Paper 3

Questions are applicable for both core and extended candidates

1 Samarium is a metal.

(f) Hydrated samarium chloride is an ionic compound.

(i) Define the term hydrated.

.....

..... [1]

(ii) State **two** physical properties of an ionic compound.

1 .....

2 .....
[2]

2 Potassium iodide is an ionic compound.

(a) State **two** properties of an ionic compound.

1 .....

2 .....
[2]

3 Fig. 1.1 shows part of the Periodic Table.

I	II											III	IV	V	VI	VII	VIII
							H										He
													C	N	O		
Na	Mg											Al				Cl	
K	Ca						Fe			Cu						Br	
																I	

Fig. 1.1

Answer the following questions using only the elements in Fig. 1.1.

Each symbol of the element may be used once, more than once or not at all.

Give the symbol of the element that:

(d) forms an ion with a charge of 2–

..... [1]

4 Lithium bromide is a compound with ionic bonding.

(a) State the meaning of the term ionic bond.

.....

..... [2]

(b) Complete Fig. 8.1 to show:

- the electronic configuration of a lithium ion
- the charge on the ion.

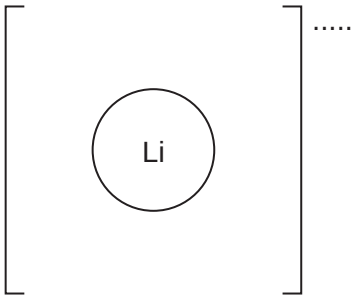


Fig. 8.1

[2]

5 Fig. 1.1 shows the electronic configurations of five atoms, **A**, **B**, **C**, **D** and **E**.

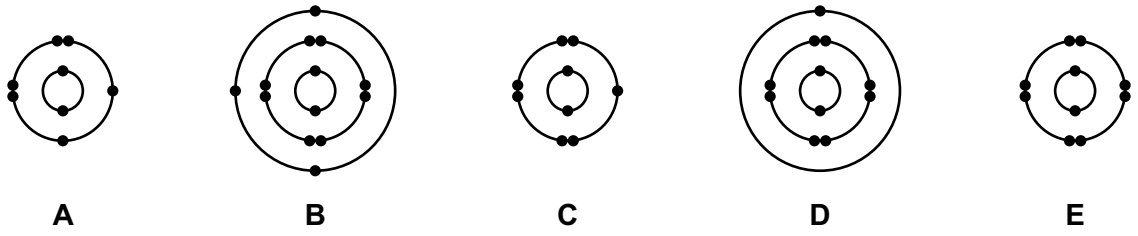


Fig. 1.1

(a) Answer the following questions.

Each letter may be used once, more than once or not at all.

Give the letter of the atom, **A**, **B**, **C**, **D** or **E**, that:

(iv) forms a stable ion with a single negative charge.

..... [1]

(b) Complete Table 1.1 to show the number of electrons, neutrons and protons in the sulfur atom and oxide ion.

Table 1.1

	number of electrons	number of neutrons	number of protons
$^{34}_{16}S$	16		
$^{18}_{8}O^{2-}$		10	

[3]

6 Table 5.1 shows the properties of four substances.

Table 5.1

substance	boiling point	electrical conductivity of solid	electrical conductivity when molten	density in g / cm^3
aluminium	high	conducts	conducts	2.70
diamond				3.51
potassium bromide	high	does not conduct	conducts	2.75
sulfur	low	does not conduct		2.07

(a) Complete Table 5.1 to show the electrical conductivity of solid diamond and molten sulfur. [2]

(c) **(i)** State the meaning of the term ionic bonding.

.....

..... [2]

(ii) Identify which information in Table 5.1 shows that potassium bromide is an ionic compound.

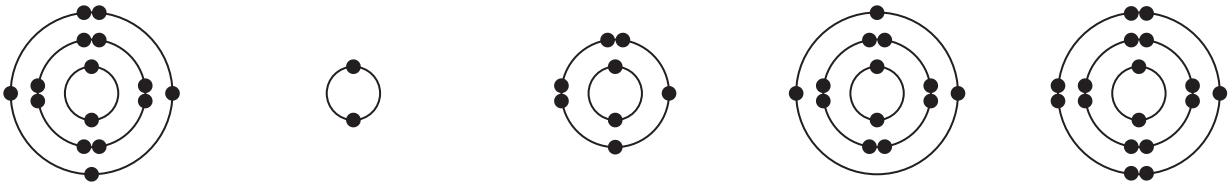
.....

.....

..... [2]

7 **(a)** The electronic structures of five atoms, **A**, **B**, **C**, **D** and **E**, are shown.

A **B** **C** **D** **E**



Answer the following questions about these electronic structures.
Each electronic structure may be used once, more than once or not at all.

State which electronic structure, **A**, **B**, **C**, **D** or **E**, represents:

(iii) an atom that forms a stable ion with a charge of 2–

..... [1]

(b) Complete the table to show the number of electrons, neutrons and protons in the uranium atom and rubidium ion shown.

	number of electrons	number of neutrons	number of protons
$^{235}_{92}U$	92		
$^{87}_{37}Rb^{+}$		50	

[3]

8 The table shows some properties of four Group I elements.

element	melting point / °C	boiling point / °C	relative hardness
lithium	181	1342	.....
sodium	98	.....	0.70
potassium	63	760	0.36
rubidium	39	686	0.22

(a) (i) Complete the table by estimating:
- the boiling point of sodium
- the relative hardness of lithium. [2]

(ii) Predict the physical state of lithium at 200 °C.

Give a reason for your answer.

.....

..... [2]

(d) Lithium chloride conducts electricity when molten and when in aqueous solution.

Give two **other** physical properties of lithium chloride that show it is an ionic compound.

1 .....

2 .....

[2]

9 **(a)** A list of symbols and formulae is shown.

CaO
CH_4
C_2H_4
C_2H_6
Cl^-
Cu^{2+}
H_2
He
K^+
N_2
Na^+
SO_2

Answer the following questions using these symbols or formulae.
Each symbol or formula may be used once, more than once or not at all.

State which symbol or formula represents:

(v) an ion formed when an atom gains an electron.

..... [1]

Paper 4

Questions are applicable for both core and extended candidates unless indicated in the question

10 The elements in Group VII of the Periodic Table are known as the halogens. Halogens can form halide ions.

(f) Calcium chloride is an ionic compound. **(extended only)**

Complete the dot-and-cross diagram in Fig. 2.1 for the ions in calcium chloride.

Give the charges on each of the ions. **(extended only)**

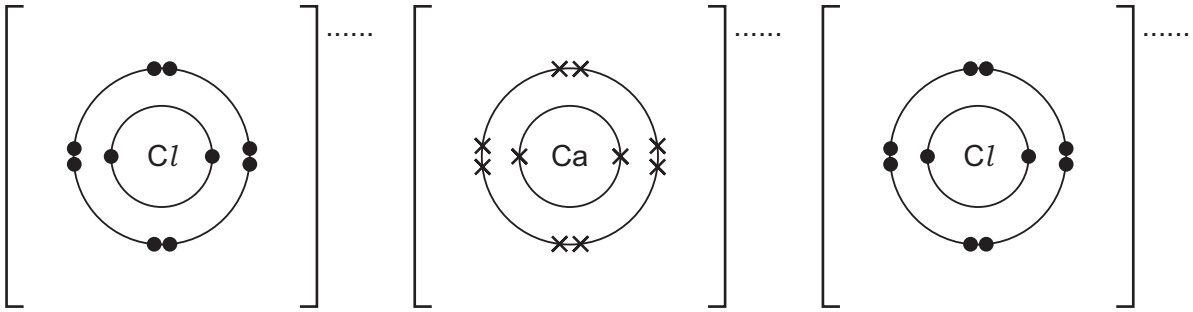


Fig. 2.1

[3]

11 This question is about ionic and covalent compounds.

(a) (i) Sodium reacts with oxygen to form the ionic compound sodium oxide.
The electronic configurations of an atom of sodium and an atom of oxygen are shown in Fig. 3.1.

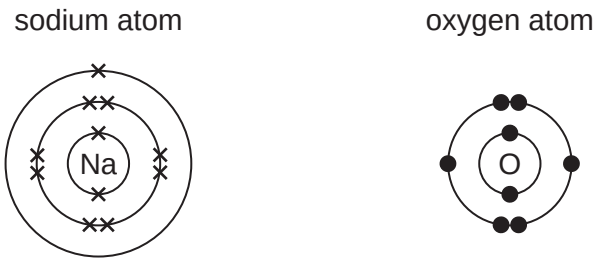


Fig. 3.1

Ions are formed by the transfer of electrons from sodium atoms to oxygen atoms.

Complete the dot-and-cross diagrams in Fig. 3.2 to show the electronic configuration of **one** sodium ion and **one** oxide ion. Show the charges on the ions.

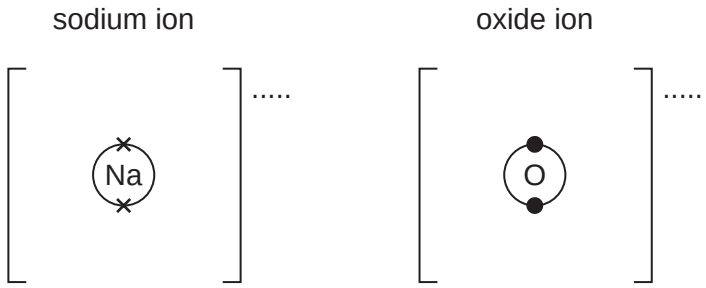


Fig. 3.2

[3]

(ii) Write the formula of sodium oxide. **(extended only)**

..... [1]

(c) The melting points of sodium oxide and carbon dioxide are shown in Table 3.1.

Table 3.1

	melting point / °C
sodium oxide	1275
carbon dioxide	–78

(i) Explain, in terms of bonding, why sodium oxide has a high melting point. **(extended only)**

.....

.....

.....

..... [2]

12 Boron and aluminium are Group III elements.

(f) Aluminium reacts with fluorine to form aluminium fluoride, AlF_3, an ionic compound.

(i) Write the symbol equation for this reaction. **(extended only)**

..... [2]

(ii) Complete Fig. 2.2 to show the electronic configuration of one aluminium ion and one fluoride ion.
Show the charges on the ions. **(extended only)**

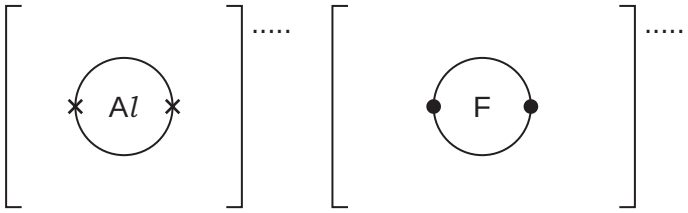


Fig. 2.2

[3]

13 Magnesium, calcium and strontium are Group II elements.

(d) Magnesium reacts with chlorine to form magnesium chloride, $MgCl_2$.

Magnesium chloride is an ionic compound. **(extended only)**

(i) Complete the dot-and-cross diagram in Fig. 2.1 of the ions in magnesium chloride.

Show the charges on the ions. **(extended only)**

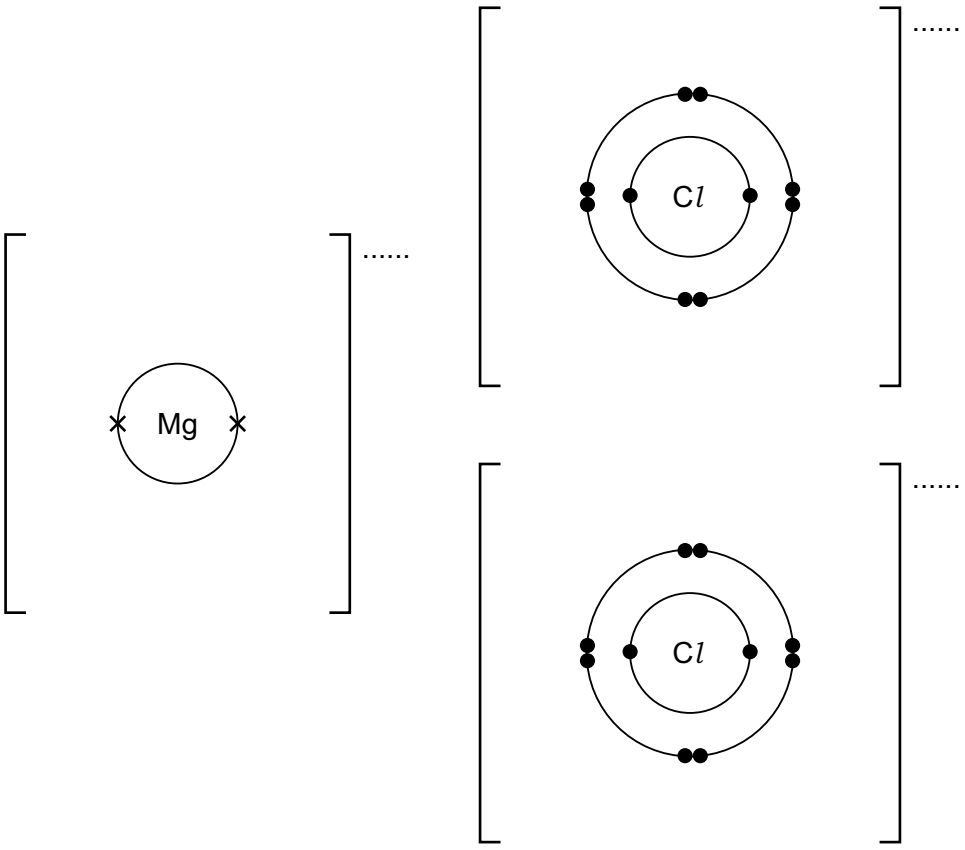


Fig. 2.1 [3]

(ii) One physical property typical of ionic compounds, such as $MgCl_2$, is that they are soluble in water.

Give two **other** physical properties that are typical of ionic compounds.

1 .....

2 .....

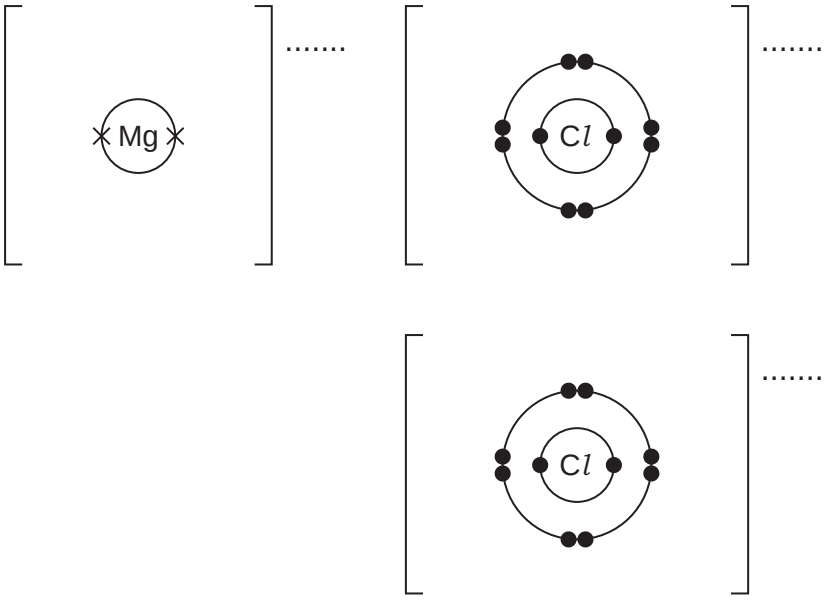
[2]

14 A student adds excess large pieces of magnesium carbonate, $MgCO_3$, to dilute hydrochloric acid, HC*l*, and measures the volume of carbon dioxide gas, CO_2, given off.

(b) Complete the dot-and-cross diagram to show the electron arrangement of the ions in magnesium chloride.

The inner shells have been drawn.

Give the charges on the ions. **(extended only)**



[3]

15 This question is about sodium and compounds of sodium.

(b) Some properties of sodium chloride are shown:

- melting point of 801 °C
- non-conductor of electricity when solid
- conductor of electricity when molten
- soluble in water.

(i) Name the type of bonding in sodium chloride.

..... [1]

(ii) Explain why sodium chloride conducts electricity when molten. **(extended only)**

.....

..... [1]

16 Potassium is a Group I element.

(b) Potassium combines with sulfur to form an ionic compound, potassium sulfide, K_2S.

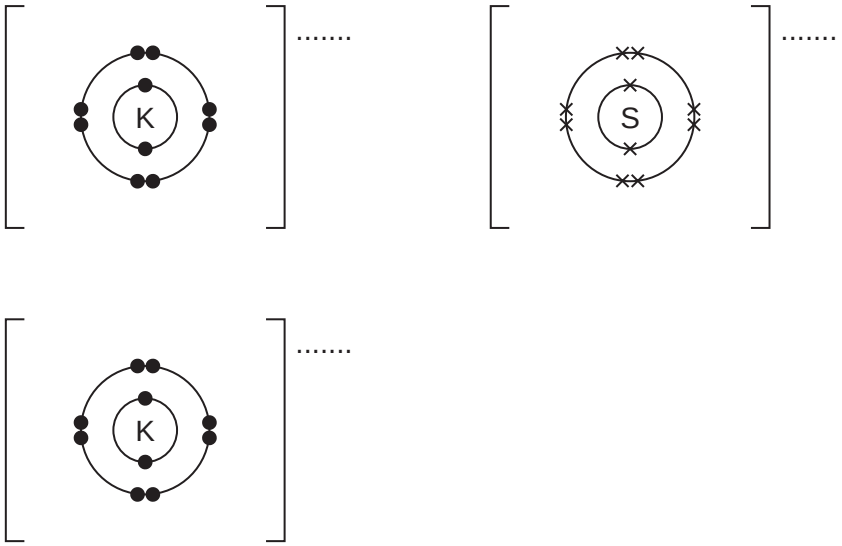
(i) Give **two** physical properties of ionic compounds.

1 .....

2 .....

[2]

(ii) Complete the dot-and-cross diagram to show the electron arrangement and charges of the ions in potassium sulfide. **(extended only)**



[3]