



Rewarding Learning

General Certificate of Secondary Education
2019

Centre Number

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Candidate Number

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Chemistry

Unit 3: Practical Skills

Practical Booklet B

Higher Tier



[GCM34]

GCM34

WEDNESDAY 19 JUNE, MORNING

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 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.

Quality of written communication will be assessed in Question **1(a)**.

A Data Leaflet, which includes a Periodic Table of the Elements, is provided.



1 25.0 cm³ of a solution of sodium hydroxide were placed in a conical flask using a pipette. Three drops of methyl orange indicator were added. The sodium hydroxide was titrated against 0.045 mol/dm³ sulfuric acid. The sulfuric acid was added from a burette.

(a) Describe how

- a burette is prepared and filled with sulfuric acid and
- accuracy is ensured when determining the end-point.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

[illegible]

[6]

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- (b) A rough titration and two subsequent accurate titrations were carried out. The table below gives the results of the titrations and the average titre is recorded below the table.

	Initial burette reading (cm ³)	Final burette reading (cm ³)	Titre (cm ³)
Rough titration	0.0	21.2	21.2
First accurate titration	21.2	41.4	20.2
Second accurate titration	25.2	45.2	20.0

Average titre = 20.1 cm³

- (i) Why is a rough titration carried out?

_____ [1]

- (ii) State the colour change at the end-point.

From _____ to _____ [2]

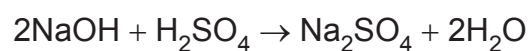
[Turn over



(iii) Calculate the number of moles of sulfuric acid added from the burette.

moles of sulfuric acid = _____ [1]

The equation for the reaction is:



(iv) Calculate the number of moles of sodium hydroxide present in 25.0 cm³.

moles of sodium hydroxide = _____ [1]

(v) Calculate the concentration of the sodium hydroxide solution in mol/dm³.

concentration = _____ mol/dm³ [1]



(vi) Calculate the concentration of the sodium hydroxide solution in g/dm³.

concentration = _____ g/dm³ [1]

[Turn over



- 2 (a) A solution of an ionic compound, labelled A, was tested as shown in the table below.

Test	Observations
1. Place approximately 5 cm ³ of solution A in a test tube and add a few drops of sodium hydroxide solution	white precipitate
2. Add excess sodium hydroxide solution to the test tube from test 1	white precipitate is soluble forming a colourless solution
3. Place approximately 5 cm ³ of solution A in a test tube and add a few drops of silver nitrate solution	cream precipitate
4. Place approximately 5 cm ³ of solution A in a test tube and add a few drops of ammonia solution	white precipitate
5. Add excess ammonia solution to the test tube from test 4	white precipitate is soluble forming a colourless solution

- (i) Write the formula of the cation present in solution A.

_____ [1]

- (ii) Write the formula of the anion present in solution A.

_____ [1]



(iii) Write the name and formula of the ionic compound dissolved in solution A.

Name: _____

Formula: _____ [2]

(iv) Write an ionic equation for the reaction in test 3 including state symbols.

_____ [3]

(v) Name the white precipitate formed in test 4.

_____ [1]

(b) An unknown solid is thought to be potassium carbonate.

(i) State how you would prove that the solid contained potassium ions.

_____ [2]

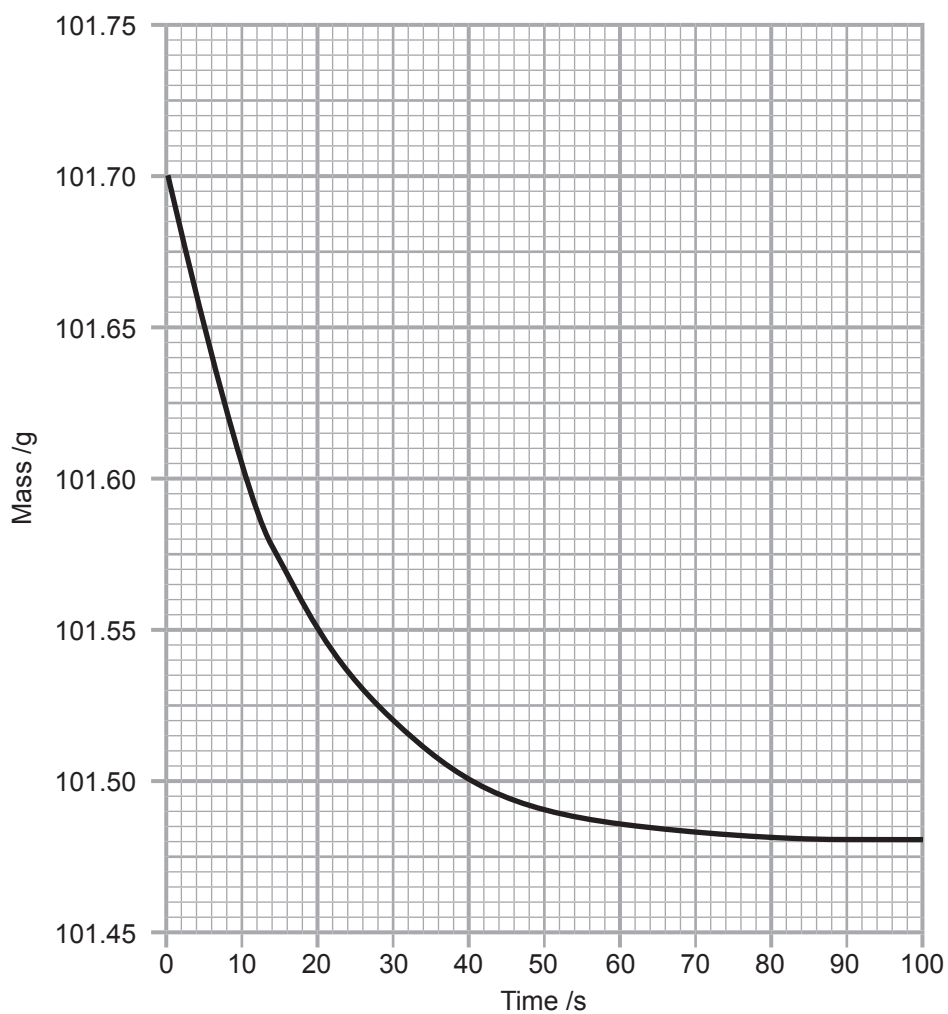
(ii) Describe the procedure you would use to prove that the solid contained carbonate ions.

_____ [4]

[Turn over



- 3 A marble chip of mass 0.56 g was added to 25.0 cm³ of hydrochloric acid in a conical flask at 25 °C. The mass of the flask and its contents was recorded every 10 seconds for 100 seconds. The results are plotted on the axes below.



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

[4]

- (b) (i) Explain why the graph levelled off.

[1]

- (ii) The experiment was repeated at 40 °C. Sketch the graph on the axes opposite which would be obtained at 40 °C with all other factors being the same.

[1]

[Turn over]



- (c) The balanced symbol equation for the reaction between the calcium carbonate in the marble chip and hydrochloric acid is:



- (i) Use the graph to calculate the mass of carbon dioxide produced during the reaction.

_____ [1]

- (ii) Calculate the number of moles of carbon dioxide which were produced during the reaction.

moles of carbon dioxide = _____ [1]

- (iii) Using your answer to (c)(ii) and the balanced symbol equation, calculate the number of moles of calcium carbonate which were present in the marble chip.

moles of calcium carbonate = _____ [1]



- (iv) Calculate the mass of calcium carbonate which was present in the marble chip.

mass of calcium carbonate = _____ g [1]

- (v) The mass of the marble chip was 0.56 g. Calculate the percentage of calcium carbonate in the marble chip. Give your answer to 1 decimal place.

percentage = _____ % [2]

[Turn over



- 4 The reactivity of metals varies greatly. Many different reactions of metals may be used to determine a reactivity series.

(a) Five metals were reacted with dilute nitric acid. The initial temperature of the nitric acid was recorded before the metal was added. The highest temperature during the reaction was also recorded. The results are shown in the table below.

Metal	Initial temperature (°C)	Highest temperature (°C)	Temperature change (°C)
zinc	20	25	5
copper	20	20	0
magnesium	20	39	
iron	20	23	
tin	20	21	

(i) Complete the table. [1]

(ii) The reactivity series for four of the metals is given below. Place tin in this reactivity series.

Most reactive: magnesium

zinc

iron

Least reactive: copper

[1]



(iii) Explain how the data in the table shows that the reaction of magnesium and nitric acid is exothermic.

_____ [1]

(iv) State two factors which should be kept the same during this experiment.

1. _____

2. _____ [2]

(v) Write a balanced symbol equation for the reaction of magnesium with nitric acid.

_____ [3]

[Turn over



- (b) A series of displacement reactions was carried out with two other metals, chromium and cobalt. The results are shown in the table below. A tick (✓) indicates that a reaction occurs.

Metal	magnesium nitrate	zinc nitrate	iron(II) nitrate	copper(II) nitrate	tin(II) nitrate	chromium(III) nitrate	cobalt(II) nitrate
chromium	×	×	✓	✓	✓		✓
cobalt	×	×	×	✓	✓	×	

- (i) Look at the statements below. Place a tick (✓) in the box beside the statements which are correct.

Cobalt is more reactive than chromium	☐
Cobalt is more reactive than copper and tin	☐
Chromium is more reactive than iron and less reactive than zinc	☐

[1]

- (ii) Name the two products of the reaction of cobalt and copper(II) nitrate.

_____ [2]

- (iii) Write a balanced symbol equation for the reaction of chromium with iron(II) nitrate forming chromium(III) nitrate and iron.

_____ [3]





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- 5 (a) An organic compound, labelled B, is a liquid at room temperature and is tested as shown in the table below.

Test	Details	Observations
1	Mix the liquid with bromine water and shake	bromine water remains orange
2	Mix the liquid with acidified potassium dichromate solution and warm gently in a water bath	changes from orange to green
3	Add solid sodium carbonate to the liquid	no reaction

- (i) State the functional group present in compound B.

_____ [1]

- (ii) To what homologous series does compound B belong?

_____ [1]

- (iii) State the functional group which is **not** present in compound B based on test 1.

_____ [1]

- (iv) State the functional group which is **not** present in compound B based on test 3.

_____ [1]



- (v) Compound B contains 3 carbon atoms. Draw the structural formula and name two organic compounds which could be compound B.

Name: _____

Name: _____ [4]

- (b) Carboxylic acids such as ethanoic acid are weak acids. Hydrochloric acid is a strong acid.

- (i) What is meant by the term weak acid?

_____ [1]

- (ii) Describe how you would test samples of hydrochloric acid and ethanoic acid to prove that one is a weak acid and one is a strong acid.

_____ [3]

[Turn over]



(c) Propanoic acid reacts with sodium hydroxide solution and with solid copper(II) carbonate.

(i) Name the salt produced in the reaction of propanoic acid with sodium hydroxide.

_____ [1]

(ii) Suggest the colour change observed in the solution when copper(II) carbonate is added to propanoic acid.

From _____ to _____ [1]

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

_____ [3]

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

Total Marks	
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Examiner Number

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SYMBOLS OF SELECTED IONS
Positive ions

Name	Symbol
Ammonium	NH_4^+
Chromium(III)	Cr^{3+}
Copper(II)	Cu^{2+}
Iron(II)	Fe^{2+}
Iron(III)	Fe^{3+}
Lead(II)	Pb^{2+}
Silver	Ag^+
Zinc	Zn^{2+}

Negative ions

Name	Symbol
Butanoate	$\text{C}_3\text{H}_7\text{COO}^-$
Carbonate	CO_3^{2-}
Dichromate	$\text{Cr}_2\text{O}_7^{2-}$
Ethanoate	CH_3COO^-
Hydrogencarbonate	HCO_3^-
Hydroxide	OH^-
Methanoate	HCOO^-
Nitrate	NO_3^-
Propanoate	$\text{C}_2\text{H}_5\text{COO}^-$
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}

**SOLUBILITY IN COLD WATER OF COMMON SALTS,
HYDROXIDES AND OXIDES**

Soluble
All sodium, potassium and ammonium salts
All nitrates
Most chlorides, bromides and iodides EXCEPT silver and lead chlorides, bromides and iodides
Most sulfates EXCEPT lead and barium sulfates Calcium sulfate is slightly soluble
Insoluble
Most carbonates EXCEPT sodium, potassium and ammonium carbonates
Most hydroxides EXCEPT sodium, potassium and ammonium hydroxides
Most oxides EXCEPT sodium, potassium and calcium oxides which react with water

Data Leaflet

Including the Periodic Table of the Elements

For the use of candidates taking
Science: Chemistry,
Science: Double Award
or Science: Single Award

Copies must be free from notes or additions of any
kind. No other type of data booklet or information
sheet is authorised for use in the examinations

gcse examinations

chemistry

Group

1	H	Hydrogen	1
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† 90 – 103 Actinium series

b = atomic number

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	145 Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	231 Pa Protactinium 91	238 U Uranium 92	237 Np Neptunium 93	242 Pu Plutonium 94	243 Am Americium 95	247 Cm Curium 96	245 Bk Berkelium 97	251 Cf Californium 98	254 Es Einsteinium 99	253 Fm Fermium 100	256 Md Mendelevium 101	254 No Nobelium 102	257 Lr Lawrencium 103