Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2017–2018

Double Award Science: Chemistry

Unit C1

Higher Tier

[GSD22]

GSD22

THURSDAY 17 MAY 2018, 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 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.

11665

1 Read the passage about lithium and some of its uses. Then use this information along with your own knowledge and understanding to answer the questions that follow.

Lithium is a very light, soft Group 1 metal and is an excellent conductor of electricity. It 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 name is given to the Group 1 elements?

_____ [1]

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

_____ [1]

(b) (i) What is meant by the term electrolysis?

_____

_____ [2]

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

_____ [2]

(iii) Apart from lithium, what else is produced during the electrolysis of molten lithium chloride?

_____ [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 concerned that we may run out of lithium. Suggest why this might be the case and how might the problem be reduced.

Reason why we might run out of lithium:

_____

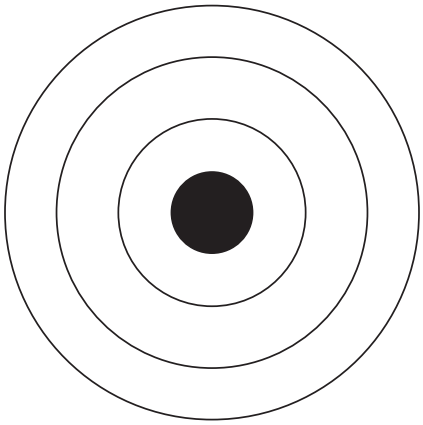
How the problem might be reduced:

_____ [2]

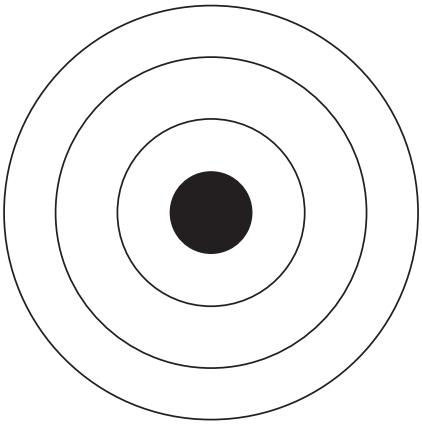
[Turn over

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

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



a sodium **atom**



a sulfur **atom**

[2]

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

Describe in words:

1. how the electronic structures of both the sodium atom and the sulfur atom change in order to form sodium sulfide. Your answer should include the charges on the ions formed, and the formula of the compound produced.

2. at least two physical properties you would expect sodium sulfide to have.

[6]

[Turn over

3 **(a)** What is a covalent bond?

_____ [1]

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

[3]

(c) Complete 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) In the space below draw a dot and cross diagram to show the bonding in a nitrogen molecule, N_2. Show all the electrons.
Label your diagram to identify 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]

The table below gives information on whether or not 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 complete the sentences which follow:

(i) For the **cations**:

All _____ and _____

salts are soluble. [2]

(ii) For the **anions**:

All chlorides are _____ except

for _____. [1]

(c) Predict whether sodium bromide and zinc nitrate are soluble (S) or insoluble (I) in water.

sodium bromide _____ zinc nitrate _____ [2]

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

_____

_____

_____ [2]

[Turn over

5 **(a)** The table below gives information about the salts formed when four bases react with acids. Complete 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) A word equation is given below:

sodium hydroxide + hydrochloric acid → sodium chloride + water

(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 The table below gives information about the physical properties of four substances A, B, C and D. Use the information to help you answer the questions which 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 choice.

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 choice.

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 choice.

Substance which could be graphite: _____

Explanation:

_____

_____ [2]

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

Substance which is a metal: _____

Explanation:

_____

_____ [2]

[Turn over

7 **(a)** When chlorine gas is bubbled into sodium iodide solution, it causes a chemical reaction which 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.
Complete 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	

Examiner Number

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	$Cr_2O_7^{2-}$
Ethanoate	CH_3COO^-
Hydrogen carbonate	HCO_3^-
Hydroxide	OH^-
Methanoate	$HCOO^-$
Nitrate	NO_3^-
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}

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

Rewarding Learning

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.

Contents **Page**

gcse
science
chemistry
double award
single award

Rewarding Learning

THE PERIODIC TABLE OF ELEMENTS

Group

1	2											3	4	5	6	7	0
							1 H Hydrogen 1										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