



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

MV18

[GCM34]

WEDNESDAY 19 JUNE, MORNING

Time

1 hour, plus your additional time allowance.

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 on blank pages.

Complete in black ink only.

Answer **all five** questions.

Information for Candidates

The total mark for this paper is 70.

Figures in brackets printed at the end of each question 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.

(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 mark]

(ii) State the colour change at the end-point.
[2 marks]

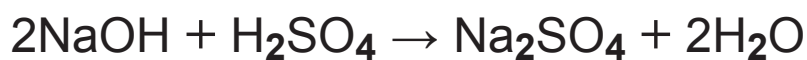
From _____

to _____

(iii) Calculate the number of moles of sulfuric acid added from the burette. [1 mark]

moles of sulfuric acid = _____

The equation for the reaction is:



(iv) Calculate the number of moles of sodium hydroxide present in 25.0 cm³. [1 mark]

moles of sodium hydroxide = _____

(v) Calculate the concentration of the sodium hydroxide solution in mol/dm³. [1 mark]

concentration = _____ mol/dm³

(vi) Calculate the concentration of the sodium hydroxide solution in g/dm³. [1 mark]

concentration = _____ g/dm³

- 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 mark]
-

- (ii) Write the formula of the anion present in solution A.
[1 mark]
-

(iii) Write the name and formula of the ionic compound dissolved in solution A. [2 marks]

Name: _____

Formula: _____

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

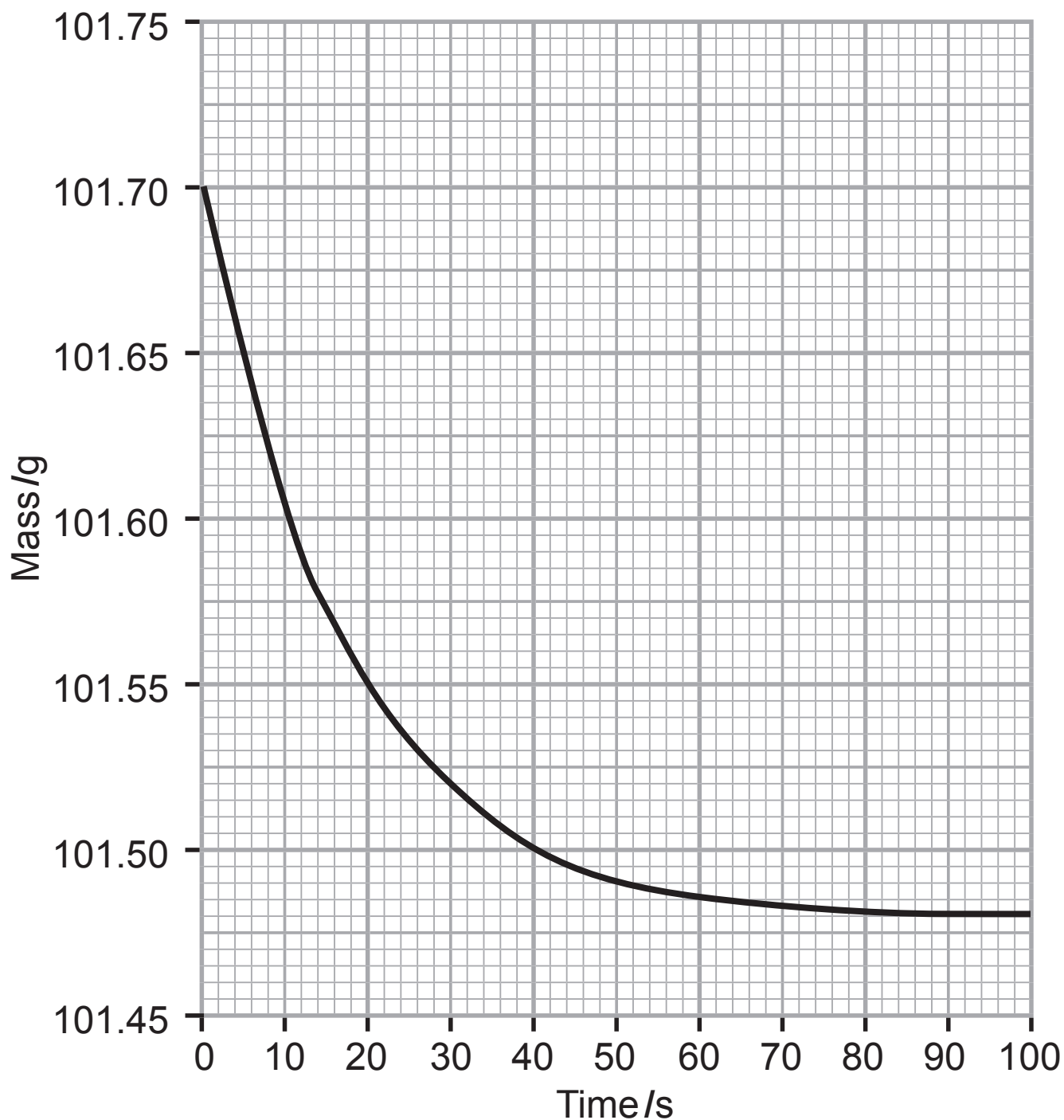
(v) Name the white precipitate formed in test 4. [1 mark]

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

(i) State how you would prove that the solid contained potassium ions. [2 marks]

(ii) Describe the procedure you would use to prove that the solid contained carbonate ions. [4 marks]

- 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 marks]

(b) (i) Explain why the graph levelled off. [1 mark]

(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 mark]

- (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 mark]
-

- (ii) Calculate the number of moles of carbon dioxide which were produced during the reaction. [1 mark]

moles of carbon dioxide = _____

- (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. [1 mark]

moles of calcium carbonate = _____

(iv) Calculate the mass of calcium carbonate which was present in the marble chip. [1 mark]

mass of calcium carbonate = _____ g

(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. [2 marks]

percentage = _____ %

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 mark]

(ii) The reactivity series for four of the metals is given below. Place tin in this reactivity series. [1 mark]

Most reactive: magnesium

zinc

iron

Least reactive: copper

(iii) Explain how the data in the table shows that the reaction of magnesium and nitric acid is exothermic. [1 mark]

(iv) State two factors which should be kept the same during this experiment. [2 marks]

1. _____

2. _____

(v) Write a balanced symbol equation for the reaction of magnesium with nitric acid. [3 marks]

(b)

| Metal | magnesium nitrate | zinc nitrate | iron(II) nitrate | copper(II) nitrate | tin(II) nitrate | chromium(III) nitrate | cobalt(II) nitrate |
|----------|-------------------|--------------|------------------|--------------------|-----------------|-----------------------|--------------------|
| chromium | X | X | ✓ | ✓ | ✓ | | ✓ |
| cobalt | X | X | X | ✓ | ✓ | X | |

A series of displacement reactions was carried out with two other metals, chromium and cobalt. The results are shown in the table on page 14.

A tick (✓) indicates that a reaction occurs.

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

[1 mark]

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

(ii) Name the two products of the reaction of cobalt and copper(II) nitrate. [2 marks]

(iii) Write a balanced symbol equation for the reaction of chromium with iron(II) nitrate forming chromium(III) nitrate and iron. [3 marks]

- 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 mark]
-

- (ii) To what homologous series does compound B belong? [1 mark]
-

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

- (iv) State the functional group which is **not** present in compound B based on test 3. [1 mark]
-

- (v) Compound B contains 3 carbon atoms. Draw the structural formula and name two organic compounds which could be compound B. [4 marks]



Name: _____

Name: _____

- (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 mark]

- (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 marks]

(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 mark]

(ii) Suggest the colour change observed in the solution when copper(II) carbonate is added to propanoic acid. [1 mark]

From _____

to _____

(iii) Write a balanced symbol equation for the reaction of copper(II) carbonate with propanoic acid. [3 marks]

This is the end of the question paper

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

| | |
|--------------------|--|
| Total Marks | |
|--------------------|--|

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-} |



New
Specification

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

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 |

gcse examinations chemistry

THE PERIODIC TABLE OF ELEMENTS

Group

| | | | | | | | | | | | | | | | | | | | |
|------------------------------------|------------------------------------|--------------------------------------------------|------------------------------------------|------------------------------------|---------------------------------------|-------------------------------------|-------------------------------------|---------------------------------------|-----------------------------------------|----------------------------------------|----------------------------------------|------------------------------------|------------------------------------|------------------------------------|-------------------------------------|-------------------------------------|----------------------------------|-------------------------------|---|
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | 1 H Hydrogen 1 | | | | | | 4 He Helium 2 | |
| | | 1 | 2 | | | | | | | | | | | 3 | 4 | 5 | 6 | 7 | 0 |
| 7 Li Lithium 3 | 9 Be Beryllium 4 | | | | | | | | | | | 11 B Boron 5 | 12 C Carbon 6 | 14 N Nitrogen 7 | 16 O Oxygen 8 | 19 F Fluorine 9 | 20 Ne Neon 10 | | |
| 23 Na Sodium 11 | 24 Mg Magnesium 12 | | | | | | | | | | | 27 Al Aluminium 13 | 28 Si Silicon 14 | 31 P Phosphorus 15 | 32 S Sulfur 16 | 35.5 Cl Chlorine 17 | 40 Ar Argon 18 | | |
| 39 K Potassium 19 | 40 Ca Calcium 20 | 45 Sc Scandium 21 | 48 Ti Titanium 22 | 51 V Vanadium 23 | 52 Cr Chromium 24 | 55 Mn Manganese 25 | 56 Fe Iron 26 | 59 Co Cobalt 27 | 59 Ni Nickel 28 | 64 Cu Copper 29 | 65 Zn Zinc 30 | 70 Ga Gallium 31 | 73 Ge Germanium 32 | 75 As Arsenic 33 | 79 Se Selenium 34 | 80 Br Bromine 35 | 84 Kr Krypton 36 | | |
| 85 Rb Rubidium 37 | 88 Sr Strontium 38 | 89 Y Yttrium 39 | 91 Zr Zirconium 40 | 93 Nb Niobium 41 | 96 Mo Molybdenum 42 | 98 Tc Technetium 43 | 101 Ru Ruthenium 44 | 103 Rh Rhodium 45 | 106 Pd Palladium 46 | 108 Ag Silver 47 | 112 Cd Cadmium 48 | 115 In Indium 49 | 119 Sn Tin 50 | 122 Sb Antimony 51 | 128 Te Tellurium 52 | 127 I Iodine 53 | 131 Xe Xenon 54 | | |
| 133 Cs Caesium 55 | 137 Ba Barium 56 | 139 La [*] Lanthanum 57 | 178 Hf Hafnium 72 | 181 Ta Tantalum 73 | 184 W Tungsten 74 | 186 Re Rhenium 75 | 190 Os Osmium 76 | 192 Ir Iridium 77 | 195 Pt Platinum 78 | 197 Au Gold 79 | 201 Hg Mercury 80 | 204 Tl Thallium 81 | 207 Pb Lead 82 | 209 Bi Bismuth 83 | 210 Po Polonium 84 | 210 At Astatine 85 | 222 Rn Radon 86 | | |
| 223 Fr Francium 87 | 226 Ra Radium 88 | 227 Ac [†] Actinium 89 | 261 Rf Rutherfordium 104 | 262 Db Dubnium 105 | 266 Sg Seaborgium 106 | 264 Bh Bohrium 107 | 277 Hs Hassium 108 | 268 Mt Meitnerium 109 | 271 Ds Darmstadtium 110 | 272 Rg Roentgenium 111 | 285 Cn Copernicium 112 | | | | | | | | |

* 58 – 71 Lanthanum series
 † 90 – 103 Actinium series

$\begin{matrix} a \\ \boxed{X} \\ b \end{matrix}$ a = relative atomic mass (approx)
 x = atomic symbol
 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 |