



General Certificate of Secondary Education
2019–2020

Centre Number

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Candidate Number

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Double Award Science: Chemistry

Unit C1
Foundation Tier

MV24

[GDW21]

THURSDAY 7 NOVEMBER 2019, 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 on blank pages.

Complete in black ink only.

Answer **all seven** questions.

Information for Candidates

The total mark for this paper is 60.

Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Question **5(c)**.

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

- 1 The melting points and boiling points of some substances (A, B, C, D) are given in the table below:

Substance	Melting point/°C	Boiling point/°C
A	-101	-34
B	-114	79
C	115	445
D	801	1465

- (a) (i) Which substance (A, B, C or D) is a liquid at room temperature (20 °C)?
[1 mark]
-

- (ii) Over what range of temperature is substance C a liquid? [1 mark]
Circle the correct answer.

115 °C

330 °C

445 °C

560 °C

(iii) Which substance (A, B, C or D) could be sodium chloride? [1 mark]

(b) Sodium chloride is found dissolved in the oceans around the world.

Complete the passage below using the terms listed. Each term may be used once, more than once or not at all.

[4 marks]

insoluble

solid

solvent

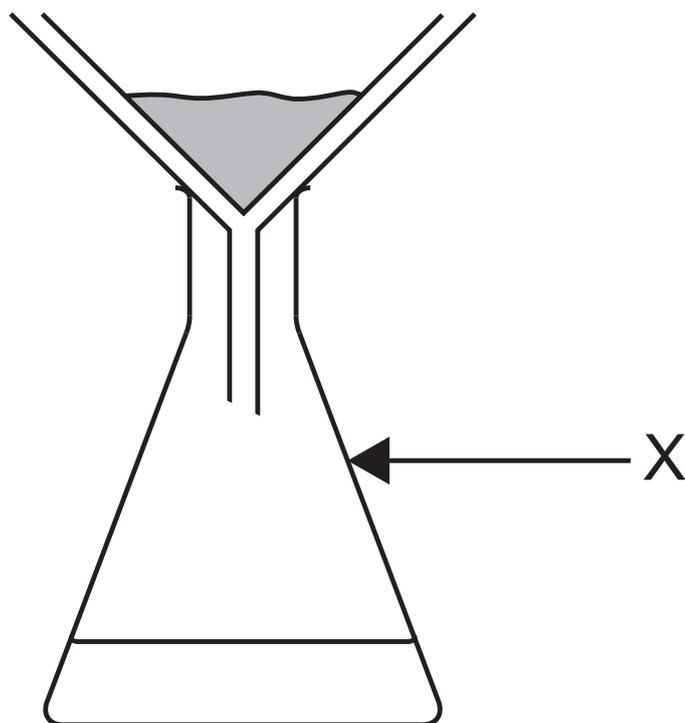
soluble

solute

solution

Sodium chloride is _____ in water. It dissolves to form a _____. The sodium chloride is the _____ and the water is the _____.

- (c) Silver chloride does not dissolve in water. The diagram below shows the apparatus which is used to separate silver chloride from water.



- (i) Name this separation technique.
[1 mark]

- (ii) Name the piece of apparatus labelled X. [1 mark]

- (iii) Show the position of the silver chloride on the diagram using an arrow labelled Y. [1 mark]

2 Mendeleev's Periodic Table and the modern Periodic Table share many features but there are also some differences.

(a) For each statement below, place a tick (✓) in the correct box to indicate if the statement is true or false. [3 marks]

Statement	True	False
The elements in Mendeleev's Periodic Table were arranged by atomic number		
The modern Periodic Table contains a block of transition metals but Mendeleev's Periodic Table did not		
The noble gases had not been discovered at the time of Mendeleev		

(b) Some physical properties and descriptions of metals are given below. Draw a line from each physical property to the correct description. [2 marks]

physical property

description

ductile

rings when struck

malleable

can be drawn or pulled into wires

sonorous

can be hammered into shape

(c) Some of the groups in the Periodic Table have names. [3 marks]

Name the Group made up of unreactive non-metals.

Name the Group made up of metals which all react vigorously with water.

Name the Group which contains an element which is a red-brown liquid at room temperature.

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(Questions continue overleaf)

- 3 (a) Some elements such as hydrogen, nitrogen, oxygen and chlorine are diatomic molecules. [2 marks]

Name one **other** element which is diatomic.

Give the formula for a molecule of nitrogen.

- (b) Nitrogen and oxygen react to give nitrogen dioxide.

Give the formula for nitrogen dioxide.
[1 mark]

(c) A symbol equation is shown below.

(i) Balance the equation and add the missing state symbols. [2 marks]



(ii) Write a word equation for this reaction. [1 mark]

- 4 (a) The symbols of the elements in Group 3 of the Periodic Table are shown below with some of their atomic numbers.

Symbol	Atomic number
B	
Al	13
Ga	31
In	
Tl	81

- (i) Complete the table by filling in the missing atomic numbers. [1 mark]

- (ii) What is meant by the term atomic number? [1 mark]

- (iii) Name the non-metal in Group 3. [1 mark]

(b) An isotope of gallium, atomic number 31, has 38 neutrons.

(i) What is the mass number of this isotope of gallium? [1 mark]

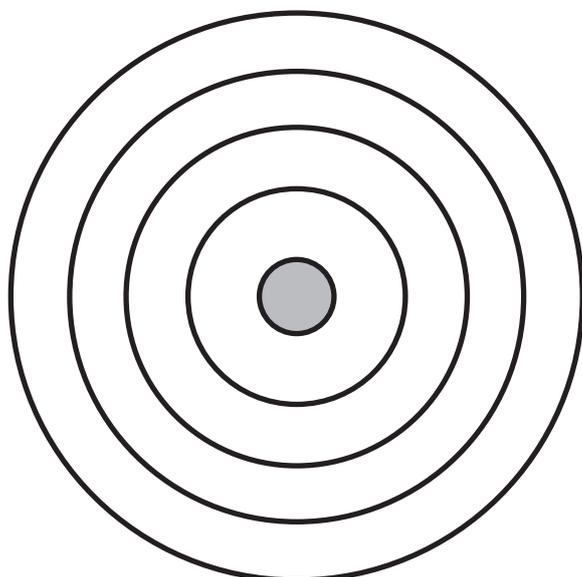
(ii) How many electrons are present in a Ga^{3+} ion? [1 mark]

(c) Complete the table below giving information about **ions** of different elements. [3 marks]

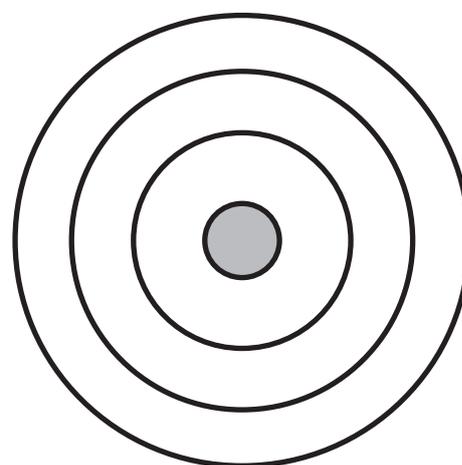
Ion	Number of protons	Number of electrons
Al^{3+}		10
	8	10
Br^-	35	

5 Calcium reacts with chlorine to form calcium chloride.

(a) Complete the diagrams below to show the arrangement of all of the electrons in an atom of calcium and in an atom of chlorine. [2 marks]



atom of calcium



atom of chlorine

(b) A flame test can be used to identify the calcium ion in calcium chloride. Complete the passage opposite about this flame test by **circling the correct answers**. [3 marks]

A nichrome wire is cleaned by dipping it in

water
concentrated hydrochloric acid
dilute hydrochloric acid

and is then dipped in calcium chloride.

A Bunsen burner is adjusted to give a

blue
yellow
orange

flame.

When the nichrome wire is now placed in the Bunsen burner flame it should produce a

crimson
lilac
brick red

colour.

(c) The electronic configuration of a sodium atom is 2,8,1. The electronic configuration of an oxygen atom is 2,6.

Describe in words: [6 marks]

- how the electronic configurations of both atoms change in order to form sodium oxide including the charges of the ions formed and the formula of the compound.
- at least two physical properties you would expect sodium oxide to have.

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

How the electronic configurations of both atoms change in order to form sodium oxide including the charges of the ions formed and the formula of the compound.

At least two physical properties you would expect sodium oxide to have.

6 Relative formula masses may be calculated using relative atomic masses.

(a) Complete the sentence below by adding the missing words: [2 marks]

The relative atomic mass is the mass of an atom compared with that of an isotope of the element _____ which has a mass of exactly _____ .

(b) Calculate the relative formula mass (M_r)
of the following compounds:
[1 mark each]

(relative atomic masses:

H = 1; C = 12; N = 14; O = 16; Na = 23;
S = 32; Cr = 52)

sodium sulfate, Na_2SO_4

sodium dichromate, $\text{Na}_2\text{Cr}_2\text{O}_7$

ammonium carbonate, $(\text{NH}_4)_2\text{CO}_3$

(c) The relative formula mass of sodium nitrate, NaNO_3 , is 85.

(i) Calculate the number of moles, to 2 decimal places, in 15.80g of sodium nitrate. [2 marks]
Show your work.

(ii) Calculate the mass, in grams, of 0.022 moles of sodium nitrate. [1 mark]

_____ g

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(Questions continue overleaf)

7 Copper(II) sulfate solution may be prepared by reacting copper(II) carbonate with sulfuric acid.

(a) Write a balanced symbol equation for this reaction. [2 marks]

(b) Using **only** the words given in the list below, answer the questions which follow. Each word may be used once, more than once or not at all. [3 marks]

colourless

black

blue

green

orange

purple

red

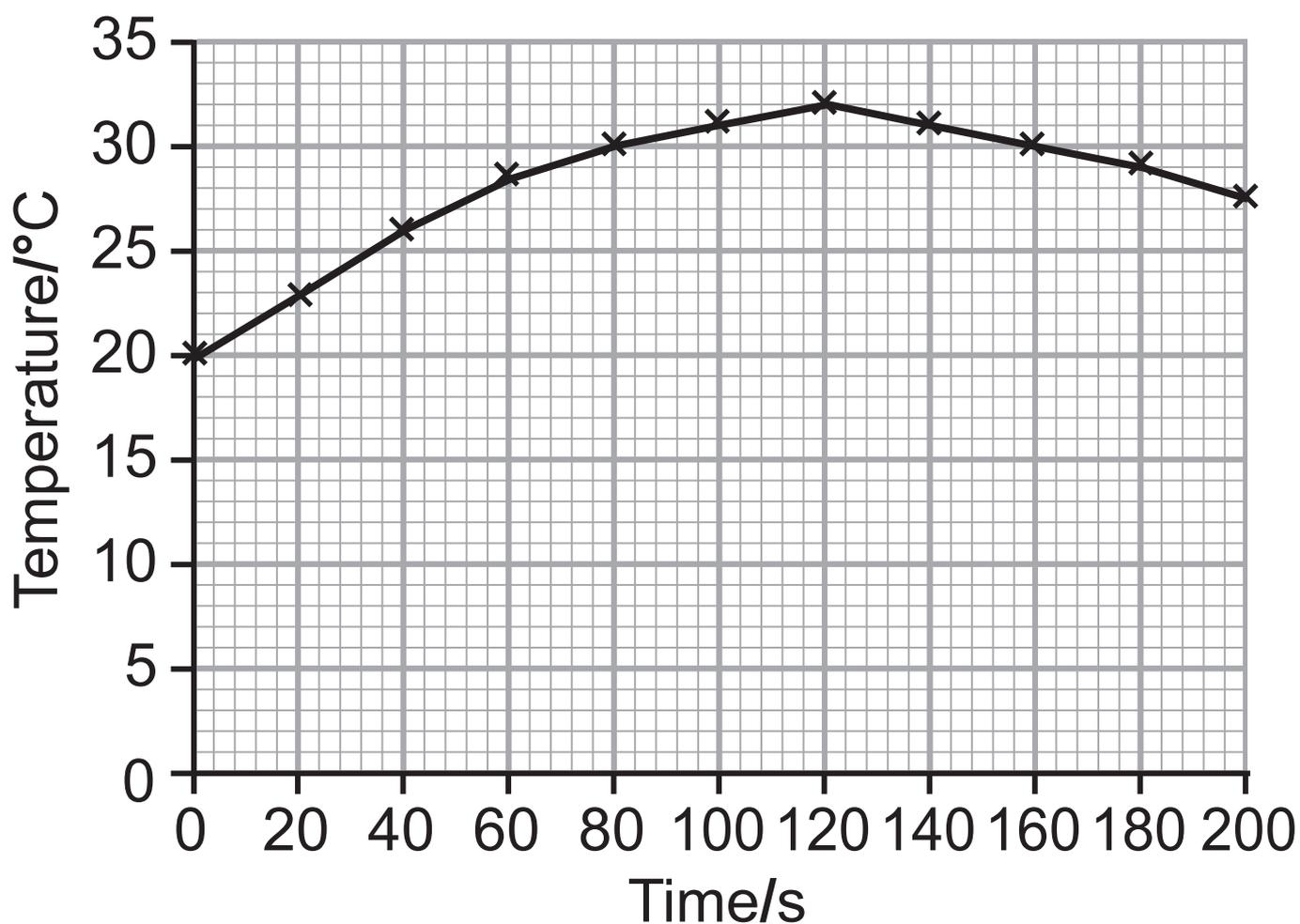
white

What colour is copper(II) carbonate?

What colour is sulfuric acid?

What colour is copper(II) sulfate solution?

(c) A sample of copper(II) carbonate was added to 25 cm³ of sulfuric acid and the temperature was recorded every 20 seconds. The results were plotted on the axes below.



- (i) What was the temperature at the start of the reaction? [3 marks total]
-

What was the highest temperature recorded during the reaction?

Calculate the maximum temperature change observed.

- (ii) Suggest why the temperature started to fall after 120 seconds. [1 mark]
-

This is the end of the question paper

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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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

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-}

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

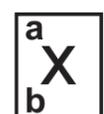
THE PERIODIC TABLE OF ELEMENTS

Group

																		0
																		4
																		He Helium
1	2											3	4	5	6	7		
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							

* 58 – 71 Lanthanum series

† 90 – 103 Actinium series



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