



Rewarding Learning

General Certificate of Secondary Education
2025

Centre Number

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Candidate Number

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Chemistry

Unit 3: Practical Skills

Practical Booklet B

Higher Tier



[GCM34]

GCM34

FRIDAY 20 JUNE, AFTERNOON

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

You must answer the questions in the spaces provided.

Do not write outside the boxed area on each page or on blank pages.

Complete questions in black ink and use a dark HB pencil for drawings and graphs.

Do not write with a gel pen.

Answer all **five** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

You may use a scientific calculator.

Quality of written communication will be assessed in Question **2(c)(ii)**.

A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

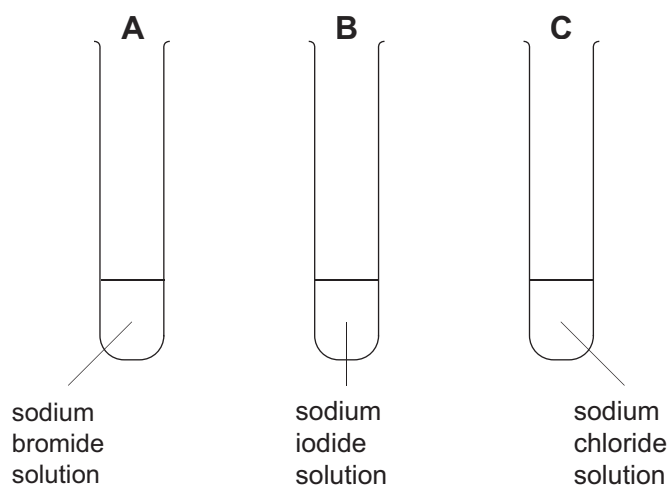
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16GCM3401

1 An experiment was carried out to compare the reactivity of the halogens.

2 cm³ of a sodium halide solution were added to the test tubes labelled **A**, **B** and **C** as shown below.



(a) (i) Chlorine water was added dropwise to each test tube until no further change occurred. Complete the table below.

| Test tube | A | B | C |
|--|---------------------------------------|---|-----------|
| Observation on addition of chlorine water dropwise | Colourless solution changed to orange | | No change |

[1]

(ii) Write a balanced symbol equation for the reaction occurring in test tube **A**.

_____ [3]

(iii) State the type of reaction occurring in test tube **A**.

_____ [1]

(iv) Name a suitable piece of apparatus used to measure 2 cm³ of the sodium halide solutions.

_____ [1]



The experiment was set up again as shown in the diagram using fresh samples of each sodium halide solution.

(b) Bromine water was then added dropwise to each test tube. In which test tube, (A, B or C), will a reaction occur? State the colour change observed.

Test tube _____

Colour change from _____ to _____ [2]

(c) Silver nitrate solution was added dropwise to fresh samples of the sodium halide solutions in the test tubes labelled A, B and C.

(i) Complete the table below.

| Test tube | A | B | C |
|--|---|--------------------|---|
| Observation on addition of silver nitrate solution | | Yellow precipitate | |

[2]

(ii) State the name of the yellow precipitate formed in test tube B.

_____ [1]

(iii) Write an ionic equation for the formation of the yellow precipitate in test tube B. Include state symbols.

_____ [3]

[Turn over



2 A range of chemical tests may be used to identify the homologous series to which an organic compound belongs.

(a) Several tests were carried out on two gaseous hydrocarbons, **X** and **Y**. The results of one of the tests are shown in the table below.

| Test | Hydrocarbon X | Hydrocarbon Y |
|--------------------------------------|------------------------------|--|
| Bubble the gas through bromine water | Bromine water remains orange | Orange bromine water changes to colourless |

(i) Name the homologous series to which hydrocarbon **X** belongs.

_____ [1]

(ii) Name the homologous series to which hydrocarbon **Y** belongs.

_____ [1]

(iii) Which hydrocarbon, **X** or **Y**, is unsaturated? Explain your answer giving evidence from the table.

_____ [1]



(b) A sample of 0.87 g of hydrocarbon **X** from (a) is found to contain 0.72 g of carbon.

(i) Determine the empirical formula of hydrocarbon **X**.

Show your working out.

empirical formula _____ [4]

(ii) The relative formula mass (M_r) of hydrocarbon **X** is 58. Determine the molecular formula of hydrocarbon **X**.

molecular formula _____ [1]

(iii) Name hydrocarbon **X**.

_____ [1]

[Turn over





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[Turn over



16GCM3407

3 AdBlue, an aqueous solution of urea, H_2NCONH_2 , is used in the exhaust system of diesel vehicles to remove oxides of nitrogen. At high temperatures, the urea in AdBlue undergoes thermal decomposition forming ammonia and carbon dioxide.

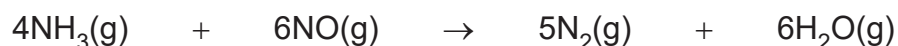
(a) (i) Explain the meaning of the term thermal decomposition.

_____ [1]

(ii) Calculate the percentage of nitrogen by mass in urea, H_2NCONH_2 .
Give your answer to 1 decimal place.

percentage of nitrogen = _____ % [2]

(b) The ammonia produced in the thermal decomposition of urea reacts with harmful nitrogen monoxide in the exhaust gases forming nitrogen and water which are non-polluting. The equation for the reaction is shown below.



(i) State Avogadro's Law.

_____ [2]



- (ii) Calculate the volume of nitrogen gas formed when excess ammonia gas reacts with 900 cm^3 of nitrogen monoxide, NO.

volume of nitrogen = _____ cm^3 [1]

- (iii) 70 cm^3 of ammonia gas are mixed with 60 cm^3 of nitrogen monoxide gas, NO. The reaction is allowed to occur. The nitrogen monoxide is the limiting reactant.

Use the headings below to calculate the total volume of gases present after the reaction has occurred.

volume of $\text{N}_2(\text{g})$ formed from 60 cm^3 of NO = _____ cm^3

volume of $\text{H}_2\text{O}(\text{g})$ formed from 60 cm^3 of NO = _____ cm^3

volume of $\text{NH}_3(\text{g})$ left over after reaction = _____ cm^3

total volume of gas = _____ cm^3 [4]

[Turn over



4 The following experiment was carried out to determine the concentration of sulfuric acid.

Step 1 Use a pipette and pipette filler to measure and add 25.0 cm^3 of sulfuric acid to a clean conical flask.

Step 2 Add three drops of an indicator to the conical flask and place the conical flask on a white tile.

Step 3 Fill a burette with sodium hydroxide solution. Record the initial burette reading.

Step 4 Add the sodium hydroxide solution from the burette to the conical flask with swirling.

Step 5 Stop adding the sodium hydroxide solution when the end point is reached. Record the final burette reading and calculate the rough titre.

Step 6 Repeat Steps 1 to 5 adding sodium hydroxide solution slowly from the burette near the end point until two accurate titres within 0.2 cm^3 of each other are obtained.

(a) State the name of this experimental method used to determine the concentration of the sulfuric acid.

_____ [1]

(b) State the name of a suitable indicator that may be used in this experiment and the colour change observed at the end point.

Indicator _____

Colour change from _____ to _____ [3]

(c) Suggest why the conical flask is placed on a white tile.

_____ [1]



(d) Draw a suitable results table with headings to record the results of this experiment.

[4]

(e) Suggest why Steps 1 to 5 are repeated until two accurate titres are obtained.

[1]

[Turn over



5 A student followed the procedure below to investigate the solubility of potassium bromide.

Step 1 Weigh out 2.6 g of potassium bromide crystals and place in a boiling tube.

Step 2 Add 10 cm³ of water to the boiling tube.

Step 3 Place the boiling tube in a beaker of water and heat gently using a Bunsen burner. Stir the contents of the boiling tube with a thermometer.

Step 4 When all the solid has dissolved, remove the boiling tube from the water bath and place in a beaker of cold water.

Step 5 Stir the solution with the thermometer and record the temperature at which crystals first appear.

(a) Draw a **labelled** diagram of the assembled apparatus used to heat the boiling tube containing potassium bromide and water.

[4]



(b) What is meant by the term solubility?

[3]

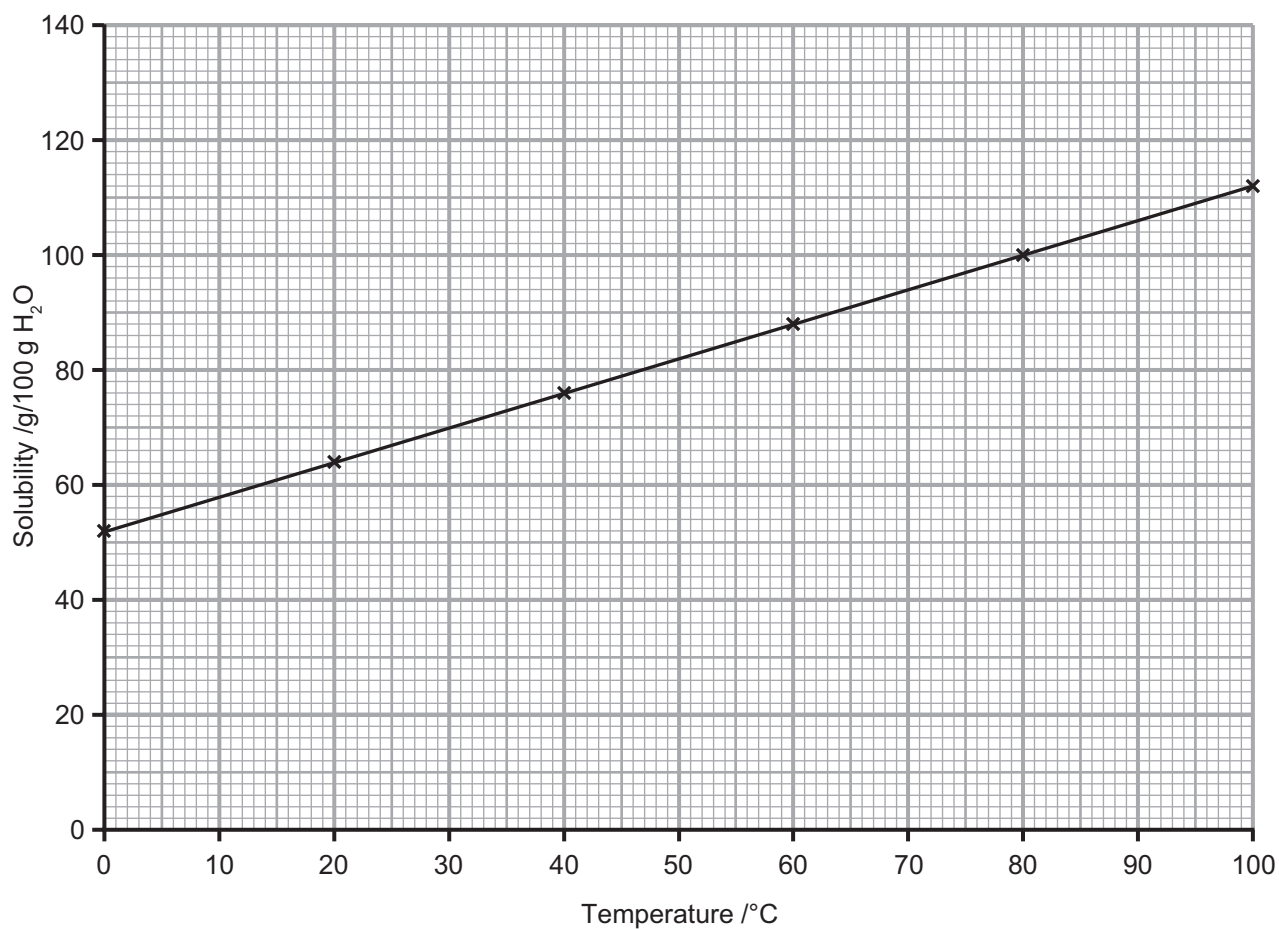
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(c) The graph below shows how the solubility of potassium bromide changes with temperature.



(i) What is the solubility of potassium bromide at 70°C?

_____ [1]

(ii) At what temperature would 14.5 g of potassium bromide saturate 25 g of water?

Show your working out.

_____ [2]



- (iii) A saturated solution of potassium bromide in 250 g of water at 80°C was cooled to 30°C. What mass of crystals was deposited?
Show your working out.

mass of crystals deposited = _____ g [4]

- (d) Potassium bromide solution and lead(II) nitrate solution react to form solid lead(II) bromide and potassium nitrate solution.

- (i) Write a balanced symbol equation for this reaction. Include state symbols.

_____ [4]

- (ii) Name the type of reaction occurring.

_____ [1]

THIS IS THE END OF THE QUESTION PAPER



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| For Examiner's use only | |
|--------------------------------|--------------|
| Question Number | Marks |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| Total Marks | |

Examiner Number

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