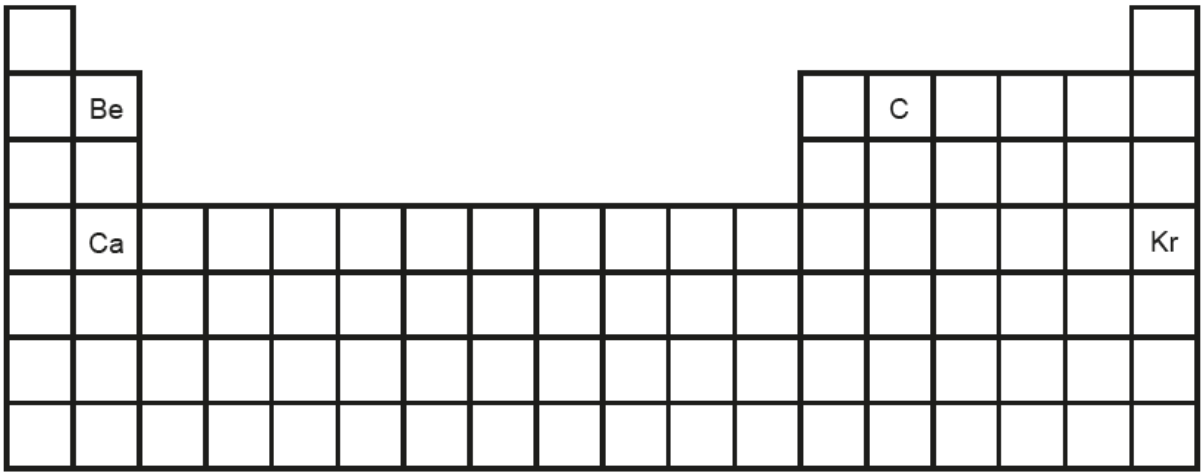
Bonding – 2021/20 GCSE Gateway Chemistry Combined Science A

1. Nov/2021/Paper_J250/03/No.1

In the Periodic Table elements are arranged in Groups and Periods.

Look at the diagram. It shows four elements.



Which element is in **Group 2** and **Period 4** of the Periodic Table?

A Be

B C

C Ca

D Kr

Your answer ☐ **[1]**

2. Nov/2021/Paper_J250/03/No.2

Look at the information about four different substances, **A**, **B**, **C** and **D**.

	State at room temperature	Conducts heat?	Conducts electricity?
A	gas	no	no
B	liquid	no	yes
C	solid	yes	no
D	solid	yes	yes

Which substance is a **metal**?

Your answer ☐ **[1]**

3. Nov/2021/Paper_J250/03/No.9

An atom of an element forms an ion with the formula X^{2-}.

Which **Group** of the Periodic Table is the element found in?

A Group 0

B Group 2

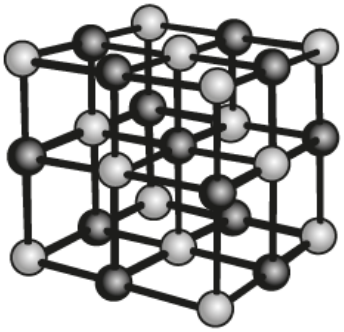
C Group 6

D Group 7

Your answer ☐ **[1]**

4. Nov/2021/Paper_J250/03/No.10

The diagram shows the 'ball and stick' model for an ionic compound.



Which statement about the 'ball and stick' model is correct?

A It shows all the forces between the ions.

B It shows the arrangement of the ions.

C It shows the charges on the ions.

D It shows the sizes of the ions.

Your answer ☐ **[1]**

5. Nov/2021/Paper_J250/03/No.15(a_ c)

Sodium and chlorine react to make sodium chloride, NaCl.

Fig. 15.1 shows the structure of sodium chloride.

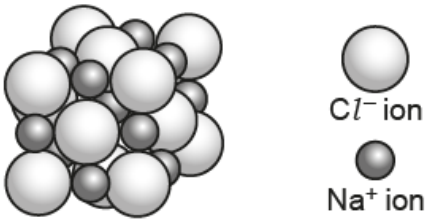


Fig. 15.1

(a) Complete the **balanced symbol** equation for the reaction of sodium and chlorine to make sodium chloride.

..... Na(s) + Cl_2(g) ⟶ .....NaCl(s) **[1]**

(b) Look at **Fig. 15.2**. It shows a sodium atom, Na, and a sodium ion, Na^+.

Sodium atom **Sodium ion**

Fig. 15.2

Explain how a sodium ion, Na^+, is formed from a sodium atom, Na.

.....

..... **[2]**

(c) Sodium chloride has a high melting point.

Explain why.

Use ideas about the structure and bonding in sodium chloride in your answer.

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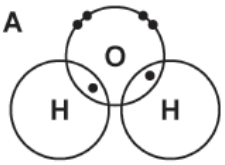
..... **[2]**

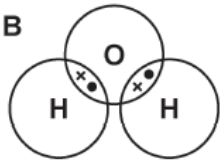
6. Nov/2020/Paper_J250/03/No.8

The bonding in a water molecule, H_2O, can be shown by a dot and cross diagram.

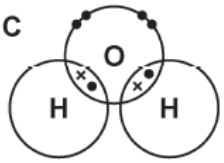
A



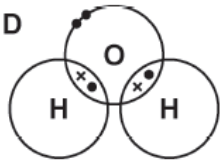
B



C



D



Which is the correct dot and cross diagram for water?

Your answer ☐ **[1]**

7. Nov/2020/Paper_J250/03/No.11

Magnesium is a metal in Group 2 and Period 3 of the Periodic Table.

Fig. 11.1 shows the arrangement of electrons in an atom of magnesium.

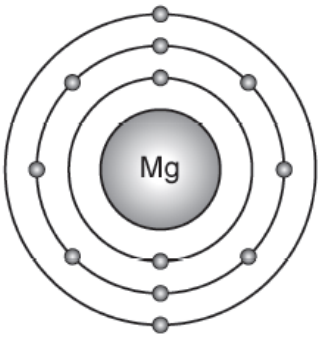


Fig. 11.1

(a) What is the approximate size of an atom of magnesium?

Tick (✓) **one** box.

1.6×10^{-15} m ☐

1.6×10^{-10} m ☐

1.6×10^{-5} m ☐

[1]

(b) Explain why magnesium is found in Group 2 and Period 3 of the Periodic Table.

Use **Fig. 11.1** to help you.

.....

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.....

..... **[2]**

(c) Magnesium reacts with oxygen, O_2, to form magnesium oxide, MgO.

(i) Complete the **balanced symbol** equation for the reaction of magnesium with oxygen.

..... Mg + O_2 → ..... MgO

[2]

(ii) Explain how an atom of magnesium reacts to form a magnesium ion.

Use **Fig. 11.1** to help you.

.....

.....

..... **[2]**

(d) Magnesium exists as isotopes.

Look at the information about two atoms of magnesium.

$^{24}_{12}Mg$ $^{25}_{12}Mg$

(i) Explain why these two atoms are isotopes of magnesium.

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.....

.....

..... **[2]**

(ii) Complete the table to show the number of **protons** and **neutrons** in each isotope of magnesium.

Isotope	Number of protons	Number of neutrons
$^{24}_{12}Mg$		
$^{25}_{12}Mg$		

[2]

8. Nov/2020/Paper_J250/03/No.14

This question is about ionic and simple covalent compounds.

Look at the information about two compounds, **Y** and **Z**.

	Compound Y	**Compound Z**
Appearance at room temperature	white solid	colourless liquid
Melting point (°C)	807	–95
Boiling point (°C)	1465	69
Electrical conductivity	conducts electricity as a molten liquid but not as a solid	does not conduct electricity

Use the information in the table to state if **Y** and **Z** are ionic or simple covalent compounds.

Explain your decision using ideas about structure and bonding.

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..... **[6]**

9. Nov/2020/Paper_J250/03/No.15

Mendeleev published a Periodic Table in 1871.

Look at the diagram. It shows a version of Mendeleev's Periodic Table.

Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8
H							
Li	Be	B	C	N	O	F	
Na	Mg	A*l*	Si	P	S	C*l*	
K Cu	Ca Zn		Ti	V As	Cr Se	Mn Br	Fe Co Ni
Rb Ag	Sr Cd	Y In	Zr Sn	Nb Sb	Mo Te	I	Ru Rh Pd

Describe how the Periodic Table on the separate Data Sheet is an improvement on Mendeleev's Periodic Table.

Use information from **both** Periodic Tables in your answer.

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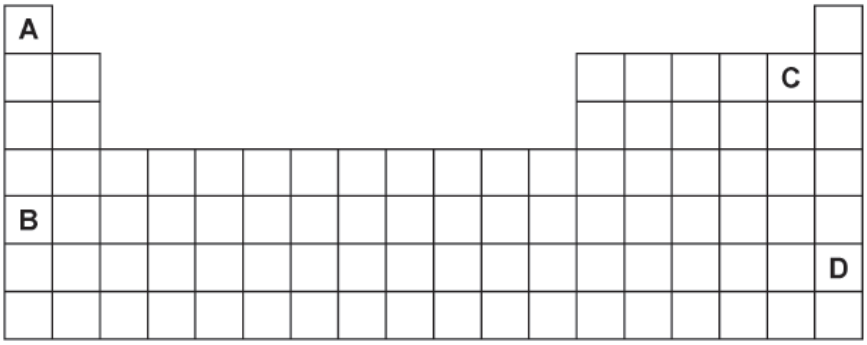
..... **[4]**

10. Nov/2020/Paper_J250/04/No.1

Look at the diagram of the Periodic Table.



Which element **A**, **B**, **C** or **D**, is a reactive metal?

Your answer ☐ **[1]**

11. Nov/2020/Paper_J250/04/No.4

A teacher places a small piece of metal into a test tube of water.

The metal floats and fizzes on the surface of the water.

What is the name of the metal?

A Copper

B Iron

C Lithium

D Silver

Your answer ☐ **[1]**

12. Nov/2020/Paper_J250/04/No.10

The table shows the boiling points of the first five Group 0 elements.

Element	Boiling point (°C)
Helium	–269
Neon	–246
Argon	–186
Krypton	–152
Xenon	–107

Which statement describes the trend in the boiling points?

A The boiling points decrease as the molecules get larger.

B The boiling points decrease as the molecules get smaller.

C The boiling points increase as the atoms get larger.

D The boiling points increase as the atoms get smaller.

Your answer ☐ **[1]**

13. Nov/2021/Paper_J250/09/No.1

An atom of an element forms an ion with the formula X^{2-}.

Which **Group** of the Periodic Table is this element found in?

A Group 0

B Group 2

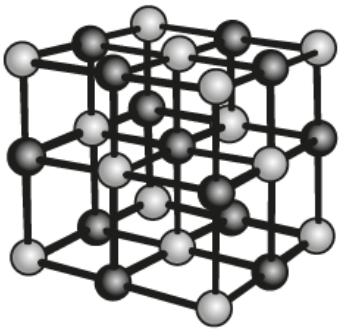
C Group 6

D Group 7

Your answer ☐ **[1]**

14. Nov/2021/Paper_J250/09/No.2

The diagram shows the 'ball and stick' model for an ionic compound.



Which statement about the 'ball and stick' model is correct?

A It shows all the forces between the ions.

B It shows the arrangement of the ions.

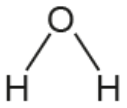
C It shows the charges on the ions.

D It shows the sizes of the ions.

Your answer ☐ **[1]**

15. Nov/2021/Paper_J250/09/No.4

An O-H bond has a length of 9.6×10^{-11} nm.



What is the approximate size of a water molecule, H_2O?

A 1×10^{-11} nm

B 5×10^{-11} nm

C 1×10^{-10} nm

D 3×10^{-10} nm

Your answer ☐ **[1]**

16. Nov/2021/Paper_J250/09/No.15(a_ b)

Carbon dioxide, CO_2, is a covalently bonded molecule.

(a) Explain what is meant by a covalent bond.

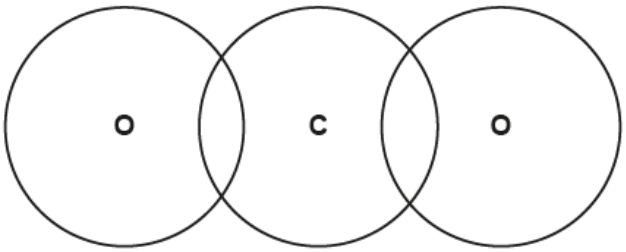
.....

..... **[2]**

(b) Look at the diagram. It shows the structure of carbon dioxide.

O═C═O

Complete the dot and cross diagram for carbon dioxide.



[2]

17. Nov/2020/Paper_J250/09/No.2

Look at the information about a nitrogen atom.

7
N
14

How many **electrons** are in a nitride ion, N^{3-}?

A 4

B 10

C 11

D 17

Your answer ☐ **[1]**

18. Nov/2020/Paper_J250/09/No.4

Which statement describes a covalent bond?

A A shared pair of electrons.

B The electrostatic attraction between oppositely charged ions.

C The electrostatic attraction between delocalised electrons and positive ions.

D The forces of attraction between molecules.

Your answer ☐ **[1]**

19. Nov/2020/Paper_J250/09/No.12

This question is about compounds of magnesium.

(a) Magnesium hydroxide contains magnesium ions, Mg^{2+}, and hydroxide ions, OH^-.

Write the **formula** of magnesium hydroxide.

..... **[1]**

(b) Magnesium carbonate, $MgCO_3$, reacts with dilute hydrochloric acid, HCl.

Magnesium chloride, $MgCl_2$, water and carbon dioxide are made.

Write the **balanced symbol equation** for the reaction.

..... **[2]**

(c) A compound of magnesium contains an unknown element, **X**.

X is an element found in Group 7 of the Periodic Table.

The compound has the formula MgX_2.

The relative formula mass of the MgX_2 is 184.1.

(i) Calculate the relative atomic mass of **X**.
A_r Mg = 24.3

Relative atomic mass of **X** = ... **[2]**

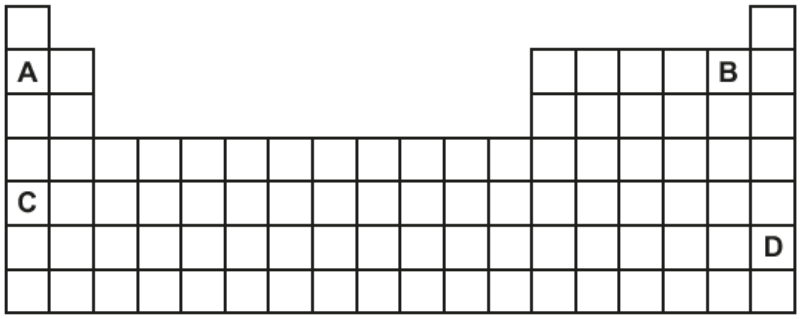
(ii) Identify element **X**.

Use the Periodic Table on the Data Sheet to help you.

..... **[1]**

20. Nov/2020/Paper_J250/10/No.10

Look at the diagram of the Periodic Table.



Which element, **A**, **B**, **C** or **D**, has the greatest tendency to form **positive ions** when it reacts with dilute hydrochloric acid?

Your answer ☐ **[1]**