Rewarding Learning

Centre Number

Candidate Number

Chemistry

Unit 3: Practical Skills

Practical Booklet B
Higher Tier

[GCM34]
Assessment

GCM34

Assessment Level of Control:
Tick the relevant box (✓)

Controlled Conditions	
Other	

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 in black ink only. **Do not write with a gel pen.**
Answer **all six** 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.
Quality of written communication will be assessed in Question **2**.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

12468.05**R**

1   25 cm³ of 1.0 mol/dm³ sodium hydroxide solution were placed in a polystyrene cup and the temperature recorded.

An excess (40 cm³) of 1.0 mol/dm³ hydrochloric acid was added. The mixture was stirred using a thermometer and the highest temperature reached was recorded.

The reaction of sodium hydroxide solution with propanoic acid was then investigated using the same apparatus. The temperature change for the reaction of sodium hydroxide solution with propanoic acid was less than the temperature change for the reaction of sodium hydroxide solution with hydrochloric acid.

thermometer

polystyrene cup

25 cm³ of sodium hydroxide
solution and excess acid
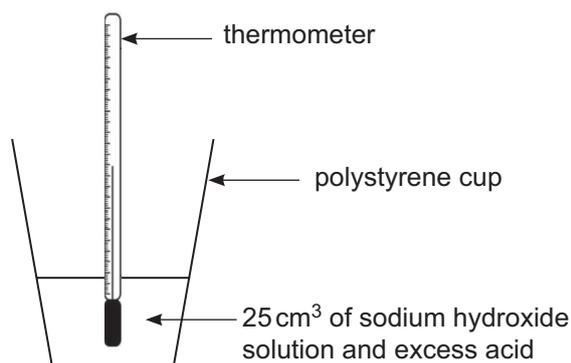
(a) (i)   Write a balanced symbol equation for the reaction between sodium hydroxide and hydrochloric acid. Include state symbols.

_____   [3]

(ii)   Explain, using evidence from the method above, whether the reaction between sodium hydroxide and hydrochloric acid is exothermic or endothermic.

_____

_____   [1]

(b) (i) Explain why a polystyrene cup was used in this experiment instead of a glass beaker.

_____

_____ [1]

(ii) Explain why the solution was stirred after adding the hydrochloric acid.

_____

_____ [1]

(iii) State and explain one improvement which could be made to the apparatus shown in the diagram.

_____

_____

_____ [2]

(iv) How would you ensure that the investigation is a fair test?

_____

_____

_____

_____ [2]

[Turn over

(c) Calculate the number of moles of sodium hydroxide in the polystyrene cup at the start of the experiment.

_____ [1]

(d) (i) Explain why the temperature change for the reaction of sodium hydroxide solution with propanoic acid was less than the temperature change for the reaction of sodium hydroxide solution with hydrochloric acid.

_____

_____ [1]

(ii) Write a word equation for the reaction between propanoic acid and sodium hydroxide.

_____ [1]

(iii) Write an ionic equation to represent the neutralisation reaction between propanoic acid and sodium hydroxide.

_____ [2]

12468.05**R**

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(Questions continue overleaf)

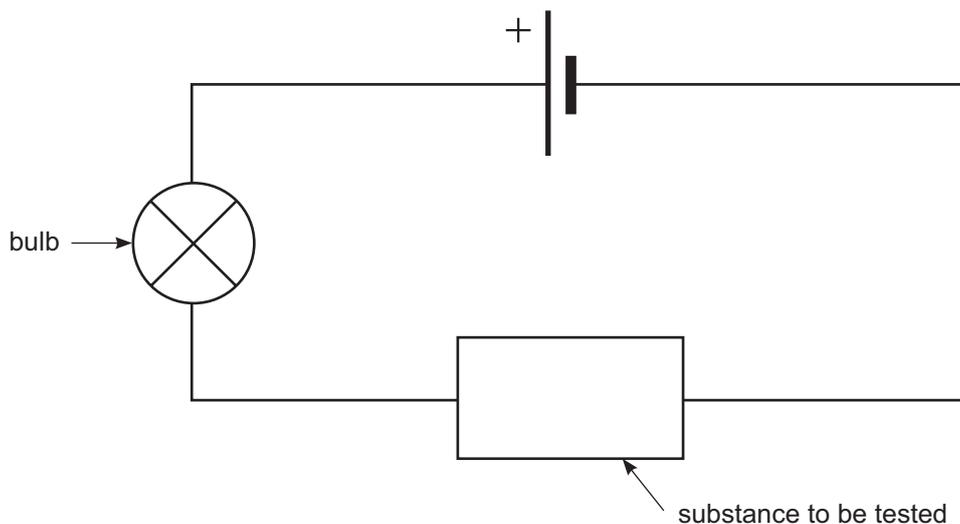**2** In an experiment to test the electrical conductivity of some substances the apparatus was set up as shown in the diagram below.

Solid samples of graphite, titanium, sulfur, sodium chloride and iodine were tested in the circuit and the results recorded in the table below.

Substance	Does the bulb light?
Graphite	Yes
Titanium	Yes
Sulfur	No
Sodium chloride	No
Iodine	No

16GCM3406

State and explain the electrical conductivity of each substance using the results obtained.

In your answer you will be assessed on the quality of your written communication including the use of specialist scientific terms.

_____

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_____

_____ [6]

[Turn over

3 Hydrated copper(II) chloride crystals, $CuCl_2.2H_2O$, may be prepared by reacting dilute hydrochloric acid with an excess of copper(II) carbonate.

(a) Write a balanced symbol equation for the reaction of hydrochloric acid with copper(II) carbonate.

_____ [3]

(b) Describe, giving experimental details, how you would prepare a sample of pure, dry hydrated copper(II) chloride crystals from excess copper(II) carbonate and $25\,cm^3$ of dilute hydrochloric acid.

_____

_____

_____

_____

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_____

_____ [6]

(c) Describe how a flame test may be carried out on a solid sample of copper(II) chloride to prove that it contained copper(II) ions.
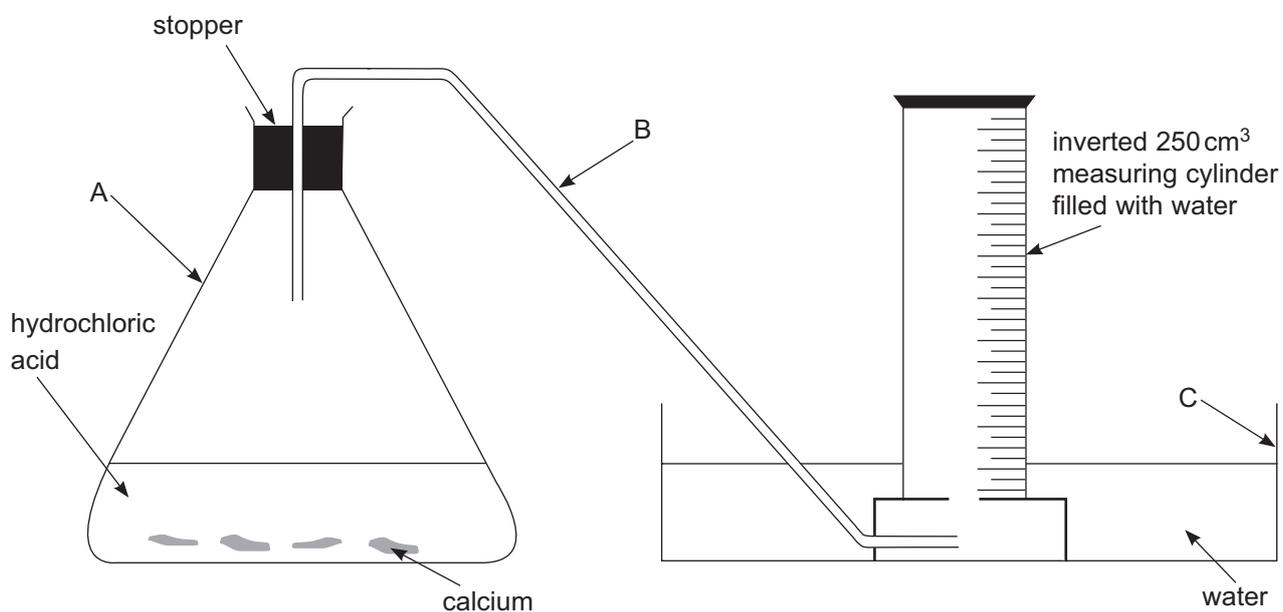
_____

_____

_____

_____

_____ [4]

(d) A few drops of silver nitrate solution were added to a solution of copper(II) chloride. State what would be observed.

_____ [1]

4 **(a)** The apparatus shown below can be used to measure the volume of hydrogen gas produced in the reaction between calcium and hydrochloric acid. To start the experiment the calcium is dropped into the flask and the stopper quickly replaced.

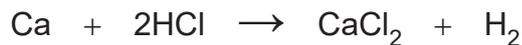**(i)** Suggest one error which may occur in this experimental method.

_____

_____ [1]

(ii) What labels should be placed at A, B and C on the diagram?

A _____

B _____

C _____ [3]

12468.05**R**

(b) In an experiment, 0.10 g of calcium were reacted with excess hydrochloric acid and the gas was collected in a gas syringe. The equation for the reaction is:

$$Ca \ + \ 2HCl \ \longrightarrow \ CaCl_2 \ + \ H_2$$

Calculate the volume of hydrogen gas, in cm^3, produced at 20 °C and 1 atm pressure and explain whether a 50 cm^3 or 100 cm^3 gas syringe would be most suitable to collect the gas.

Volume of gas = _____ cm^3

_____

_____

_____ [4]

(c) Oxygen gas may be prepared by the catalytic decomposition of hydrogen peroxide.

(i) Name the catalyst used in this preparation and describe its appearance.

Name: _____

Appearance: _____ [3]

(ii) Describe the appearance of the hydrogen peroxide used to prepare oxygen gas.

_____ [2]

(iii) Describe the test for oxygen gas.

_____ [1]

[Turn over

5 The table below shows the results of tests using chemicals which are referred to as **P**, **Q**, **R**, **S** and **T**. Use the information in the table to identify each of the chemicals.

Chemical	Test results
P	**P** changes from orange to green when warmed with ethanol
Q	**Q** changes from colourless to milky when carbon dioxide gas is bubbled through it
R	**R** changes from orange to colourless when ethene gas is bubbled through it
S	White fumes are produced when a glass rod dipped in **S** is applied to a sample of ammonia gas
T	**T** changes from colourless to pink when added to sodium hydroxide solution

Identify **P**, **Q**, **R**, **S** and **T**.

P _____ [2]

Q _____ [1]

R _____ [1]

S _____ [2]

T _____ [1]

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6 A solution of sodium carbonate was prepared by dissolving 7.84 g of a sample of hydrated sodium carbonate ($Na_2CO_3.xH_2O$) in 1000 cm³ (1 dm³) of deionised water.

25.0 cm³ of this solution were placed in a conical flask with a few drops of methyl orange indicator and titrated against 0.100 mol/dm³ hydrochloric acid.

The average titre was found to be 24.5 cm³.

The equation for the reaction is:

$$Na_2CO_3 \ + \ 2HCl \ \longrightarrow \ 2NaCl \ + \ H_2O \ + \ CO_2$$

(a) Complete the table below.

Substance	Colour
solid hydrated sodium carbonate	
sodium carbonate solution	

[2]

(b) What piece of apparatus is used to measure out 25.0 cm³ of sodium carbonate solution?

_____ [1]

(c) Draw a labelled diagram of the assembled apparatus used to carry out this titration.

[4]

(d) Calculate the concentration of the sodium carbonate solution in mol/dm^3.

concentration = _____ mol/dm^3 [3]

(e) Calculate the value of x in this sample of $Na_2CO_3.xH_2O$.

x = _____ [3]

(f) Suggest an alternative practical method to determine the value of x in a sample of $Na_2CO_3.xH_2O$.

_____

_____ [1]

_____

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