Cambridge Assessment International Education

Example Responses – Paper 6

Cambridge IGCSE™ / IGCSE (9–1) Chemistry 0620 / 0971

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) Chemistry 0620 / 0971.

This booklet contains responses to all questions from June 2023 Paper 61, 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

0620 / 0971 June 2023 Question Paper 61

0620 / 0971 June 2023 Mark Scheme 61

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

Question 1

1 Ethanol can be made by fermentation of sugars found in plants. A by-product of fermentation is carbon dioxide gas.

A student made some ethanol using the following method.

step 1 Cut up some sugar cane and crush it.
step 2 Add hot water to the sugar cane and stir to dissolve the sugar in the sugar cane.
step 3 Remove the solids from the mixture to obtain sugar solution.
step 4 Let the sugar solution cool and then add yeast.
step 5 Place the mixture obtained in the apparatus shown in Fig. 1.1.
step 6 Leave the apparatus until fermentation is complete.

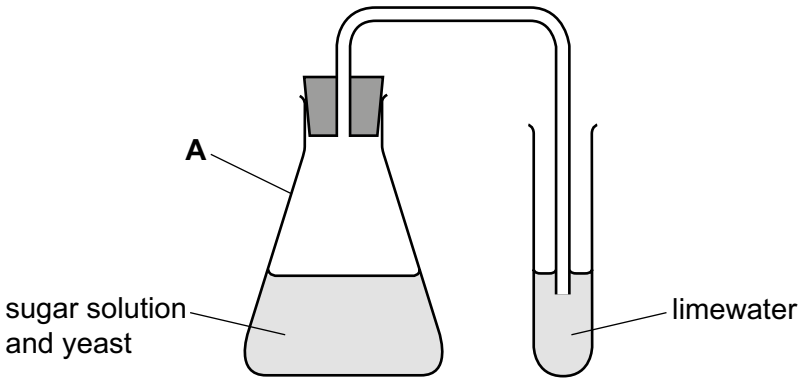


Fig. 1.1

(a) Name the item of apparatus labelled **A** in Fig. 1.1.

conical flask ..... [1]

Examiner comment

While most candidates correctly identified **A**, a small number of candidates gave incorrect names such as 'beaker'.

(b) Explain why hot water rather than cold water is used in **step 2**.

so that the sugar dissolves faster ..... [1]

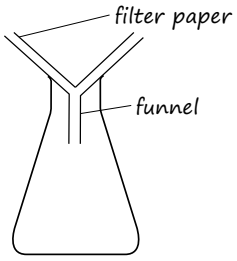
Examiner comment

Candidates who referred to increasing the rate of reaction without referring to dissolving were not awarded the mark.

(c) Name the method used to remove the solids from the mixture in **step 3** and draw a diagram to show how this is done.

name of process filtration

diagram



[2]

Examiner comment

While most candidates correctly named the process, many were not awarded the mark for the diagram. The most common reason for this was to not use a funnel so that the filter paper was unsupported. Candidates were not required to use a ruler to draw the diagram.

(d) State why the sugar solution is allowed to cool before the yeast is added in **step 4**.

fermentation occurs between 25°C and 35°C

..... [1]

Examiner comment

- Other answers that used knowledge beyond the IGCSE Chemistry syllabus were accepted, such as enzymes being denatured of yeast being killed at high temperatures.
- A common error was to state that yeast is denatured at high temperatures, rather than the enzymes in yeast.

(e) Describe how the appearance of the limewater changes as fermentation takes place.

the limewater turns milky ..... [1]

(f) Describe how the student could tell that fermentation is complete.

no more bubbles are seen

..... [1]

Examiner comment

- As carbon dioxide gas is made during fermentation, when fermentation is no longer occurring there will be no bubbles of gas seen.
- The two most common mistakes candidates made were to state that the limewater would stop changing, or that no more carbon dioxide would be made. For the first of these answers, once the limewater has become milky it

will remain milky as more carbon dioxide is passed through it (or, with very large amounts of carbon dioxide will become clear again, but it will then remain clear as more carbon dioxide passes through it). For the second of these answers does not tell us how the student could tell that there was no more carbon dioxide being produced.

(g) Name the process used to separate ethanol from the mixture obtained by fermentation.

fractional distillation ..... [1]

Question 2

2 A student investigates the reaction between aqueous ammonia and two different aqueous solutions of copper(II) sulfate labelled **A** and **B**. Solutions **A** and **B** have different concentrations.

The student does two experiments.

Experiment 1

- Fill a burette with solution **A**.
- Run some of solution **A** out of the burette so that the level of solution **A** is on the burette scale and record the initial burette reading.
- Use a measuring cylinder to pour 25 cm^3 of aqueous ammonia into a conical flask.
- Stand the conical flask on a white tile.
- Slowly add solution **A** from the burette to the conical flask, while swirling the flask, until the mixture in the conical flask just starts to become cloudy.
- Record the final burette reading.

Experiment 2

- Empty the conical flask and rinse it with distilled water.
- Empty the burette and rinse it with distilled water.
- Rinse the burette with solution **B**.
- Repeat Experiment 1 using solution **B** instead of solution **A**.

(a) Use the burette diagrams in Fig. 2.1 and Fig. 2.2 to complete Table 2.1.

Experiment 1

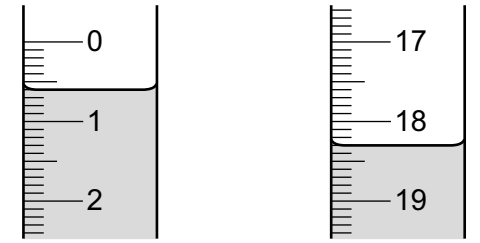


Fig. 2.1

Experiment 2

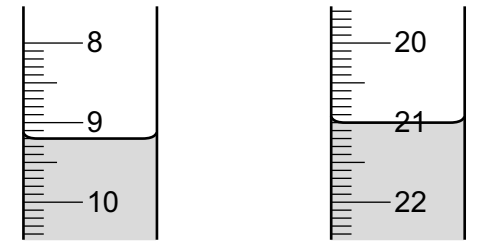


Fig. 2.2

Table 2.1

	Experiment 1 using solution **A**	Experiment 2 using solution **B**
final burette reading / cm^3	18.3	21.0
initial burette reading / cm^3	0.6	9.2
volume of aqueous copper(II) sulfate added / cm^3	17.7	11.8

[4]

Examiner comment

All readings made from the same apparatus should be given to the same number of decimal places. The most common reason for candidates not being awarded full marks for completing the table was because they recorded the final burette reading as '21' rather than '21.0'.

(b) Explain why a white tile is used during the titration.

to make it easier to tell when the mixture starts to become cloudy

..... [1]

Examiner comment

- Candidates who just stated that it enabled the colour change or formation of a precipitate to be seen were not awarded the mark as they can be seen without the white tile. The white tile made the observation clearer rather than possible.
- It was evident that many candidates were not familiar with the use of a white tile during a titration and gave answers based on protecting the bench or raising the conical flask up.

(c) In Experiment 2, the burette and the conical flask are both rinsed with water. The burette is then rinsed with solution **B**.

(i) State why both the burette and the conical flask are rinsed with water.

to remove substances remaining from Experiment 1 [1]

(ii) Explain why the burette is then rinsed with solution **B**.

to remove water which would dilute solution B

..... [1]

Examiner comment

While most candidates appreciated the need to remove the water, some candidates gave vague answers such as 'to make it a fair test' or were still focusing on removing solution A left from Experiment 1. These answers did not gain the mark.

(iii) Describe how the result of Experiment 2 would be different if the conical flask is rinsed with aqueous ammonia after rinsing with water.
Explain your answer.

rinsing the flask with ammonia would leave ammonia in the flask and so more solution B would be needed [2]

Examiner comment

Vague answers such as 'the results would change' were not awarded any marks. Some candidates did not read the question carefully and gave answers that suggested the burette (rather than the conical flask) was rinsed with aqueous ammonia.

(d) (i) Deduce which solution of copper(II) sulfate, **A** or **B**, is more concentrated.
Explain your answer.

B is more concentrated as a smaller volume of solution B was required

..... [1]

Examiner comment

- Both identification of the more concentrated solution and the reason were required to be awarded the mark. Some candidates did not give a reason and so were not awarded the mark.
- A common error was to state solution A was more concentrated because more solution A was used.

(ii) Deduce how many times more concentrated this solution of copper(II) sulfate is than the other solution of copper(II) sulfate.

17.7 ÷ 11.8 = 1.5 [1]

Examiner comment

- Candidates could be awarded the mark even if their answer to the preceding part was incorrect.
- The two most common errors were to calculate the difference between the two titres (and so give an answer of 5.9) or to invert the division and so give an answer of 0.67 (which would mean the solution is less concentrated rather than more concentrated).

(e) Describe how the reliability of the results obtained can be checked.

repeat the experiments and compare the results

..... [1]

Examiner comment

- A measurement or experiment is reliable if you repeat it and get the same or a similar result over and over again.
- Answers which suggested repeating the experiment alone were not awarded the mark as it is important that the results are compared to see if they are similar.
- Answers which suggested repeating and finding the mean without mention of comparing the results were not awarded the mark. Finding the mean of multiple results helps to eliminate random errors rather than checks the reliability or reproducibility.

(f) Deduce the volume of solution **A** required when Experiment 1 is carried out with 10 cm^3 of aqueous ammonia.

7.1 cm^3 [2]

Examiner comment

One mark was awarded for a correct volume, the other for the correct units of volume. The units mark could be awarded even if the numerical value was incorrect. Calculation of the volume required $\left(\frac{17.7 \times 10}{25}\right)$ gives a value of 7.08. This answer was accepted despite it not being possible to read a burette to the nearest one hundredth of a cubic centimetre. A common error was for candidates to base their answer on the final burette reading rather than the titre (and so give an answer of 7.32), which meant the only mark available was the one for the units.

(g) In Experiments 1 and 2, the volume of aqueous ammonia is measured using a measuring cylinder.

Give an advantage and a disadvantage of using a volumetric pipette instead of a measuring cylinder to measure the volume of aqueous ammonia.

advantage more accurate

disadvantage takes longer

[2]

Examiner comment

Some candidates gave answers which suggested they did not understand the difference between a volumetric pipette and a teat, or dropping pipette. Both items appear on the apparatus list in the syllabus and so candidates should be familiar with the use of both. Some candidates stated, correctly, that a volumetric pipette can only measure a fixed volume, however, this is not a problem in these experiments as the volume of aqueous ammonia was fixed at 25 cm^3. Answers which suggested repeating the experiment alone were not awarded the mark as it is important that the results are compared to see if they are similar.

Question 3

3 A student tests two solids: solid **E** and solid **F**.

Tests on solid E

Table 3.1 shows the tests and the student's observations.

Table 3.1

tests	observations
test 1 Gently heat half of solid **E** in a boiling tube.	a solution forms, steam is given off and condensation forms at the top of the tube
test 2 Dissolve the remaining solid **E** in water to form solution **E**. Divide solution **E** into three portions. To the first portion of solution **E**, add aqueous sodium hydroxide dropwise and then in excess.	a brown precipitate forms which remains when excess is added
test 3 Warm the product of **test 2** and test any gas produced.	the gas turns red litmus paper blue
test 4 To the second portion of solution **E**, add 1 cm depth of dilute nitric acid followed by a few drops of aqueous silver nitrate.	no change
test 5 To the third portion of solution **E**, add 1 cm depth of dilute nitric acid followed by a few drops of aqueous barium nitrate.	white precipitate

(a) State what conclusion can be made about solid **E** from the observations in **test 1**.

solid E is hydrated ..... [1]

Examiner comment

The formation of steam and condensation means that water is lost when the solid is heated. Some candidates did not read the question carefully and tried to give conclusions based on tests other than test 1.

(b) Identify the gas produced in **test 3**.

ammonia ..... [1]

Examiner comment

If the candidate identified the gas by use of only an incorrect formula, then the mark was not awarded.

(c) State what conclusion can be made about solid **E** from the observations in **test 4**.

solid E is not a halide ..... [1]

Examiner comment

Candidates find interpreting negative test results more demanding than interpreting positive test results. The test carried out was the test for halide ions (chloride, bromide and iodide) and not halogens. Statements that solid E did not contain a halogen were ignored.

(d) Identify the **three** ions in solid **E**.

solid E contains the ions ammonium, iron(III) and sulfate .....

..... [3]

Examiner comment

- If formulae are given rather than the names of ions, then those formulae must be fully correct to be awarded the marks available.
- Most candidates correctly identified the presence of sulfate ions.
- Iron, rather than iron(III), was insufficient to be awarded a mark.
- A common error was to identify nitrate ions and being present rather than ammonium ions.

Tests on solid F

Solid **F** is zinc sulfite.

Complete the expected observations.

The student dissolves solid **F** in water to form solution **F**.

The student divides solution **F** into three portions.

(e) To the first portion of solution **F**, the student adds aqueous ammonia dropwise until it is in excess.

observations adding dropwise a white precipitate is formed

observations in excess the precipitate dissolves and forms a colourless solution

[2]

(f) To the second portion of solution **F**, the student adds a few drops of acidified aqueous potassium manganate(VII).

observations purple potassium manganate(VII) became colourless

..... [1]

(g) To the third portion of solution **F**, the student adds 1 cm depth of dilute nitric acid followed by a few drops of aqueous barium nitrate.

observations no change

..... [1]

Examiner comment

The most common incorrect answer seen was 'white precipitate', which is the positive result for the sulfite test that had been carried out. As solid F was zinc sulfite (not sulfate), there would not have been a precipitate of barium sulfate formed and so no change would have been seen.

Question 4

4 Solid cobalt(II) oxide is a base which is insoluble in water. It reacts very slowly with cold dilute sulfuric acid to form a solution of cobalt(II) sulfate.

Describe how to make pure, dry crystals of hydrated cobalt(II) sulfate.

You are provided with cobalt(II) oxide, dilute sulfuric acid and common laboratory apparatus.

- pour dilute sulfuric acid into a conical flask
- add excess cobalt(II) oxide to the dilute sulfuric acid
- stir and heat the mixture
- filter to remove the excess cobalt(II) oxide
- place the filtrate in an evaporating basin and warm it until a saturated solution is formed
- cool the saturated solution, filter off the crystals of hydrated cobalt(II) sulfate and dry them with filter paper

[6]

Examiner comment

- It is a good idea to write answers to the planning question as a series of steps or bulleted points.
- There is no advantage to writing a list of apparatus that will be used, if there is mark for the use of appropriate apparatus then the mark will only be awarded if the item of apparatus is used in an appropriate way.
- Candidates should read the question carefully. Many answers to this question started with cobalt(II) sulfate solution and so could only be awarded the last two marking points.
- It is a good idea to plan an answer out before starting to write it. Many answers seen had footnotes or additions where important steps had initially been omitted.

Cambridge Assessment International Education
The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA, United Kingdom
t: +44 1223 553554
e: info@cambridgeinternational.org www.cambridgeinternational.org