



Rewarding Learning

General Certificate of Secondary Education  
2024

Centre Number

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Candidate Number

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# GCSE Chemistry

Unit 1

Foundation Tier



[GCM11]

\*GCM11\*

WEDNESDAY 22 MAY, 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 60.

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 **4(c)**.

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

13958



\*16GCM1101\*

1 The positions of some elements in the Periodic Table are shown below.

							H								
													O		
	Mg														
K							Fe						As		
														I	

(a) Select the correct **symbol** from the Periodic Table above to answer the following questions.

(i) Which element is found in Group 2 of the Periodic Table?

\_\_\_\_\_ [1]

(ii) Which element is found in Period 2 of the Periodic Table?

\_\_\_\_\_ [1]

(iii) Which two elements are gases at room temperature?

\_\_\_\_\_ [1]

(iv) Which element is a transition metal?

\_\_\_\_\_ [1]

(v) Which element forms an ion with the same electronic configuration as argon?

\_\_\_\_\_ [1]



**(b)** Group 1 of the Periodic Table contains reactive elements. They show similar chemical properties and there is a trend in reactivity down the group.

**(i)** How are the Group 1 elements stored in the laboratory?

\_\_\_\_\_ [1]

**(ii)** State the name by which the Group 1 elements are known.

\_\_\_\_\_ [1]

**(iii)** Explain why the Group 1 elements show similar chemical properties.

\_\_\_\_\_  
\_\_\_\_\_ [1]

**(iv)** State and explain the trend in reactivity down Group 1.

Trend: \_\_\_\_\_

Explanation: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [3]

[Turn over



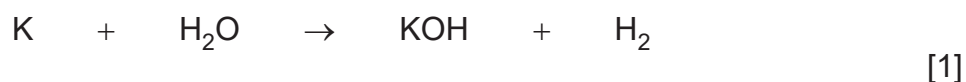
(c) Group 1 elements react vigorously with cold water.

(i) State two observations which are made when a piece of potassium reacts with cold water but are not made when a piece of lithium reacts with cold water.

1. \_\_\_\_\_

2. \_\_\_\_\_ [2]

(ii) Balance the symbol equation below for the reaction of potassium with water.





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**(Questions continue overleaf)**

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**[Turn over**



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**2 (a)** Ideas about the structure of the atom have changed over the last 150 years.

**(i)** Name the scientist who suggested an atom consists of a nucleus surrounded by electrons.

\_\_\_\_\_ [1]

**(ii)** Name the subatomic particle discovered by James Chadwick.

\_\_\_\_\_ [1]

**(iii)** Name the subatomic particle with the smallest relative mass.

\_\_\_\_\_ [1]

**(iv)** Explain why atoms have no overall charge.

\_\_\_\_\_  
\_\_\_\_\_ [1]



**(b)** Magnesium chloride is a compound formed from the elements magnesium and chlorine.

**(i)** Name the type of bonding in the compound magnesium chloride.

\_\_\_\_\_ [1]

**(ii)** Draw a dot and cross diagram to show how magnesium chloride forms from atoms of magnesium and chlorine.

Include the charges of the ions formed.

\_\_\_\_\_ [6]

**(iii)** State one physical property of magnesium chloride.

\_\_\_\_\_ [1]

**[Turn over**



3 Acidic, neutral and alkaline solutions may be classified using indicators.

(a) Complete the table below.

Solution	pH	Indicator	Colour of indicator
sodium hydroxide	12	phenolphthalein	
hydrochloric acid		universal indicator	

[3]

(b) Complete the following sentences by filling in the blanks.

All acids contain \_\_\_\_\_ ions in aqueous solution. All aqueous

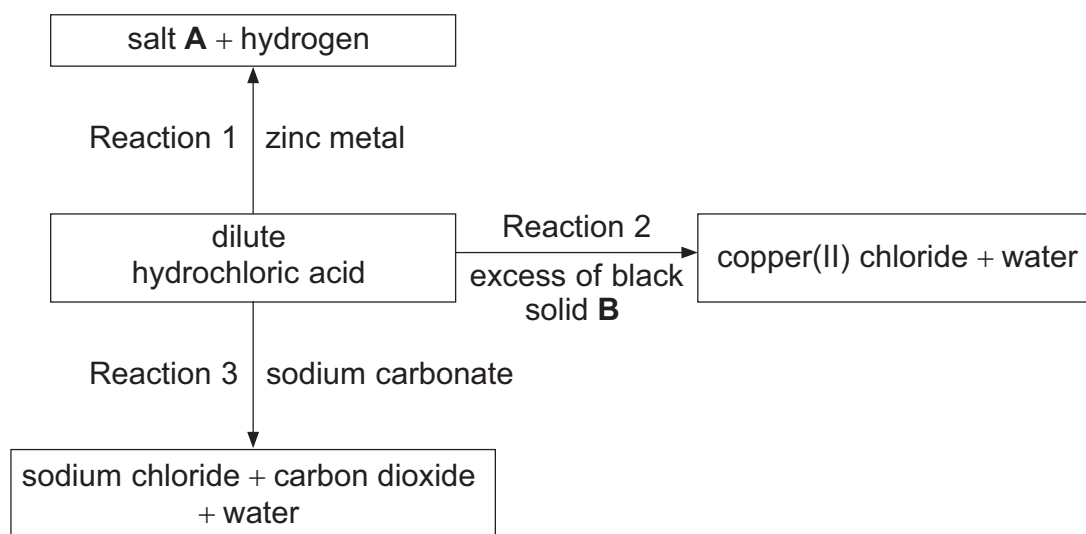
solutions of alkalis contain \_\_\_\_\_ ions.

[2]





(c) The diagram below shows three reactions used to prepare soluble salts.



(i) Name the salt **A** produced in Reaction 1.

\_\_\_\_\_ [1]

(ii) Describe the test for hydrogen gas, produced in Reaction 1.

\_\_\_\_\_  
\_\_\_\_\_ [1]

(iii) Name the black solid **B** used in Reaction 2.

\_\_\_\_\_ [1]

(iv) Explain why an excess of black solid **B** is used in Reaction 2.

\_\_\_\_\_  
\_\_\_\_\_ [1]

(v) Write a balanced symbol equation for Reaction 3.

\_\_\_\_\_ [3]

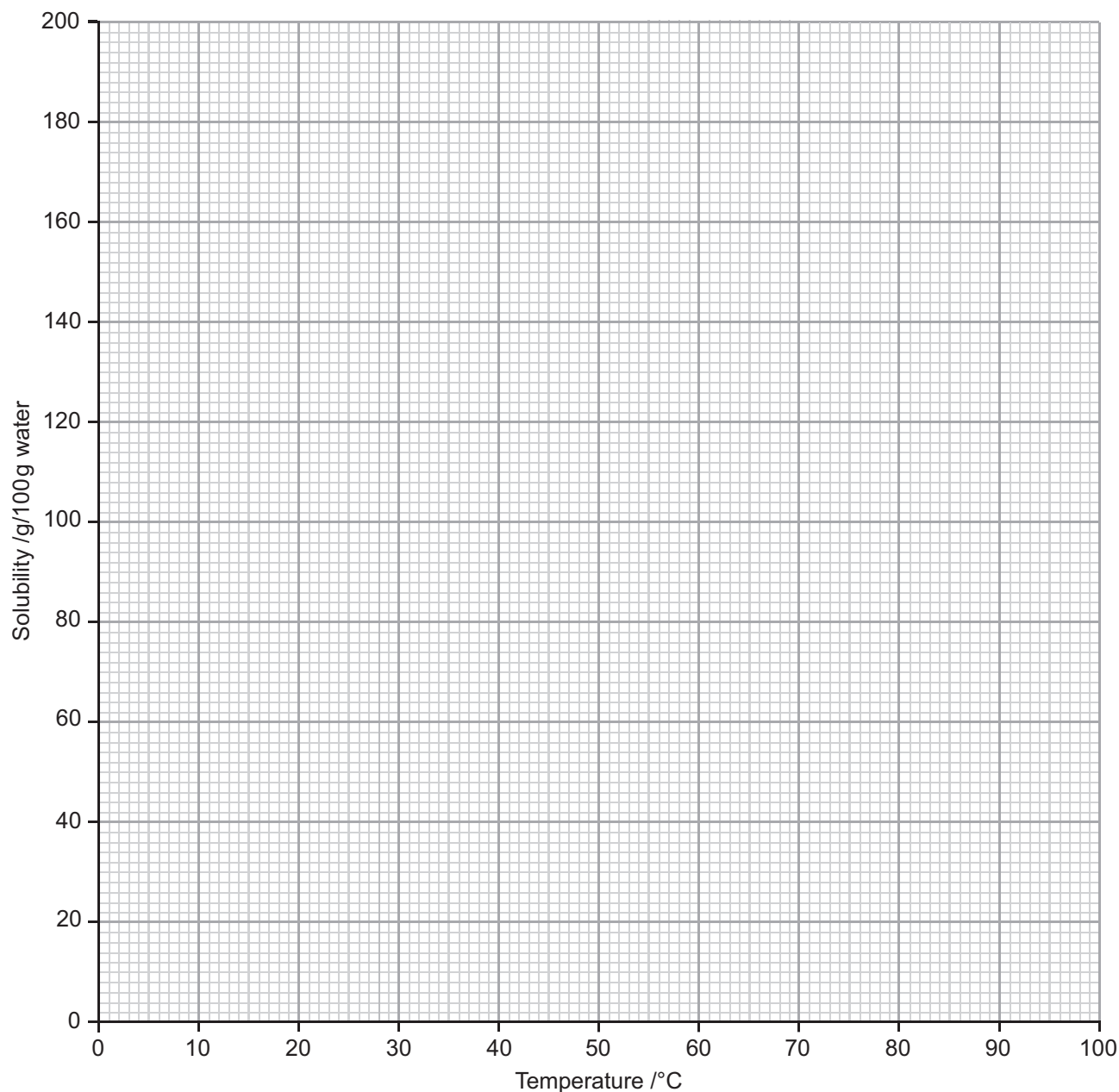
[Turn over



- 4 The oceans and seas are valuable sources of many chemical compounds which are dissolved in the water. The table below gives solubility values of a solid obtained from sea water.

Temperature /°C	0	20	40	60	80	100
Solubility of solid /g/100 g water	80	87	100	120	145	178

- (a) Plot a solubility curve for the solid on the axes below using the data in the table.



[3]



**(b)** Use the solubility data and the graph you have drawn in **(a)** to answer the following questions.

**(i)** What is the general trend in the solubility of the solid as temperature increases?

\_\_\_\_\_ [1]

**(ii)** What is the solubility of the solid at 90°C?

\_\_\_\_\_ g/100g water [1]

**(iii)** 28 g of the solid are mixed with 25 g of water at 60°C. Explain whether the solution formed is saturated or unsaturated.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

**[Turn over**



(c) Sea water contains dissolved sodium ions and chloride ions.

Describe tests that could be carried out on a sample of sea water to confirm the presence of sodium ions and of chloride ions.

Your answer should include:

- how you would carry out the test using a sample of seawater
- any reagents used
- the results for a positive test
- the names of any precipitates formed during the tests.

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

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[6]



- 5 Silica gel is a desiccant which is often found in small packets in boxes of shoes and optical equipment.



A small quantity of anhydrous cobalt(II) chloride,  $\text{CoCl}_2$ , may be added to the silica gel. A colour change from blue to pink is observed as the silica gel absorbs water. The pink colour indicates that the silica gel is no longer effective.

- (a) (i) Suggest what is meant by the term desiccant.

\_\_\_\_\_ [1]

- (ii) Name another compound which could be used in place of anhydrous cobalt(II) chloride.

\_\_\_\_\_ [1]

[Turn over



- (b) The formula of hydrated cobalt(II) chloride is  $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$ . Calculate the percentage of water of crystallisation in hydrated cobalt(II) chloride. Give your answer to 1 decimal place.

percentage = \_\_\_\_\_ % [2]

- (c) The table below shows information about water and some desiccants.

- (i) Complete the table.

Name of compound	Formula	Total number of oxygen atoms in the formula	Total number of atoms in the formula	Relative formula mass ( $M_r$ )
water	$\text{H}_2\text{O}$	1	3	18
silica	$\text{SiO}_2$			
magnesium sulfate	$\text{MgSO}_4$		6	
aluminium hydroxide	$\text{Al}(\text{OH})_3$			78

[3]



(ii) Calculate the number of moles of aluminium hydroxide present in 5.5 g of aluminium hydroxide.

number of moles = \_\_\_\_\_ [1]

(iii) Calculate the mass of water in 0.24 moles of water.

mass of water = \_\_\_\_\_ g [1]

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**THIS IS THE END OF THE QUESTION PAPER**

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Question Number	Marks
1	
2	
3	
4	
5	

<b>Total Marks</b>	
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Examiner Number

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\*16GCM1116\*



## SYMBOLS OF SELECTED IONS

### Positive ions

Name	Symbol
Ammonium	$\text{NH}_4^+$
Chromium(III)	$\text{Cr}^{3+}$
Copper(II)	$\text{Cu}^{2+}$
Iron(II)	$\text{Fe}^{2+}$
Iron(III)	$\text{Fe}^{3+}$
Lead(II)	$\text{Pb}^{2+}$
Silver	$\text{Ag}^+$
Zinc	$\text{Zn}^{2+}$

### Negative ions

Name	Symbol
Butanoate	$\text{C}_3\text{H}_7\text{COO}^-$
Carbonate	$\text{CO}_3^{2-}$
Dichromate	$\text{Cr}_2\text{O}_7^{2-}$
Ethanoate	$\text{CH}_3\text{COO}^-$
Hydrogencarbonate	$\text{HCO}_3^-$
Hydroxide	$\text{OH}^-$
Methanoate	$\text{HCOO}^-$
Nitrate	$\text{NO}_3^-$
Propanoate	$\text{C}_2\text{H}_5\text{COO}^-$
Sulfate	$\text{SO}_4^{2-}$
Sulfite	$\text{SO}_3^{2-}$



## Data Leaflet

### Including the Periodic Table of the Elements

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

### 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

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

# THE PERIODIC TABLE OF ELEMENTS

## Group

												1						0
												1 <b>H</b> Hydrogen 1						4 <b>He</b> Helium 2
1	2											3	4	5	6	7		
7 <b>Li</b> Lithium 3	9 <b>Be</b> Beryllium 4											11 <b>B</b> Boron 5	12 <b>C</b> Carbon 6	14 <b>N</b> Nitrogen 7	16 <b>O</b> Oxygen 8	19 <b>F</b> Fluorine 9	20 <b>Ne</b> Neon 10	
23 <b>Na</b> Sodium 11	24 <b>Mg</b> Magnesium 12											27 <b>Al</b> Aluminium 13	28 <b>Si</b> Silicon 14	31 <b>P</b> Phosphorus 15	32 <b>S</b> Sulfur 16	35.5 <b>Cl</b> Chlorine 17	40 <b>Ar</b> Argon 18	
39 <b>K</b> Potassium 19	40 <b>Ca</b> Calcium 20	45 <b>Sc</b> Scandium 21	48 <b>Ti</b> Titanium 22	51 <b>V</b> Vanadium 23	52 <b>Cr</b> Chromium 24	55 <b>Mn</b> Manganese 25	56 <b>Fe</b> Iron 26	59 <b>Co</b> Cobalt 27	59 <b>Ni</b> Nickel 28	64 <b>Cu</b> Copper 29	65 <b>Zn</b> Zinc 30	70 <b>Ga</b> Gallium 31	73 <b>Ge</b> Germanium 32	75 <b>As</b> Arsenic 33	79 <b>Se</b> Selenium 34	80 <b>Br</b> Bromine 35	84 <b>Kr</b> Krypton 36	
85 <b>Rb</b> Rubidium 37	88 <b>Sr</b> Strontium 38	89 <b>Y</b> Yttrium 39	91 <b>Zr</b> Zirconium 40	93 <b>Nb</b> Niobium 41	96 <b>Mo</b> Molybdenum 42	98 <b>Tc</b> Technetium 43	101 <b>Ru</b> Ruthenium 44	103 <b>Rh</b> Rhodium 45	106 <b>Pd</b> Palladium 46	108 <b>Ag</b> Silver 47	112 <b>Cd</b> Cadmium 48	115 <b>In</b> Indium 49	119 <b>Sn</b> Tin 50	122 <b>Sb</b> Antimony 51	128 <b>Te</b> Tellurium 52	127 <b>I</b> Iodine 53	131 <b>Xe</b> Xenon 54	
133 <b>Cs</b> Caesium 55	137 <b>Ba</b> Barium 56	139 <b>La*</b> Lanthanum 57	178 <b>Hf</b> Hafnium 72	181 <b>Ta</b> Tantalum 73	184 <b>W</b> Tungsten 74	186 <b>Re</b> Rhenium 75	190 <b>Os</b> Osmium 76	192 <b>Ir</b> Iridium 77	195 <b>Pt</b> Platinum 78	197 <b>Au</b> Gold 79	201 <b>Hg</b> Mercury 80	204 <b>Tl</b> Thallium 81	207 <b>Pb</b> Lead 82	209 <b>Bi</b> Bismuth 83	210 <b>Po</b> Polonium 84	210 <b>At</b> Astatine 85	222 <b>Rn</b> Radon 86	
223 <b>Fr</b> Francium 87	226 <b>Ra</b> Radium 88	227 <b>Ac†</b> Actinium 89	261 <b>Rf</b> Rutherfordium 104	262 <b>Db</b> Dubnium 105	266 <b>Sg</b> Seaborgium 106	264 <b>Bh</b> Bohrium 107	277 <b>Hs</b> Hassium 108	268 <b>Mt</b> Meitnerium 109	271 <b>Ds</b> Darmstadtium 110	272 <b>Rg</b> Roentgenium 111	285 <b>Cn</b> 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 <b>Ce</b> Cerium 58	141 <b>Pr</b> Praseodymium 59	144 <b>Nd</b> Neodymium 60	145 <b>Pm</b> Promethium 61	150 <b>Sm</b> Samarium 62	152 <b>Eu</b> Europium 63	157 <b>Gd</b> Gadolinium 64	159 <b>Tb</b> Terbium 65	162 <b>Dy</b> Dysprosium 66	165 <b>Ho</b> Holmium 67	167 <b>Er</b> Erbium 68	169 <b>Tm</b> Thulium 69	173 <b>Yb</b> Ytterbium 70	175 <b>Lu</b> Lutetium 71
232 <b>Th</b> Thorium 90	231 <b>Pa</b> Protactinium 91	238 <b>U</b> Uranium 92	237 <b>Np</b> Neptunium 93	242 <b>Pu</b> Plutonium 94	243 <b>Am</b> Americium 95	247 <b>Cm</b> Curium 96	245 <b>Bk</b> Berkelium 97	251 <b>Cf</b> Californium 98	254 <b>Es</b> Einsteinium 99	253 <b>Fm</b> Fermium 100	256 <b>Md</b> Mendelevium 101	254 <b>No</b> Nobelium 102	257 <b>Lr</b> Lawrencium 103