Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2016–2017

Double Award Science: Chemistry

Unit C1

Foundation Tier

ML

[GSD21]

THURSDAY 18 MAY 2017, 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.
Answer **all eight** 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 **6**.
A Data Leaflet, which includes a Periodic Table of the elements is provided.

1 **(a)** The list below contains the names of six elements:

iron	copper	carbon
chlorine	magnesium	sulfur

(i) Choose two **non-metals** from the list.

_____ and _____ [2]

(ii) Choose an element from the list above which can be used to make:

1. pipes for plumbing _____ [1]
2. bridges _____ [1]
3. alloys for aircraft _____ [1]

(iii) What is the chemical symbol for iron?
Circle the correct answer.

I Ir F Fr Fe

[1]

(b) Choose **two** words from the list below to complete the sentence about elements.

atom molecule compound substance electron

An element cannot be broken down into a simpler _____ by chemical means because it consists of only one type of _____.

[2]

(c) (i) A green solid can be broken down using heat to give a black solid and a colourless gas. Is the green solid a mixture, a compound or an element?

_____ [1]

(ii) A different solid conducts heat and electricity. Which **two** of the statements, from the list below, would also be true for this solid?
Tick (✓) the correct boxes.

1. It will be malleable ☐
2. It will be a white powder ☐
3. It will be ductile ☐
4. It will dissolve in water ☐ [2]

[Turn over

2 Part of an **early** version of a Periodic Table is shown below.

H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe

(a) Complete the sentences below by circling the correct answers.

The law of [octaves / isotopes / elements] was developed by [Mendeleev. / Newlands. / Dalton.]

He arranged the elements by atomic [number. / mass. / size.] [3]

(b) Hydrogen is one of the elements present in this early version.
Describe a test for hydrogen gas.

_____

_____

_____ [2]

(c) Suggest one reason why hydrogen, fluorine and chlorine were all placed in the same group in this version of the Periodic Table.

_____

_____ [1]

(d) **(i)** Give the symbol for the element in Group 6 of the **modern** Periodic Table, which is also a gas.

_____ [1]

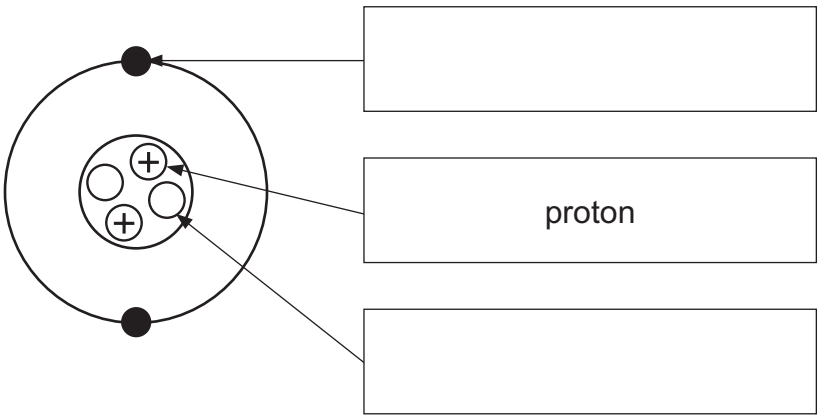
(ii) Name an element which is in Period 1 of the **modern** Periodic Table.

_____ [1]

[Turn over

3 The diagram below represents an atom.

(a) (i) Complete the two missing labels.



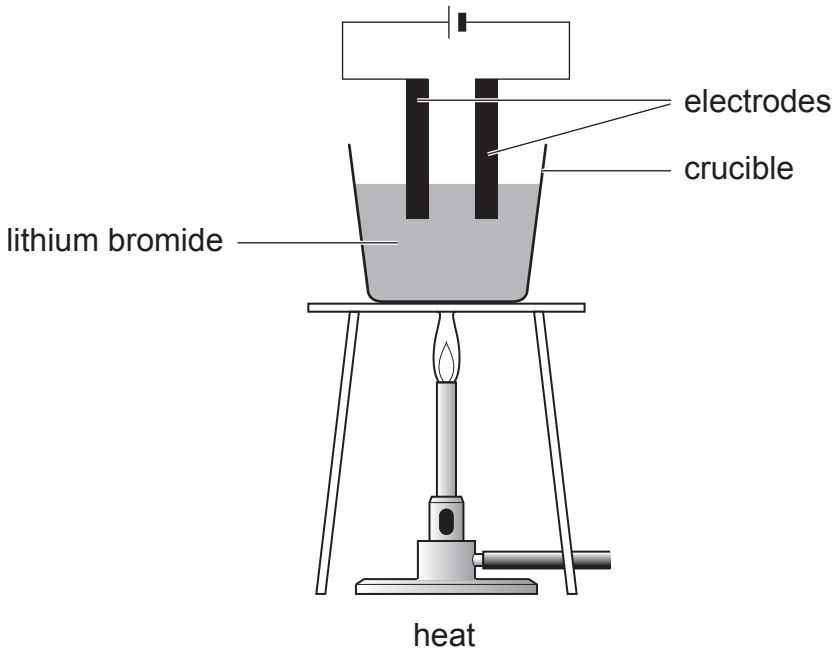
[2]

(ii) What is the atomic number for this atom?
Circle the correct answer.

1 2 4 6

[1]

(b) Lithium bromide is a solid which can be broken down to its elements by electrolysis as shown in the diagram below.



(i) Why is it necessary to heat the lithium bromide?

_____ [1]

(ii) Lithium metal is formed at the negative electrode.
Name the element formed at the positive electrode.

_____ [1]

[Turn over

4 **(a)** Five substances are listed below:

sulfuric acid ethanoic acid ammonia

water sodium hydroxide

(i) How many of the substances in the list above would turn red litmus paper blue?

_____ [1]

(ii) Which substance, from the list, is a weak acid?

_____ [1]

(iii) Which of the units, listed below, is used to describe the concentration of sodium hydroxide solution? Circle the correct answer.

mol / dm dm / mol mol / dm^3 dm^3 / mol mol^3 / dm^3

[1]

(b) The balanced symbol equation below shows how a salt may be formed.

$$MgCO_{3\,(s)} + H_2SO_{4\,(aq)} \rightarrow MgSO_{4\,(aq)} + H_2O_{(l)} + CO_{2\,(\quad)}$$

(i) Complete the equation above by writing the correct state symbol (s, aq, l or g) for CO_2 inside the brackets. [1]

(ii) Complete the word equation to describe the reaction shown by the symbol equation above.

	+		→	magnesium sulfate	+ water +	carbon dioxide

[2]

(iii) Describe the test for carbon dioxide.

_____

_____ [2]

(c) Potassium chloride solution can be produced by the reaction shown below.

potassium hydroxide + hydrochloric acid → potassium chloride + water

(i) Write a balanced symbol equation to describe the reaction between potassium hydroxide and hydrochloric acid.

_____ [2]

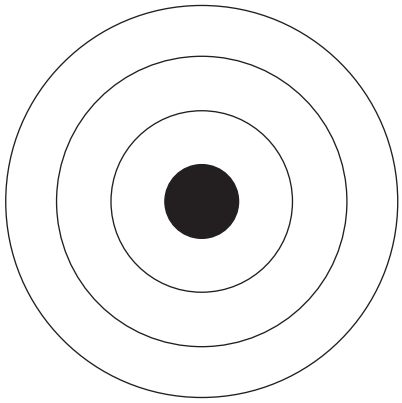
(ii) What colour would you expect for potassium chloride solution?

_____ [1]

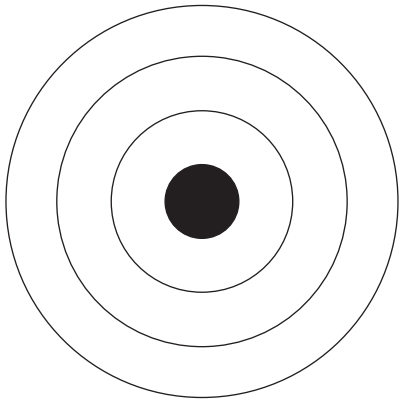
[Turn over

5 Chlorine gas has the chemical formula Cl_2.
Chlorine reacts with magnesium to form the compound magnesium chloride.

(a) (i) Complete the diagrams below to show **all** the electrons in a magnesium atom and a chlorine atom.



magnesium atom



chlorine atom

[2]

(ii) Describe how the electronic arrangements of both atoms change when they form magnesium and chloride ions.

_____

_____

_____ [2]

(iii) How are the ions held together in magnesium chloride?

_____ [1]

(b) (i) In the space below draw a dot and cross diagram to show the bonding in chlorine Cl_2. Only outer electrons are needed.

[3]

(ii) Name the type of bonding in a chlorine molecule.

_____ [1]

(iii) Chlorine is described as a diatomic gas. What does the term diatomic mean?

_____ [1]

[Turn over

6 Two bottles were found in a chemical store but the labels had fallen off.
The teacher needed to find out which bottle contained **potassium** and which one contained **lithium**.

Describe how the teacher could **safely** react both of the metals with water and compare **similarities** and **differences** that would be observed between the two reactions.

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

Safety precautions needed in carrying out the reactions:

Similarities observed:

Differences observed:

[6]

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(Questions continue overleaf)

7 **(a)** What does **solubility** mean?

Solubility is the mass of a solid required to _____

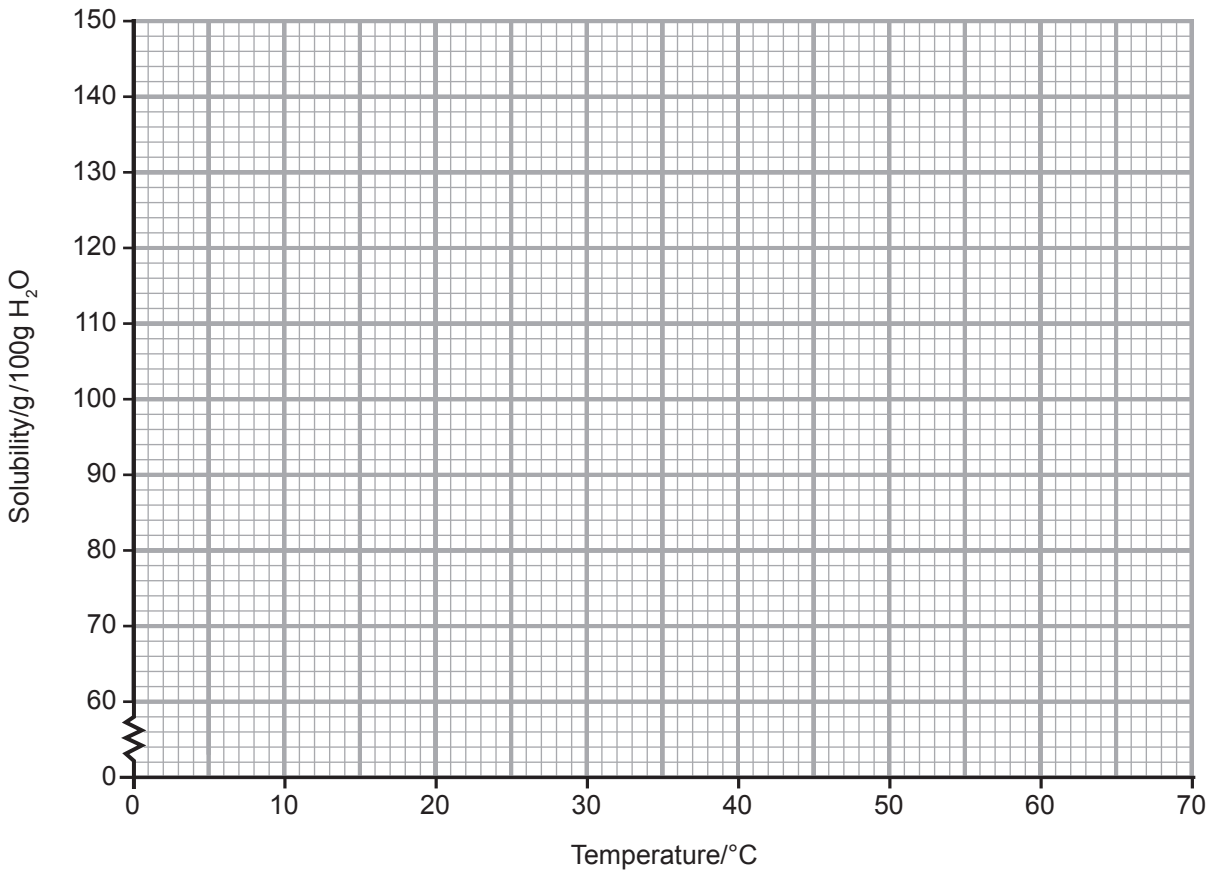
_____

_____ [4]

(b) The table below gives the results of an investigation to find the solubility of sodium nitrate ($NaNO_3$) at different temperatures.

Temperature/°C	10	20	30	40	50	60	70
Solubility/g/100g H_2O	80	88	96	105	114	124	135

(i) On the grid below plot a solubility curve for sodium nitrate.



[3]

(ii) Use your solubility curve to find the solubility of sodium nitrate at 25 °C.

_____ [1]

(c) (i) Describe the trend in solubility with temperature for sodium nitrate.

_____

_____ [1]

(ii) Complete the table below to show how solubility can be expected to change with temperature for the three substances.
Tick (✓) the three correct boxes.

Substance	Solubility **increases** with temperature increase	Solubility **decreases** with temperature increase
potassium chloride		
carbon dioxide		
copper(II) sulfate		

[3]

[Turn over

8 The table below gives data on some **atoms** and **ions**, which are labelled A, B and C.

(a) Use your knowledge and understanding of atomic structure to complete the gaps in the table.

atom/ion	mass number	number of protons	number of neutrons	number of electrons
A		11	12	11
B	16	8		10
C	7		4	2

[3]

(b) Work out which atoms or ions are represented by A and B.
Complete the table below.

atom/ion	chemical symbol/formula	charge
A		
B		

[4]

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For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
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