



Rewarding Learning

General Certificate of Secondary Education
2022–2023

Centre Number

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Candidate Number

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Double Award Science: Chemistry

Unit C1

Foundation Tier



[GDW21]

GDW21

MONDAY 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 eight** 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 8.

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

13973.06R



16GDW2101

- 1 There are three subatomic particles and different numbers of these particles are found in atoms and simple ions.

- (a) The table below shows information about the three subatomic particles. Complete the table.

Subatomic particle	Relative charge	Relative mass	Position in an atom
electron	-1		
proton			nucleus
neutron		1	

[3]

- (b) Electronic configurations show the arrangement of electrons in an atom or ion. Five electronic configurations are given in the table below and are represented by the letters V to Z.

Letter	Electronic configuration
V	2, 4
W	2, 6
X	2, 8
Y	2, 8, 3
Z	2, 8, 8, 2

- (i) Write the symbol of an atom of an element which would have the electronic configuration V.

_____ [1]



(ii) Draw a diagram to show the electronic configuration W.

[1]

(iii) Several different ions have the electronic configuration X (2, 8).
Complete the table.

Charge on ion	Formula of ion	Name of ion	Electronic configuration
Single negative charge		fluoride	2, 8
Single positive charge	Na ⁺		2, 8
Double negative charge			2, 8

[4]

(iv) Y represents the electronic configuration of an atom. How many protons does the atom have?

[1]

(v) Which one of the letters (V, W, X, Y, Z) represents the electronic configuration of an atom of an element in Period 4 of the Periodic Table?

[1]

[Turn over



2 Substances can be described as pure or as a mixture.

(a) Information on several substances is shown in the table below.

Substance	Composition
Brass	copper
	zinc
Air	nitrogen
	oxygen
	carbon dioxide
	noble gases
	water vapour
Baking soda	sodium hydrogencarbonate
Stainless steel	iron
	silicon
	manganese
	nickel
	chromium

(i) Name one noble gas which could be present in air.

_____ [1]

(ii) Write the chemical formula for carbon dioxide.

_____ [1]

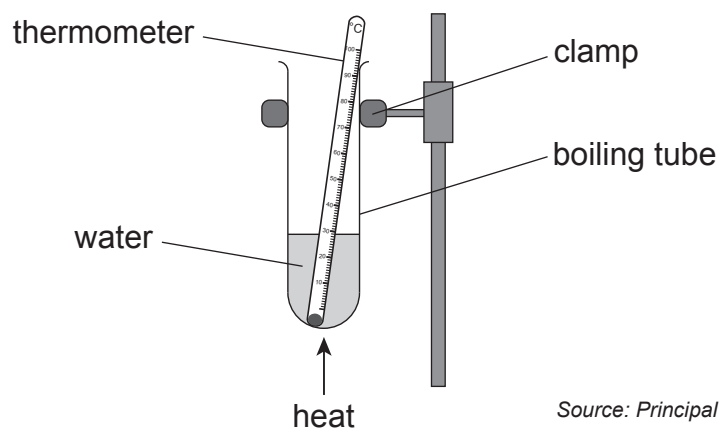


- (iii) Complete the table below by placing a tick (✓) in the correct column for each substance.

Substance	Pure substance	Mixture
Brass		
Air		
Baking soda		
Stainless steel		

[4]

- (b) The diagram below shows the apparatus used in an experiment to determine the boiling point of pure water.



Source: Principal Examiner

- (i) What piece of apparatus would be used to heat the water?

_____ [1]

- (ii) State the boiling point of pure water. Include the units.

_____ [2]

- (iii) State the change, if any, to the boiling point of water if the volume of water was increased.

_____ [1]

[Turn over]



(c) Some baking soda was dissolved in water.

Complete the sentence below by circling the correct words.

When baking soda is dissolved in water, baking soda is the

solute

solution

and

solvent

water is the

solute

solution

solvent

[2]



3 The table below lists some information about the elements in Group 7.

Element	Atomic number	Melting point / °C
Fluorine	9	–188
Chlorine	17	–101
Bromine	35	–7
Iodine	53	113

(a) (i) What name is given to Group 7 of the Periodic Table?

_____ [1]

(ii) Complete the following sentence to describe the trend shown by the information in the table.

As the atomic number of the Group 7 elements increases, the melting point _____ [1]

(iii) Which of the elements in the table is the least reactive?

_____ [1]

(iv) All of the Group 7 elements are diatomic. What is meant by the term diatomic?

_____ [2]

(b) Complete the following.

The melting point of a substance is the _____ at which
a _____ changes into a _____. [3]

[Turn over



- 4 Chlorine reacts with lithium and with hydrogen. Lithium chloride is an ionic compound and hydrogen chloride is a covalent compound.

(a) The electronic configurations of a lithium atom and a chlorine atom are:

Li atom: 2, 1

Cl atom: 2, 8, 7

- (i) Using the electronic configurations given above, explain how lithium atoms react with chlorine atoms to form lithium chloride.

[2]

- (ii) Explain why a lithium ion is more stable than a lithium atom.

[1]



(b) Draw a dot and cross diagram to show the bonding in a molecule of hydrogen chloride HCl. Only outer shell electrons should be shown.

[3]

[Turn over]

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16GDW2109

5 Compounds can be represented by formulae.

(a) Which one of the following is the formula for the compound barium chloride?

Circle the correct answer.

BaCl

BeCl

BaCl₂

BeCl₂

[1]

(b) Name the compound which has the formula K₂Cr₂O₇.

[1]

(c) Calcium oxide reacts with water to form calcium hydroxide.
Complete the balanced symbol equation for this reaction.

+

→

Ca(OH)₂

[2]

(d) Calcium hypochlorite Ca(ClO)₂, is used to kill bacteria in swimming pools.

(i) How many different elements are present in calcium hypochlorite?

[1]

(ii) How many chlorine atoms are present in calcium hypochlorite?

[1]





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[Turn over



16GDW2111

- 6 (a) Barium sulfate, BaSO_4 , is used in medicine to help diagnose disorders of the digestive tract. It is often taken in a tablet form.

(i) Calculate the relative formula mass (M_r) of barium sulfate, BaSO_4 .

Relative atomic masses (A_r): O = 16; S = 32; Ba = 137

relative formula mass (M_r) _____ [1]

(ii) Calculate the percentage of sulfur, by mass, in barium sulfate, BaSO_4 .
Give your answer to 1 decimal place.

$$\text{Percentage of sulfur} = \frac{\text{total mass of sulfur}}{\text{relative formula mass}} \times 100$$

percentage of sulfur _____ % [3]



(b) The relative formula mass (M_r) of silver nitrate, AgNO_3 is 170.

(i) Calculate the mass, in grams, of 12.0 moles of silver nitrate.

mass _____ g [1]

(ii) Calculate the number of moles which are present in 476 grams of silver nitrate.

moles _____ [1]

[Turn over]

13973.06R



16GDW2113

7 Acids react with alkalis to form salts.

(a) Name a salt that is blue in colour.

_____ [1]

(b) Name the ion which is present in all alkalis.

_____ [1]

(c) Write the formula of sulfuric acid.

_____ [1]

(d) Name the two products of the reaction of nitric acid with sodium hydroxide.

_____ [2]



- 8 Potassium reacts with iodine to form potassium iodide. State the colour and physical state of iodine and potassium iodide at room temperature and name the type of bonding in iodine and potassium iodide.

In your answer you should include:

- the colour and physical state of iodine at room temperature
- the colour and physical state of potassium iodide at room temperature
- the name of the type of bonding in iodine at room temperature
- the name of the type of bonding in potassium iodide at room temperature

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

The colour and physical state of iodine at room temperature:

The colour and physical state of potassium iodide at room temperature:

The name of the type of bonding in iodine at room temperature:

The name of the type of bonding in potassium iodide at room temperature:

[6]

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16GDW2115

THIS IS THE END OF THE QUESTION PAPER

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**For Examiner's
use only**

Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	

Examiner Number

Total Marks	
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16GDW2116

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

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