



Rewarding Learning

General Certificate of Secondary Education
2022

Centre Number

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Candidate Number

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Chemistry

Unit 3: Practical Skills

Booklet A

Higher Tier

[GCM33]



GCM33

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

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

Write your answers in the spaces provided in this question paper.
Answer **all** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is **30**.

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

Follow all health and safety instructions.

You may use a ruler and calculator if required.

The apparatus and materials required to complete the task(s) are provided.

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

For Examiner's use only	
Question Number	Marks
1	
2	

Total Marks	
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1 (a) Describe the appearance of hydrated copper(II) sulfate.

[1]

(b) (i) Follow the procedure below. Mass measurements should be recorded in **Table 1** and observations in **Table 2**.

1. Weigh an empty evaporating basin and record the mass.
2. Keep the evaporating basin on the balance and add between 4.0g and 5.0g of hydrated copper(II) sulfate into the evaporating basin.
3. Record the mass of the evaporating basin and hydrated copper(II) sulfate.
4. Place the evaporating basin containing the hydrated copper(II) sulfate on a gauze on a tripod over a Bunsen burner.
5. Heat the evaporating basin and its contents **gently** over a Bunsen burner flame for 5 minutes. Record the observations made.
6. Allow the evaporating basin and contents to cool for 5 minutes.
7. Reweigh the evaporating basin and its contents and record the mass.

Table 1

Mass measurements	Mass/g
Mass of empty evaporating basin	
Mass of evaporating basin and hydrated copper(II) sulfate	
Mass of evaporating basin and contents after heating for 5 minutes	

Table 2

Observations made during the heating of hydrated copper(II) sulfate	
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[5]

(ii) Calculate the loss in mass as a result of heating.

[1]

- (c) Place 25 cm³ of deionised water in a small beaker using a 25 cm³ measuring cylinder and add 2 spatula measures of hydrated copper(II) sulfate. Stir with a glass rod. Record your observations.

_____ [2]

Keep the contents of the beaker for part (d).

- (d) You are provided with 4 boiling tubes. Label these boiling tubes 1, 2, 3 and 4.

Using a 10 cm³ measuring cylinder, measure 5 cm³ of the solution prepared in part (c) and place in boiling tube 1. Repeat for boiling tubes 2, 3 and 4.

- (i) Add 10 drops of sodium hydroxide solution to boiling tube 1 and record your observations.

_____ [1]

- (ii) Add 10 drops of ammonia solution to boiling tube 2. Record your observations.

_____ [1]

- (iii) Using a 10 cm³ measuring cylinder, add a further 10 cm³ of ammonia solution to boiling tube 2. Stopper the boiling tube and shake gently. Record your observations.

_____ [2]

- (iv) Using a disposable pipette, add approximately 3 cm³ of barium chloride solution to boiling tube 3. Record your observations.

_____ [2]

Examiner Only

Marks Remark

- (v) Add a 2 cm piece of magnesium ribbon to boiling tube 4.
Record your observations.

_____ [2]

- (e) Place a spatula measure of hydrated copper(II) sulfate on a watch glass.
Place two drops of concentrated hydrochloric acid on a second watch glass.
Dip a piece of nichrome wire into the concentrated hydrochloric acid and then into the sample of hydrated copper(II) sulfate.
Hold the nichrome wire in a blue Bunsen burner flame and record your observations below.

_____ [1]

Examiner Only

Marks Remark

2 (a) Follow the procedure below.

1. Fill a burette with the hydrochloric acid labelled **2.5 mol/dm³ hydrochloric acid**.
2. Fill a second burette with deionised water.
3. Measure and cut 4 pieces of magnesium ribbon each 2 cm long.
4. Measure 20.0 cm³ of 2.5 mol/dm³ hydrochloric acid from the burette into a boiling tube. Return the boiling tube to the boiling tube rack.
5. Add one 2 cm piece of magnesium ribbon to the hydrochloric acid in the boiling tube and immediately start the stopclock.
6. Stop the stopclock when the magnesium ribbon has disappeared and record the time taken **to the nearest second** in the results table below.
7. Measure 16.0 cm³ of 2.5 mol/dm³ hydrochloric acid from the burette into a clean boiling tube. Add 4.0 cm³ of deionised water from the second burette to the boiling tube and stir with a glass rod to mix. Return the boiling tube to the boiling tube rack.
8. Add one 2 cm piece of magnesium ribbon to the boiling tube and immediately start the stopclock.
9. Stop the stopclock when the magnesium ribbon has disappeared and record the time taken **to the nearest second** in the results table below.
10. Repeat steps 7–9 for the remaining volumes of hydrochloric acid and deionised water shown in the table below. Refill the burettes if necessary.
11. Calculate the rate of reaction for each concentration of acid using the equation below and record in the table.

$$\text{rate} = \frac{1}{\text{time}}$$

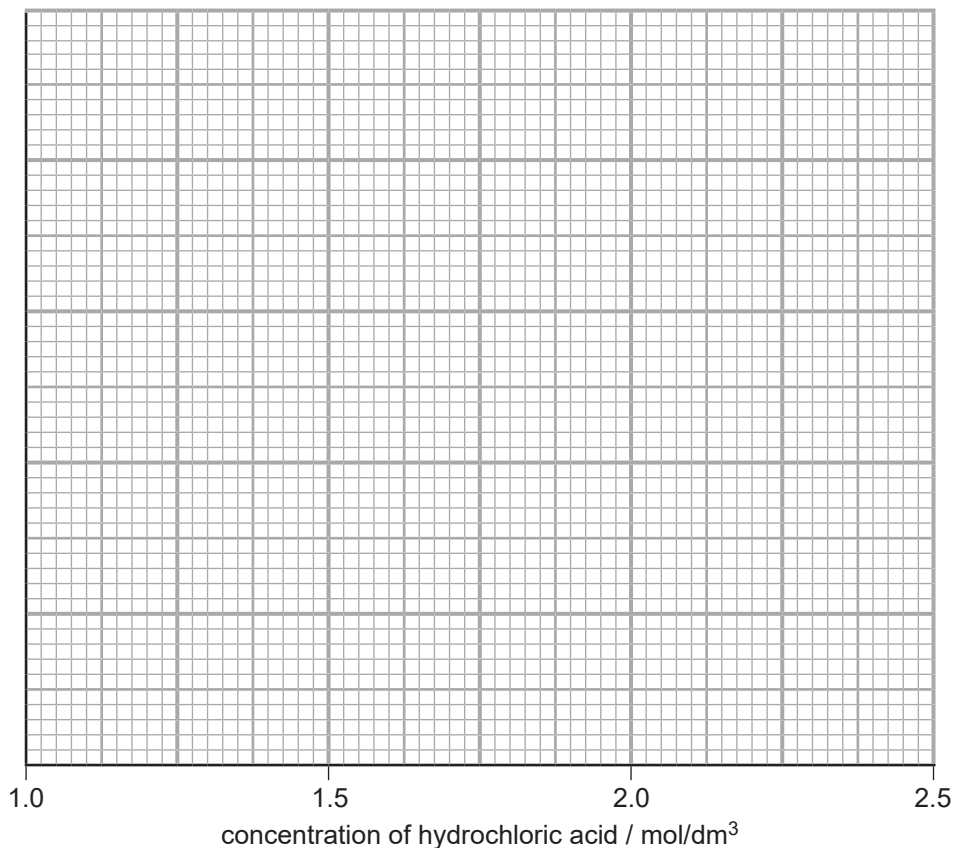
Volume of hydrochloric acid/cm ³	Volume of deionised water/cm ³	Concentration/mol/dm ³	Time taken for Mg to disappear/s	Rate of reaction/s ⁻¹
20.0	0.0	2.5		
16.0	4.0	2.0		
12.0	8.0	1.5		
8.0	12.0	1.0		

[4]

Examiner Only

Marks Remark

- (b) (i) Plot a suitable graph of **time taken** for magnesium to disappear against concentration of hydrochloric acid on the axes below and draw a line or curve of best fit. Label the vertical axis.



[5]

- (ii) State the trend observed from the graph.

_____ [1]

- (iii) Use your graph to determine the time taken for the reaction to finish when the concentration of hydrochloric acid is 1.25 mol/dm^3 .

_____ [1]

- (iv) Use the results table to state the trend in the rate of reaction.

_____ [1]

Examiner Only

Marks Remark

THIS IS THE END OF THE QUESTION PAPER

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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-}



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



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



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APPARATUS AND MATERIALS LIST AND CONFIDENTIAL INSTRUCTIONS

To be accessed by Head of Department only

It is the responsibility of the centre to ensure that appropriate risk assessments are carried out for all practical skills assessments.

Question 1

- Access to an electronic balance (capable of reading to 2 decimal places)
- Evaporating basin
- Spatula
- Heatproof mat
- Tripod
- Gauze
- Bunsen burner
- Tongs suitable for lifting an evaporating basin
- Stopclock/timer
- 1 × 100 cm³ beaker
- Glass rod
- 4 × boiling tubes
- 1 × rubber bung to fit boiling tube
- 1 × boiling tube rack
- Labels or pen for writing on glass (to label boiling tubes as **1**, **2**, **3** and **4**) or other suitable method for labelling
- 1 × 25 cm³ measuring cylinder
- 2 × 10 cm³ measuring cylinders (or instruct candidates to rinse the same cylinder with deionised water between uses)
- Several disposable pipettes
- 2 × watch glasses
- 1 × piece of nichrome wire suitable for a flame test
- deionised water in a wash bottle

Approximately 8g of hydrated copper(II) sulfate in a suitable container labelled **hydrated copper(II) sulfate** and also with the hazard label for health hazard (exclamation mark label).

20 cm³ of just less than 0.5 mol/dm³ sodium hydroxide solution in a suitable container labelled **sodium hydroxide solution** and with the hazard label for health hazard (exclamation mark label).

20 cm³ of 0.5 mol/dm³ ammonia solution in a suitable container and labelled **ammonia solution** and with the hazard label for health hazard (exclamation mark label).

10 cm³ of 0.1 mol/dm³ barium chloride solution in a suitable container and labelled **barium chloride solution** and with the hazard label for health hazard (exclamation mark label).

10 cm³ of approximately 2.5 mol/dm³ hydrochloric acid labelled **concentrated hydrochloric acid** and with the hazard label for corrosive.

1 × 2 cm strip of magnesium ribbon labelled **magnesium ribbon for use in Question 1** and with the hazard label for flammable.

Question 2

- 1 × 50 cm³ burette labelled **2.5 mol/dm³ hydrochloric acid**
- 1 × 50 cm³ burette labelled **deionised water**
- 2 × burette clamps
- 2 × retort stands
- 2 × filter funnels for filling the burettes
- 4 × boiling tubes
- 1 × boiling tube rack
- Glass rod
- Stopclock/timer
- Scissors
- Ruler
- 2 × 250 cm³ beaker (waste beakers for burettes)

100 cm³ of approximately 2.5 mol/dm³ hydrochloric acid labelled **2.5 mol/dm³ hydrochloric acid** and with the hazard label for health hazard (exclamation mark label).

100 cm³ of deionised water labelled **deionised water** (or access to deionised water in the laboratory with a suitable labelled beaker)

Approximately 10 cm of magnesium ribbon labelled **magnesium ribbon for use in Question 2** and with the hazard label for flammable.