



Rewarding Learning

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

<b>MV18</b>
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[GDW21]

**THURSDAY 7 NOVEMBER 2019, MORNING**

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## **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**

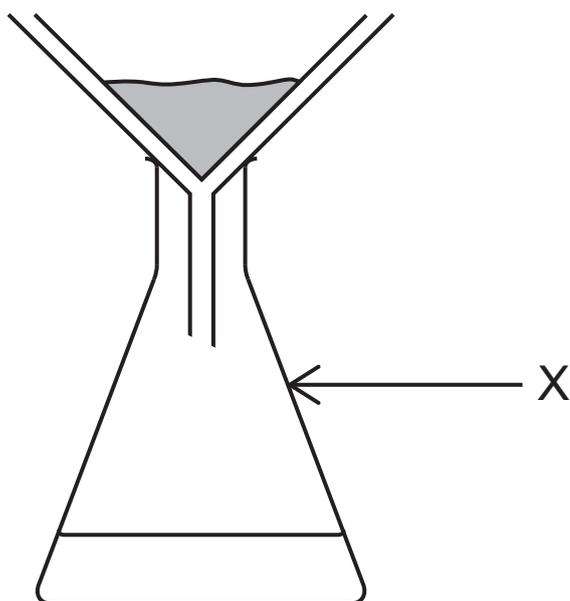
**solute**

**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

ductile

malleable

sonorous

### description

rings when struck

can be drawn or pulled into wires

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.

---

- 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]

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- (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  $\text{Ga}^{3+}$  ion?  
[1 mark]

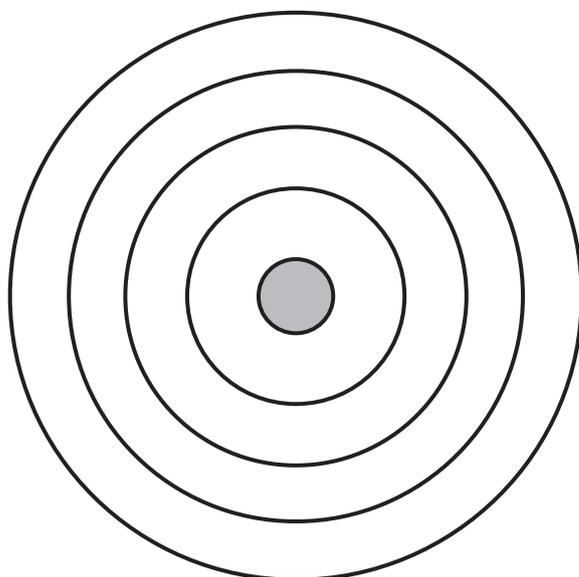
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(c) Complete the table below giving information about **ions** of different elements. [3 marks]

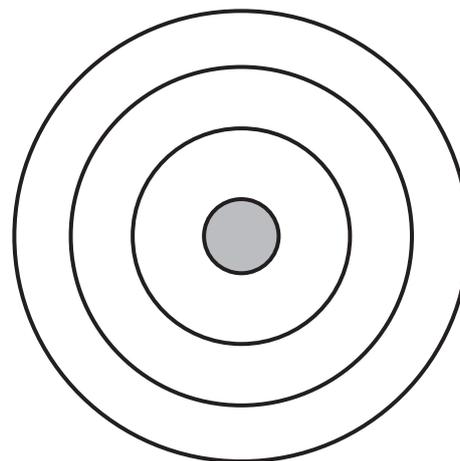
Ion	Number of protons	Number of electrons
$\text{Al}^{3+}$		10
	8	10
$\text{Br}^-$	35	

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 below 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.

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---

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

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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,  $\text{Na}_2\text{SO}_4$

\_\_\_\_\_

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,  $\text{NaNO}_3$ , 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

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?

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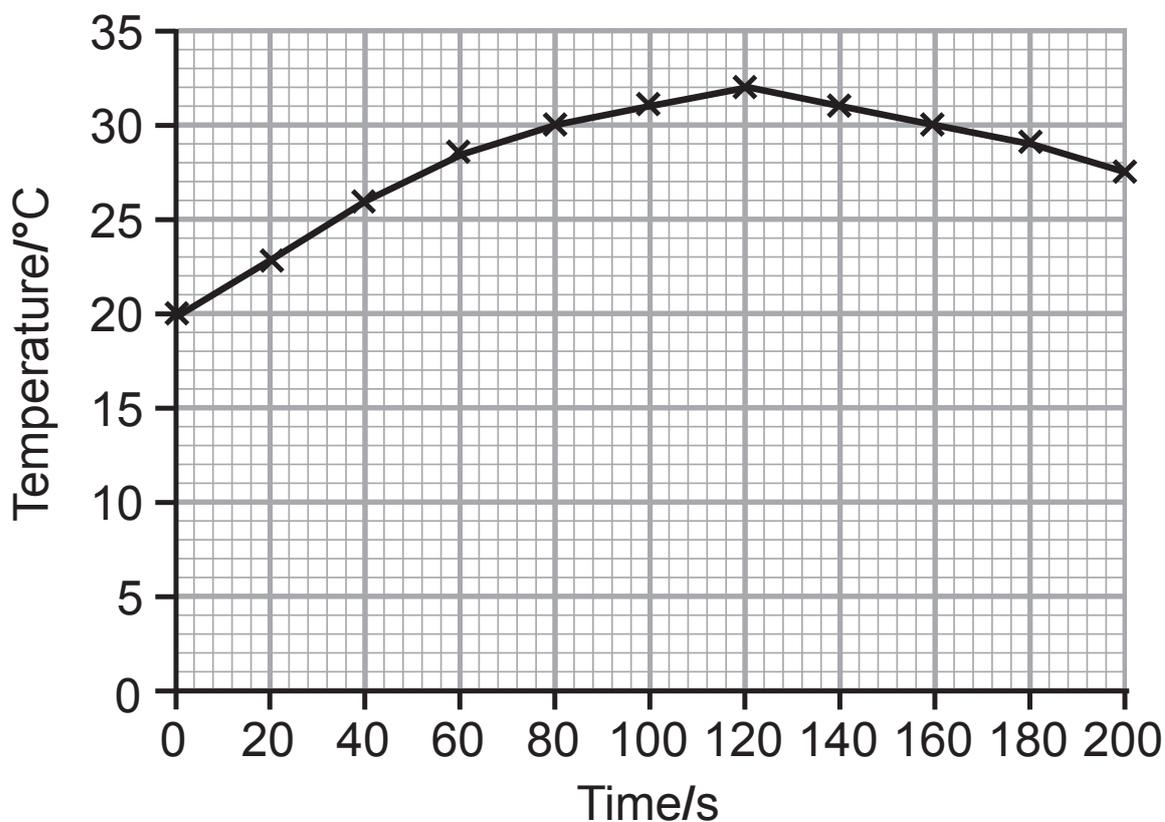
What colour is sulfuric acid?

---

What colour is copper(II) sulfate solution?

---

- (c) A sample of copper(II) carbonate was added to 25 cm<sup>3</sup> 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]

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What was the highest temperature recorded during the reaction?

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Calculate the maximum temperature change observed.

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

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**This is the end of the question paper**

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

<b>Total Marks</b>	
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Examiner Number



New  
Specification

## SYMBOLS OF SELECTED IONS

### Positive ions

Name	Symbol
Ammonium	$\text{NH}_4^+$
Chromium(III)	$\text{Cr}^{3+}$
Copper(II)	$\text{Cu}^{2+}$
Iron(II)	$\text{Fe}^{2+}$
Iron(III)	$\text{Fe}^{3+}$
Lead(II)	$\text{Pb}^{2+}$
Silver	$\text{Ag}^+$
Zinc	$\text{Zn}^{2+}$

### Negative ions

Name	Symbol
Butanoate	$\text{C}_3\text{H}_7\text{COO}^-$
Carbonate	$\text{CO}_3^{2-}$
Dichromate	$\text{Cr}_2\text{O}_7^{2-}$
Ethanoate	$\text{CH}_3\text{COO}^-$
Hydrogencarbonate	$\text{HCO}_3^-$
Hydroxide	$\text{OH}^-$
Methanoate	$\text{HCOO}^-$
Nitrate	$\text{NO}_3^-$
Propanoate	$\text{C}_2\text{H}_5\text{COO}^-$
Sulfate	$\text{SO}_4^{2-}$
Sulfite	$\text{SO}_3^{2-}$

### 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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## 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

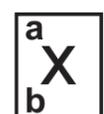
# THE PERIODIC TABLE OF ELEMENTS

## Group

																		0
																		4
																		<b>He</b> Helium
1	2											3	4	5	6	7		
7 <b>Li</b> Lithium 3	9 <b>Be</b> Beryllium 4											11 <b>B</b> Boron 5	12 <b>C</b> Carbon 6	14 <b>N</b> Nitrogen 7	16 <b>O</b> Oxygen 8	19 <b>F</b> Fluorine 9	20 <b>Ne</b> Neon 10	
23 <b>Na</b> Sodium 11	24 <b>Mg</b> Magnesium 12											27 <b>Al</b> Aluminium 13	28 <b>Si</b> Silicon 14	31 <b>P</b> Phosphorus 15	32 <b>S</b> Sulfur 16	35.5 <b>Cl</b> Chlorine 17	40 <b>Ar</b> Argon 18	
39 <b>K</b> Potassium 19	40 <b>Ca</b> Calcium 20	45 <b>Sc</b> Scandium 21	48 <b>Ti</b> Titanium 22	51 <b>V</b> Vanadium 23	52 <b>Cr</b> Chromium 24	55 <b>Mn</b> Manganese 25	56 <b>Fe</b> Iron 26	59 <b>Co</b> Cobalt 27	59 <b>Ni</b> Nickel 28	64 <b>Cu</b> Copper 29	65 <b>Zn</b> Zinc 30	70 <b>Ga</b> Gallium 31	73 <b>Ge</b> Germanium 32	75 <b>As</b> Arsenic 33	79 <b>Se</b> Selenium 34	80 <b>Br</b> Bromine 35	84 <b>Kr</b> Krypton 36	
85 <b>Rb</b> Rubidium 37	88 <b>Sr</b> Strontium 38	89 <b>Y</b> Yttrium 39	91 <b>Zr</b> Zirconium 40	93 <b>Nb</b> Niobium 41	96 <b>Mo</b> Molybdenum 42	98 <b>Tc</b> Technetium 43	101 <b>Ru</b> Ruthenium 44	103 <b>Rh</b> Rhodium 45	106 <b>Pd</b> Palladium 46	108 <b>Ag</b> Silver 47	112 <b>Cd</b> Cadmium 48	115 <b>In</b> Indium 49	119 <b>Sn</b> Tin 50	122 <b>Sb</b> Antimony 51	128 <b>Te</b> Tellurium 52	127 <b>I</b> Iodine 53	131 <b>Xe</b> Xenon 54	
133 <b>Cs</b> Caesium 55	137 <b>Ba</b> Barium 56	139 <b>La</b> <sup>*</sup> Lanthanum 57	178 <b>Hf</b> Hafnium 72	181 <b>Ta</b> Tantalum 73	184 <b>W</b> Tungsten 74	186 <b>Re</b> Rhenium 75	190 <b>Os</b> Osmium 76	192 <b>Ir</b> Iridium 77	195 <b>Pt</b> Platinum 78	197 <b>Au</b> Gold 79	201 <b>Hg</b> Mercury 80	204 <b>Tl</b> Thallium 81	207 <b>Pb</b> Lead 82	209 <b>Bi</b> Bismuth 83	210 <b>Po</b> Polonium 84	210 <b>At</b> Astatine 85	222 <b>Rn</b> Radon 86	
223 <b>Fr</b> Francium 87	226 <b>Ra</b> Radium 88	227 <b>Ac</b> <sup>†</sup> Actinium 89	261 <b>Rf</b> Rutherfordium 104	262 <b>Db</b> Dubnium 105	266 <b>Sg</b> Seaborgium 106	264 <b>Bh</b> Bohrium 107	277 <b>Hs</b> Hassium 108	268 <b>Mt</b> Meitnerium 109	271 <b>Ds</b> Darmstadtium 110	272 <b>Rg</b> Roentgenium 111	285 <b>Cn</b> Copernicium 112							

\* 58 – 71 Lanthanum series

† 90 – 103 Actinium series



a = relative atomic mass (approx)

x = atomic symbol

b = atomic number

140 <b>Ce</b> Cerium 58	141 <b>Pr</b> Praseodymium 59	144 <b>Nd</b> Neodymium 60	145 <b>Pm</b> Promethium 61	150 <b>Sm</b> Samarium 62	152 <b>Eu</b> Europium 63	157 <b>Gd</b> Gadolinium 64	159 <b>Tb</b> Terbium 65	162 <b>Dy</b> Dysprosium 66	165 <b>Ho</b> Holmium 67	167 <b>Er</b> Erbium 68	169 <b>Tm</b> Thulium 69	173 <b>Yb</b> Ytterbium 70	175 <b>Lu</b> Lutetium 71
232 <b>Th</b> Thorium 90	231 <b>Pa</b> Protactinium 91	238 <b>U</b> Uranium 92	237 <b>Np</b> Neptunium 93	242 <b>Pu</b> Plutonium 94	243 <b>Am</b> Americium 95	247 <b>Cm</b> Curium 96	245 <b>Bk</b> Berkelium 97	251 <b>Cf</b> Californium 98	254 <b>Es</b> Einsteinium 99	253 <b>Fm</b> Fermium 100	256 <b>Md</b> Mendelevium 101	254 <b>No</b> Nobelium 102	257 <b>Lr</b> Lawrencium 103