



General Certificate of Secondary Education
2017–2018

Centre Number

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Candidate Number

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Double Award Science: Chemistry

Unit C1
Higher Tier

ML

[GSD22]

THURSDAY 17 MAY 2018, 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 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 seven** 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 **2(b)**.

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

- 1 Read the paragraph below about lithium and some of its uses. With this information and your own knowledge and understanding, answer the questions that follow.

Lithium is a very light, soft Group 1 metal and is an excellent conductor of electricity. Lithium can be extracted by electrolysis of molten lithium chloride. Lithium is used in making batteries for mobile phones and golf trolleys. Lithium–aluminium alloys are used in the manufacture of aircraft, bicycle frames and high speed trains.

- (a) (i) What is the name of the Group 1 elements?

_____ [1]

- (ii) How are lithium and the other Group 1 elements stored in the laboratory?

_____ [1]

- (b) (i) What does **electrolysis** mean?

_____ [2]

- (ii) Write a half equation to show what happens at the cathode during the electrolysis of molten lithium chloride.

_____ [2]

- (iii) Electrolysis of molten lithium chloride produces lithium and what other substance?

_____ [1]

- (c) Why is lithium used in batteries for mobile phones and golf trolleys?

_____ [1]

(d) Give two main advantages of using lithium–aluminium alloys.

1. _____

2. _____ [2]

(e) Some people are worried that we could run out of lithium.

Write down why we could run out of lithium:

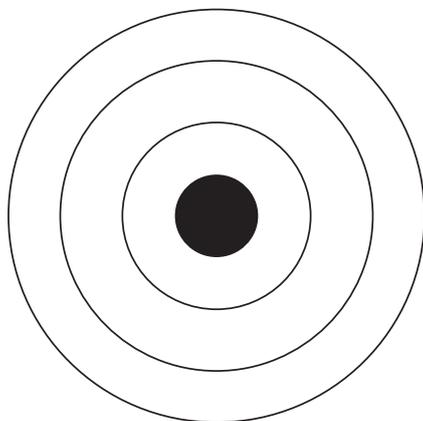
How can we improve this situation?

_____ [2]

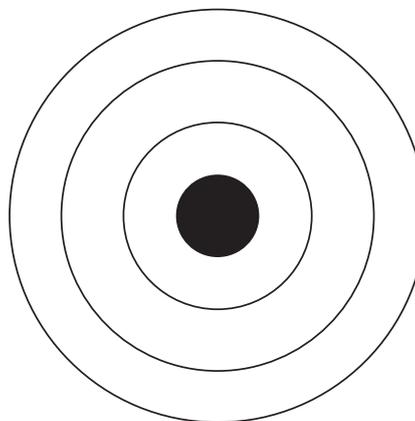
[Turn over

2 Sodium reacts with sulfur to form a compound called sodium sulfide.

(a) Finish the diagrams below to show the electronic structures of:



a sodium atom



a sulfur atom

[2]

3 (a) What is a covalent bond?

_____ [1]

(b) Draw a dot and cross diagram to show how covalent bonding occurs in a chlorine molecule, Cl_2 . Show all the electrons.

[3]

(c) Finish the three sentences below by adding the missing words:

Covalent bonding is typical of _____ elements and compounds.

The term diatomic means that there are _____ atoms covalently bonded in a _____.

Covalent bonds are _____ and _____

amounts of _____ are needed to break them. [6]

- (d) Draw a dot and cross diagram to show the bonding in a nitrogen molecule, N_2 .
Show all the electrons.
Label your diagram to show a lone pair of electrons.

[3]

[Turn over

4 This question is about solubility.

(a) Complete the sentence below to define **solubility**.

Solubility is the mass of _____

 _____ [4]

Look at the table below. It shows that some salts are soluble (S) or insoluble (I) in water.

anion cation	carbonate	chloride	nitrate	sulfate
sodium	S	S	S	S
lead	I	I	S	I
magnesium	I	S	S	S
ammonium	S	S	S	S
calcium	I	S	S	S

(b) Use the information in the table to finish the sentences that follow:

(i) For the **cations**:

All _____ and _____
 salts are soluble. [2]

(ii) For the **anions**:

All chlorides are _____ except
 for _____. [1]

(c) Do you think sodium bromide and zinc nitrate are soluble (S) or insoluble (I) in water?

sodium bromide _____ zinc nitrate _____ [2]

(d) A colourless sodium chloride solution is mixed with a colourless lead nitrate solution. Why does the mixture turn white?

 [2]

[Turn over

- 5 (a) The table below gives information about the salts formed when four bases react with acids. Finish the table by filling in all the gaps.

Base	Acid	Formula of cation in salt	Formula of anion in salt	Formula of salt produced
calcium hydroxide	hydrochloric acid		Cl^-	CaCl_2
	sulfuric acid	Cu^{2+}		CuSO_4
magnesium oxide		Mg^{2+}	Cl^-	
sodium hydroxide	nitric acid		NO_3^-	

[4]

- (b) Read the word equation below:



- (i) Use this equation to help write an **ionic** equation to show the formation of sodium chloride.

_____ [2]

- (ii) The reaction between sodium hydroxide and hydrochloric acid can be described as a neutralisation. Write an ionic equation including state symbols for a neutralisation reaction.

_____ [3]



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(Questions continue overleaf)

- 6 Look at the table below. It gives information about the physical properties of four substances A, B, C and D. Use the information to help you answer the questions that follow.

Substance	Melting point/ °C	Boiling point/ °C	Electrical conductivity when solid	Electrical conductivity when molten
A	808	1465	poor	good
B	3650	4200	good	good
C	660	2500	good	good
D	-182	-161	poor	poor

- (a) Which substance A, B, C or D has a molecular covalent structure? Explain your answer.

Substance with a molecular covalent structure: _____

Explanation:

_____ [2]

- (b) Which substance A, B, C or D is made up of oppositely charged ions in a giant lattice structure? Explain your answer.

Substance made up of oppositely charged ions in a giant lattice structure:

Explanation:

_____ [2]

(c) Which substance A, B, C or D could be graphite? Explain your answer.

Substance that could be graphite: _____

Explanation:

_____ [2]

(d) Which substance A, B, C or D is a metal with a relatively low melting point? Explain your answer.

Substance that is a metal: _____

Explanation:

_____ [2]

[Turn over

7 (a) When chlorine gas is bubbled into sodium iodide solution, it causes a chemical reaction that results in a colour change in the solution.

(i) Write a balanced symbol equation for this reaction.

_____ [3]

(ii) Describe the colour change in the solution.

The colour changes from _____

to _____ [2]

(iii) The reaction is described as a displacement reaction.
Finish the sentence:

The reaction between chlorine and sodium iodide is described as a

displacement reaction because _____ is

displacing _____ [2]

(b) When bromine is added to sodium iodide solution a similar reaction occurs to that of chlorine with sodium iodide solution.

Explain why **chlorine** and **bromine** react in similar ways.

_____ [2]

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For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	

Total Marks	
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Examiner Number

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11665.03 ML

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
Carbonate	CO_3^{2-}
Dichromate	$\text{Cr}_2\text{O}_7^{2-}$
Ethanoate	CH_3COO^-
Hydrogen carbonate	HCO_3^-
Hydroxide	OH^-
Methanoate	HCOO^-
Nitrate	NO_3^-
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}

DATA LEAFLET

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

Contents	Page
Periodic Table of the Elements	2–3
Symbols of Selected Ions	4
Solubility of Common Salts	4

gcse . Science

**chemistry
 double award
 single award**



THE PERIODIC TABLE OF ELEMENTS

Group

																	0					
1	2											3	4	5	6	7						
		<div style="display: flex; justify-content: center; align-items: center; gap: 10px;"> <div style="border: 1px solid black; padding: 5px; text-align: left;"> 1 H Hydrogen 1 </div> </div>																				4 He Helium 2
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	99 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	263 Sg Seaborgium 106	262 Bh Bohrium 107	265 Hs Hassium 108	266 Mt Meitnerium 109	269 Ds Darmstadtium 110	272 Rg Roentgenium 111	285 Cn Copernicium 112											

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

a
b

 x

a = relative atomic mass (approx)
 x = atomic symbol
 b = atomic number

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	147 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