Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2018–2019

Double Award Science: Chemistry

Unit C1

Higher Tier

[GDW22]

GDW22

THURSDAY 28 FEBRUARY 2019, 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 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.

12275.03**R**

1 **(a)** The metal ions in some compounds can be identified using a flame test.

(i) Complete the table about some metal ions.

Ion	Atomic number	Number of electrons
	19	18
Ca^{2+}		
	29	27

[3]

(ii) What term is used to describe a positive ion?

_____ [1]

(iii) Describe how you would carry out a flame test.

_____

_____

_____

_____

_____ [3]

(iv) What colour would be observed if a flame test was carried out on a solid compound containing calcium ions?

_____ [1]

(b) Calcium nitrate is a compound.

(i) Write the formula for calcium nitrate.

_____ [1]

(ii) What is meant by the term compound?

_____

_____ [2]

(iii) Name two compounds which could react together to form a solution of calcium nitrate.

_____

_____ [2]

[Turn over

2 Magnesium carbonate reacts with hydrochloric acid. A salt is produced.

(a) What do you understand by the term **salt**?

[3]

(b) Describe the reaction of solid magnesium carbonate with hydrochloric acid. Your answer should include:

- the name of the salt produced and the names of any other products
- the appearance of the reactants
- observations during the reaction

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

The name of the salt produced and the names of any other products:

The appearance of the reactants:

Observations during the reaction:

[6]

3 The elements aluminium and oxygen react to form the ionic compound aluminium oxide.

(a) Draw diagrams to show the arrangement of all the electrons in an aluminium ion and in an oxide ion and give the charge on both ions.

aluminium ion

charge _____

oxide ion

charge _____ [4]

(b) Below are three predictions made by students during a class discussion about aluminium oxide.

Prediction 1: solid aluminium oxide will conduct electricity
Prediction 2: aluminium oxide will have a high melting point
Prediction 3: the formula of aluminium oxide is Al_2O_3

(i) Decide if each prediction is true or false and complete the table below by putting a tick (✓) in the correct boxes. One has been done for you.

Prediction	Prediction is true	Prediction is false
1		✓
2		
3		

[2]

(ii) Explain fully why prediction 1 is false.

_____

_____ [1]

[Turn over

4 Methane and oxygen are covalently bonded molecules.

(a) **(i)** In the spaces below draw dot and cross diagrams to show the bonding in methane (CH_4) and in oxygen (O_2). Only outer electrons are needed.

methane

oxygen

[4]

(ii) Label a lone pair of electrons on one of the diagrams. [1]

(b) What name is given to the weak intermolecular forces between oxygen molecules?

_____ [1]

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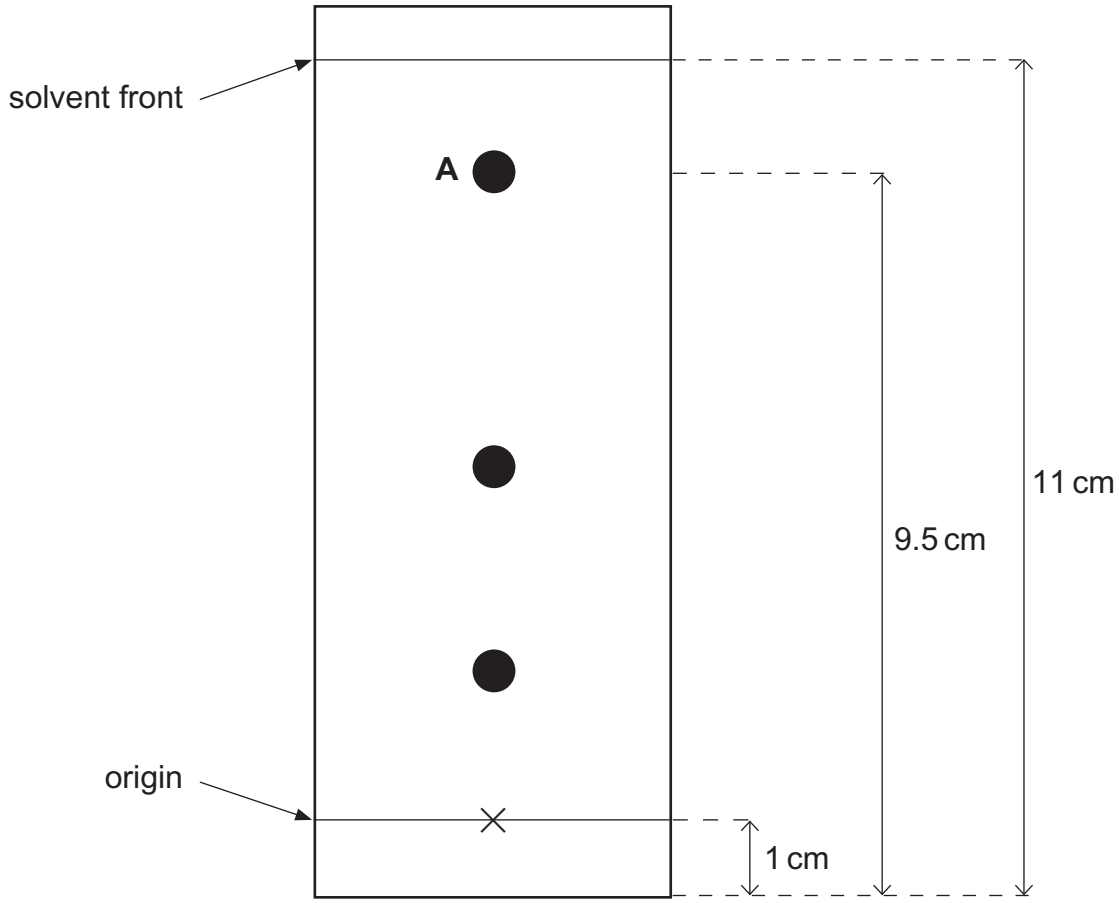
(Questions continue overleaf)

5 The diagram below shows the results of a chromatography experiment to separate a mixture of dyes.



(a) In paper chromatography what is meant by the term “mobile phase”?

_____

_____ [1]

(b) Describe how the experiment could have been carried out to achieve the results shown opposite.

[4]

(c) Calculate the R_f value for the spot labelled **A**. Use the measurements provided.

Show your working out.

R_f = _____ [2]

[Turn over

6 The table below gives information about four halogens.

element	physical state at room temperature	colour	formula of ion
fluorine	gas	yellow	F^-
chlorine	gas	green	Cl^-
bromine	liquid	red-brown	Br^-
iodine	solid	grey-black	I^-

(a) Describe the trend in physical state at room temperature and the trend in colour as you move down the group of halogens.

Trend in physical state:

Trend in colour:

[2]

(b) Explain why all the halogens form ions with a charge of minus one.

[2]

(c) Fluorine is the most reactive halogen. Write a balanced symbol equation for the reaction of fluorine with potassium iodide.

[3]

(d) Astatine is the fifth member of the halogens.

(i) Use the information given in the table and your understanding of halogen chemistry to predict the following properties of astatine.

Physical state at room temperature: _____

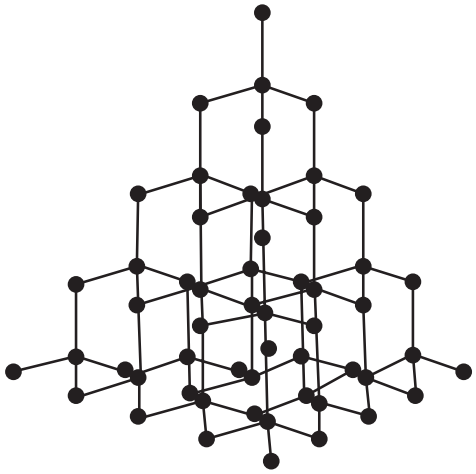
Formula of molecule: _____ [2]

(ii) Predict the name of the compound formed when potassium reacts with astatine.

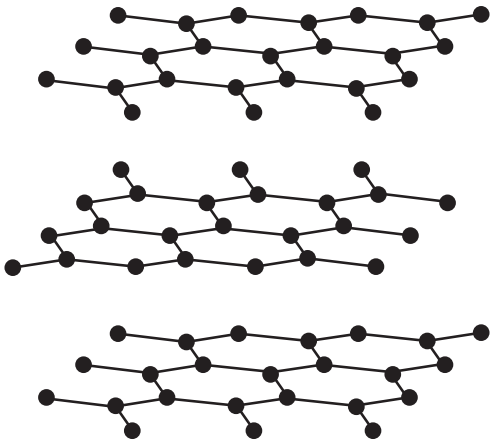
_____ [1]

[Turn over

7 **(a)** The diagrams below show two allotropes of carbon.



X



Y

(i) Name both allotropes.

X _____

Y _____ [1]

(ii) What do the black dots in the diagrams represent?

_____ [1]

(iii) Both these allotropes of carbon are solids which are insoluble in water. Name another physical property they share and explain why they have this property.

Physical property: _____

Explanation: _____

_____ [2]

(b) Stainless steel is widely used because it is shiny and resists corrosion. A popular type of stainless steel is known as 18-8. It is an alloy of iron containing 18% chromium and 8% nickel.

What word, apart from alloy, is used to describe a mixture such as this?

_____ [1]

(c) Draw a labelled diagram of the structure of a metal such as iron.

[3]

(d) Explain why iron is a good conductor of electricity.

_____

_____

_____ [2]

[Turn over

8 Calcium hydroxide reacts with carbon dioxide according to the equation:

$$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$$

(a) 370 g of calcium hydroxide were mixed with 308 g of carbon dioxide.

(relative formula masses (M_r): $Ca(OH)_2$ = 74; CO_2 = 44; $CaCO_3$ = 100)

(i) Calculate the number of moles of calcium hydroxide in 370 g.

moles = _____ [1]

(ii) Calculate the number of moles of carbon dioxide in 308 g.

moles = _____ [1]

(iii) Using the ratio in the equation above and your answers to (i) and (ii) state which reactant is the limiting reactant.

_____ [1]

(iv) Calculate the number of moles of calcium carbonate formed.

moles = _____ [1]

(v) Calculate the mass of calcium carbonate formed.

mass = _____ g [1]

(b) (i) Complete the expression below used to calculate percentage yield.

$$\text{percentage yield} = \frac{\text{\_\_\_\_\_}}{\text{theoretical yield}} \times 100$$

[1]

(ii) Suggest two reasons why the percentage yield of a reaction may be less than 100%.

1. _____

2. _____ [2]

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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
Butanoate	$C_3H_7COO^-$
Carbonate	CO_3^{2-}
Dichromate	$Cr_2O_7^{2-}$
Ethanoate	CH_3COO^-
Hydrogencarbonate	HCO_3^-
Hydroxide	OH^-
Methanoate	$HCOO^-$
Nitrate	NO_3^-
Propanoate	$C_2H_5COO^-$
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

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Rewarding Learning

New Specification

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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

gcse examinations

chemistry

For first teaching from September 2017

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	98 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	266 Sg Seaborgium 106	264 Bh Bohrium 107	277 Hs Hassium 108	268 Mt Meitnerium 109	271 Ds Darmstadtium 110	272 Rg Roentgenium 111	285 Cn Copernicium 112						

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

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

a
X
b

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