

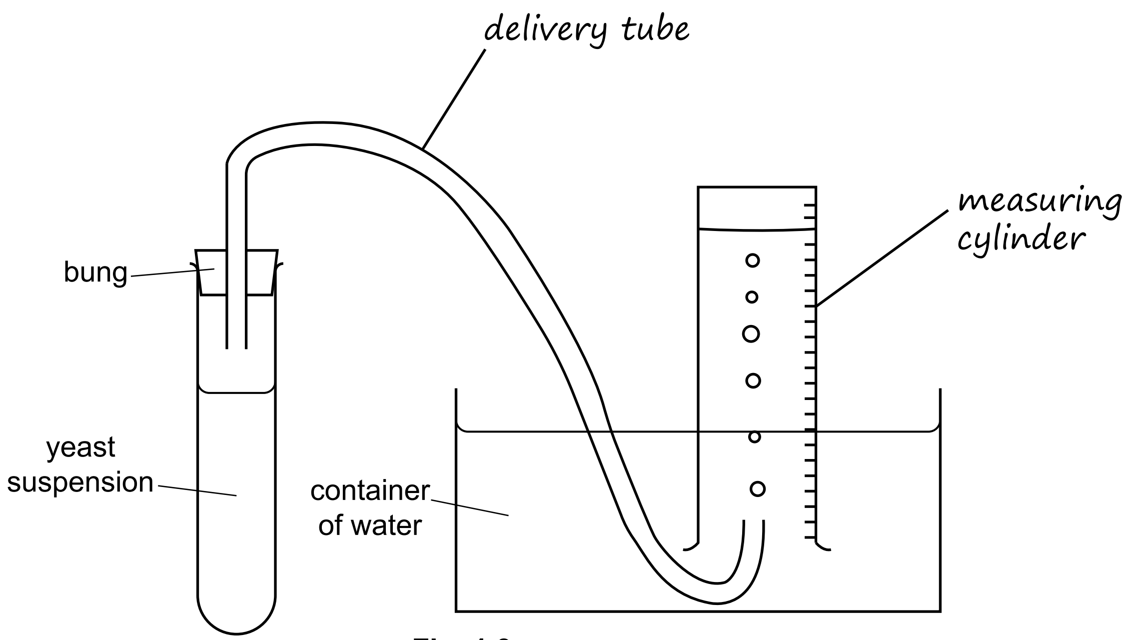


Fig. 1.3

[2]

Examiner comment

- Many candidates did not answer this question.
- The question asked candidates to show a different method to measure volume of gas apart from use of a gas syringe, but many drew a gas syringe.
- Many drawings included a thermometer in the container of water.
- Some candidates included a delivery tube, but some of these were labelled as ‘pipes’ or the tube did not enter the measuring cylinder under water.
- Many drawings did not include a second piece of equipment to measure volume.
- Some candidates did not label their drawings.

(c) Yeast can respire reducing sugars.

Describe the method you would use to test a substance for the presence of reducing sugars.

Take a sample of the substance and add Benedict’s solution. Heat the mixture at 80°C in a water bath and look for a colour change. [2]

Examiner comment

- The Benedict’s test was well known and most candidates knew that Benedict’s reagent should be heated with the sample.
- Candidates were not expected to give the results of the test, although a large number did.

(d) Bread is made from flour, water and yeast which are mixed to form a dough.

Fig. 1.4 shows a person making bread.

Fig. 1.4

The carbon dioxide gas produced by yeast causes the volume of the dough to increase.

Sodium chloride (salt) is often added to dough when making bread. The sodium chloride affects the rate at which the yeast respire.

Plan an investigation to determine the effect of the mass of sodium chloride on the volume of dough.

Make three balls of dough each containing the same volume and type of flour, yeast and water.

Mix a different mass of sodium chloride (1 g, 2 g and 3 g) into each ball of dough and knead to combine. Use a balance to measure the mass of sodium chloride.

Measure the initial volume of dough using a measuring cylinder.

Leave the dough for 30 minutes at 20 °C.

After this time measure the final volume of dough, using the measuring cylinder and calculate the change in volume.

Repeat this investigation two more times.

[6]

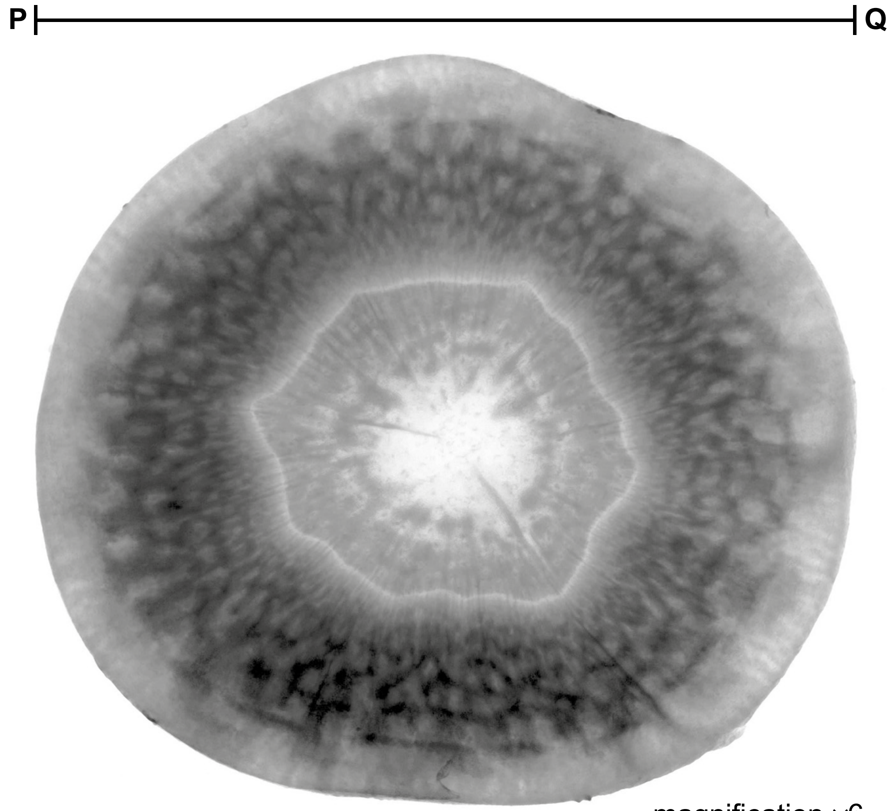
[Total: 20]

Examiner comment

- Candidates needed to be precise when describing the constant variables. For example, saying ‘the experiment is left for *about* half an hour’ is not enough.
- Some candidates did not describe a valid dependent variable. Some described the need to measure how much the dough has risen, but did not state that this could be done by measuring the volume of dough before and after. Some candidates thought the volume of carbon dioxide produced needed to be measured using a gas syringe.
- Many candidates needed to include more detail in their method. For instance, by describing the use of a balance to measure the mass of the dough ingredients and describing a method to measure the volume of dough, e.g. using a measuring cylinder.
- For the investigation design question, candidates were awarded a mark for stating that the experiment should be repeated at least two more times. Some candidates did not mention repetitions, or only repeated the experiment once.
- Some candidates stated the name of the independent variable, but gave no indication as to how this variable would be changed.

Question 2

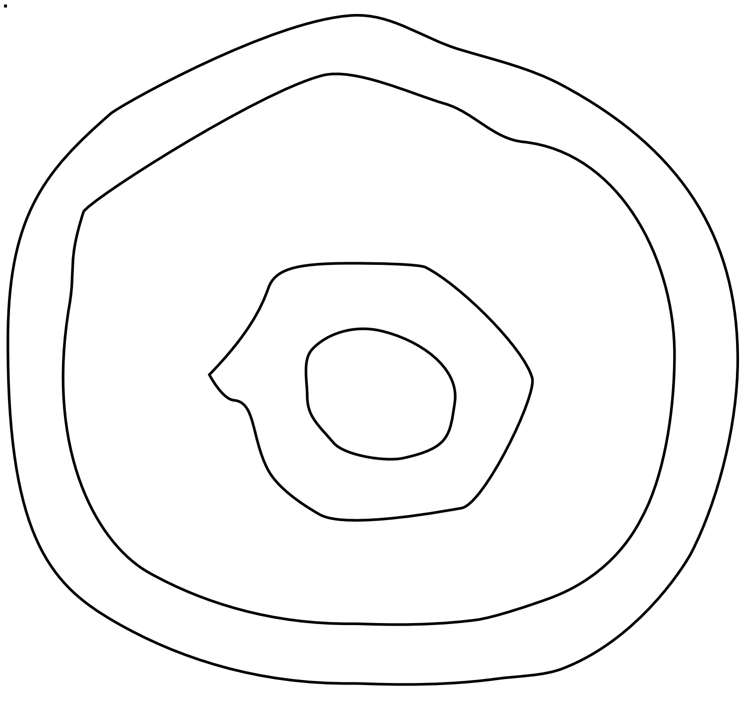
2 Fig. 2.1 is a photograph of a cross-section of a root from a carrot plant, *Daucus carota*.



magnification ×6

Fig. 2.1

(a) (i) Draw a large diagram of the carrot root cross-section that shows the layers visible in Fig. 2.1.



[4]

Examiner comment

- Some candidates included shading or cells in their diagram, so were not awarded the first marking point.
- Occasionally, candidate drawings were too big and crossed into the text at the top or bottom of the question.

(ii) Line **PQ** on Fig. 2.1 represents the diameter of the carrot root cross-section.

Measure the length of line **PQ** on Fig. 2.1.

length of **PQ** ....*109*.......... mm

Calculate the actual diameter of the carrot root cross-section using the formula and your measurement.

$$\text{magnification} = \frac{\text{length of line } \mathbf{PQ} \text{ in Fig. 2.1}}{\text{actual diameter of the carrot root cross-section}}$$

Give your answer to **one** decimal place.

Space for working.

$$\frac{109}{6} = 18.1667$$

..........*18.2*.......... mm
[3]

Examiner comment

- The question asked for the answer to be given to one decimal place. Some candidates did not give an answer to one decimal place.
- Some candidates incorrectly multiplied by 6 rather than dividing by 6. Some had difficulties converting cm to mm.

(b) A student investigated the effect of the concentration of a salt solution on the mass of carrot cubes. The student used this method:

- Carrots were cut into cubes. Each side of the cube was 1 cm in length.
- The initial mass of each carrot cube was measured and recorded.
- Each carrot cube was put into a different concentration of salt solution.
- The carrot cubes were left in the salt solutions for one hour.
- After one hour, the carrot cubes were removed from the salt solution and dried with a paper towel.
- The final mass of each carrot cube was measured and recorded.

(i) State the dependent variable in the investigation described in **2(b)**.

the dependent variable was the mass of the carrot cubes..........

.... [1]

Examiner comment

Common incorrect answers included 'mass', which was not enough, or 'concentration of salt solutions' which was the independent variable.

(ii) State **two** variables that were kept constant in this investigation.

1 the initial volume of the carrot cubes

2 the time that the carrot cubes were left in the salt solution

[2]

Examiner comment

- The *initial* volume of the carrot cube was the same for all carrot cubes (1 cm^3). However, the volume of the cubes would have changed over the course of the investigation. Therefore, it was not enough to state that the size or volume of the cubes was kept constant.
- The initial mass was not constant, as shown in Table 2.1.
- Some gave 'time', unqualified. Descriptions of a variable needed to be sufficiently detailed to be unambiguous and awarded a mark.

(iii) Explain why it was important to dry the carrot cubes before measuring the final mass.

the extra water on the carrot cube will add to the final mass, so

the cubes should be dried before measuring the final mass

[1]

Examiner comment

- Many candidates referred to improvements in accuracy or reliability. Their answer needed to refer to how the extra water would have contributed to the final mass of the carrot cubes.
- Some candidates said that the carrot cubes needed to be dried to remove the excess salt solution, but did not explain that this extra solution would add to the mass.

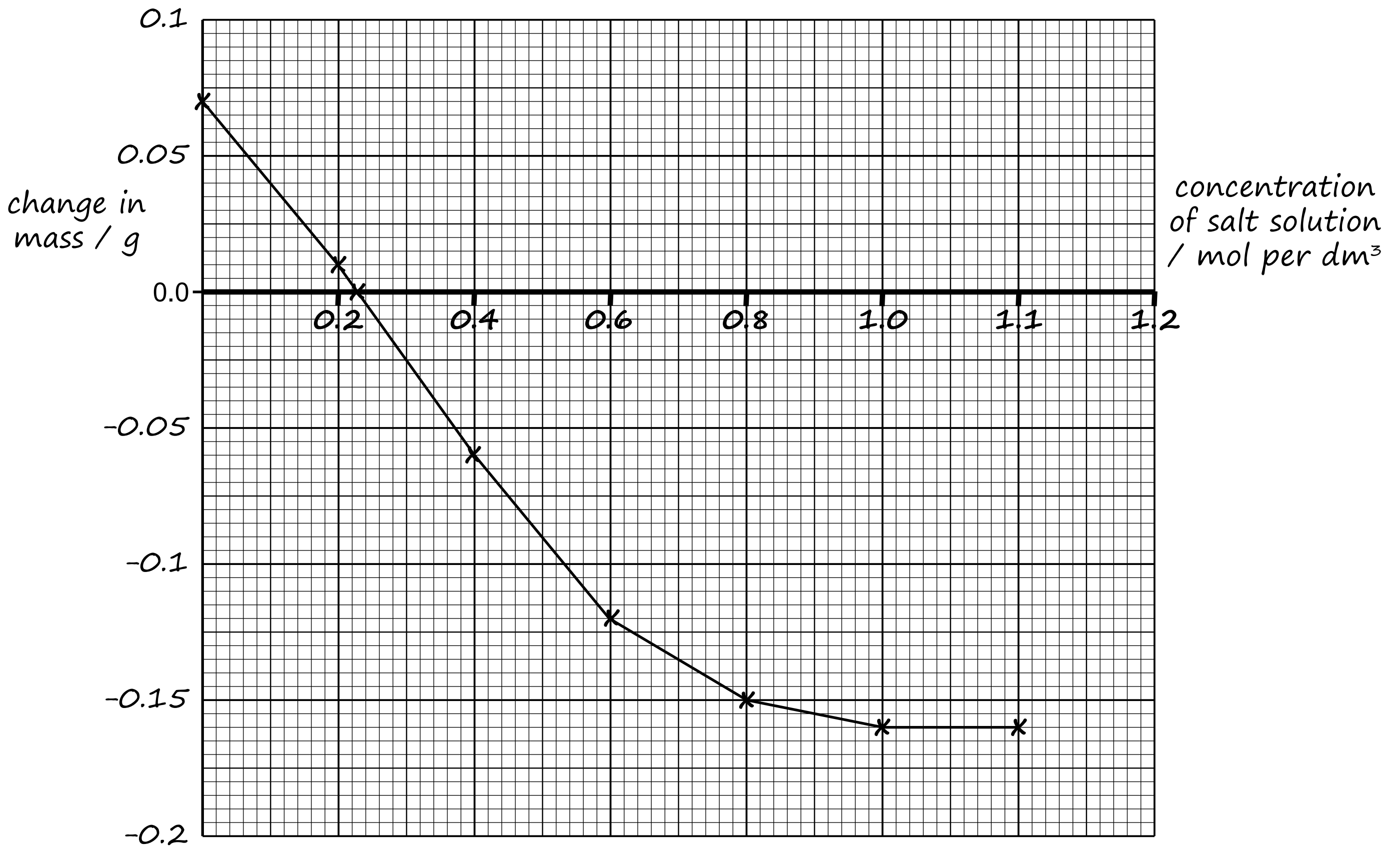
The results of the investigation are shown in Table 2.1.

Table 2.1

concentration of salt solution / mol per dm^3	initial mass of carrot cube / g	final mass of carrot cube / g	change in mass / g
0.0	0.97	1.04	0.07
0.2	0.98	0.99	0.01
0.4	0.96	0.90	–0.06
0.6	0.98	0.86	–0.12
0.8	0.99	0.84	–0.15
1.0	0.95	0.79	–0.16
1.2	0.96	0.80	–0.16

(iv) Using the data in Table 2.1, plot a line graph on the grid to show the effect of concentration of salt solution on the change in mass of the carrot cubes.

One axis has been started for you.



[4]

Examiner comment

- Many candidates made the scale for the y-axis too small, so the data points did not cover at least half the available space.
- Some candidates gave values on the y-axis which were out by a factor of 10, for example giving 0.5 rather than 0.05.
- Some candidates gave a non-linear scale and some had the axes the wrong way round. The independent variable needed to be on the x-axis.
- As osmosis experiments involve mass loss and negative values, candidates needed more practice constructing and plotting graphs of this nature would be useful.

(v) Using your graph, estimate the concentration of salt solution at which there is no change in the mass of the carrot cube.

Show on the graph how you obtained your estimate.

.................*0.23*................ mol per dm^3
[2]

Examiner comment

- The example response shows the intercept as a cross on the x-axis. This is the ideal answer. However, most graphs were drawn with the x-axis labelled along the bottom of the graph paper. In this case it was expected that a line would be drawn from where the graph crossed the zero change in mass, down to the x-axis.
- A significant number of intercepts were shown where the mass of carrot cubes became constant, i.e. at 1.1 mol per dm^3, rather than where their line crossed their x-axis at zero change in mass.
- Those candidates who did not answer the previous question were unable to answer this question too.
- More practice is needed for this skill, as some candidates were unsure as to what they were being asked to do.
- Candidates needed to follow the instructions carefully, as there were many answers given where there was no indication of an intercept on their graph.

(vi) Using the information in Table 2.1, calculate the **percentage** change in mass of the carrot cube that was placed in the 0.4 mol per dm^3 salt solution.

Space for working.

$$\frac{(0.9 - 0.96)}{0.96} \times 100 = -6.25$$

.............................*–6.25*............................ %
[2]

Examiner comment

Some candidates divided -0.06 by 0.9 rather than 0.96 and some divided 0.96 by 0.9.

(vii) The student did not repeat the investigation and only collected one set of results.

Explain why it is better to collect several sets of results.

it is better to collect several sets of results so that anomalous results can be identified and then discarded from the results before an average is calculated [1]

Examiner comment

- Some candidates gave explanations that referred to preventing anomalies, increasing reliability or stated that it was so that an average could be calculated, but these were ignored.
- Candidates needed to use correct vocabulary when describing anomalies. They referred to 'abnormal results', 'errors', 'mistakes', etc. in their answers, that showed the right understanding, but some candidates had not used the correct term.

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