

Paper 3

[Bonding (Chemical bonds, Ionic bonding + ionic compounds, Covalent bonding Metallic bonding)]

Q1.(2018)

Phosphorus bonds with hydrogen to form the toxic gas phosphine, PH_3 .

Draw a 'dot and cross' diagram to show the **covalent** bonding in PH_3 .

[2]

Q2.(2018)

The table shows some common ions.

Negative ions		Positive ions	
Nitrate	NO_3^-	Aluminium	Al^{3+}
Oxide	O^{2-}	Magnesium	Mg^{2+}

(a) Write the formula for **aluminium oxide**.

..... [1]

Q3.(2018)

A teacher wrote the formula for magnesium nitrate as:



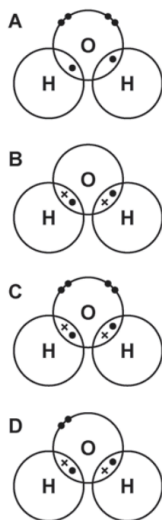
A student says that the formula is incorrect.

Who is right? Explain your answer.

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

Q4.(2020)

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



Which is the correct dot and cross diagram for water?

Your answer ☐

[1]

Q5.(2020)

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]

Q6.(2022)

Nitrogen dioxide is made from the reaction of nitrogen with oxygen.

Fig. 11.2 shows the bonding in a molecule of oxygen, O_2 .

Fig. 11.2

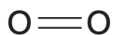
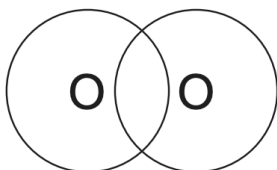


Fig. 11.3 shows an incomplete dot and cross diagram for oxygen.

Fig. 11.3



Complete Fig. 11.3 to show the arrangement of the electrons in a molecule of oxygen. [2]

Q7.(2022)

Aluminium forms an Al^{3+} ion and chlorine forms a Cl^- ion.

Three students write down the formula of aluminium chloride.

Student A: $AlCl$

Student B: $AlCl_3$

Student C: Al_3Cl

Which student is correct?

Explain your answer.

Student

Reason

.....

.....

..... [2]

Q8.(2023)

Sodium sulfite contains Na^+ ions and SO_3^{2-} ions.What is the **formula** of sodium sulfite?

- A NaSO_3
B $\text{Na}(\text{SO}_3)_2$
C Na_2SO_3
D $\text{Na}_2(\text{SO}_3)_2$

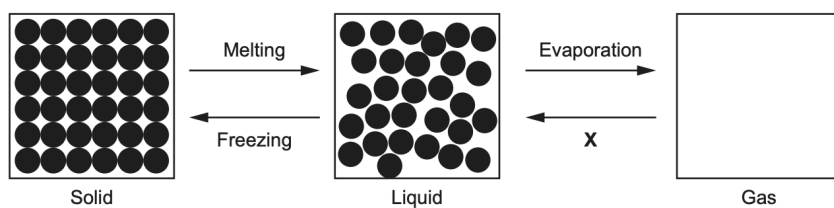
Your answer

[1]

Q9.a(2023)

1 (a) Fig. 11.1 shows the particle model for an element.

Fig. 11.1



(i) Complete Fig. 11.1 by drawing in the particles of the element when it is a gas.

[1]

Q9.b(2023)

Describe how the particles of the element move in a solid.

..... [1]

Q9.c(2023)

Name the change of state labelled X on Fig. 11.1.

..... [1]

Q10.(2023)

The table shows the state of the element chlorine at three different temperatures.

State of chlorine	Temperature (°C)
solid	−165
liquid	−90
gas	−20

Use the information in the table to estimate the melting point of chlorine.

Tick (✓) **one** box.

- −170 °C ☐
- −101 °C ☐
- −43 °C ☐
- −2 °C ☐

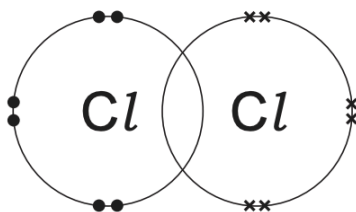
[1]

Q11.a(2023)

A particle of chlorine has the formula Cl_2 .

Fig. 11.2 shows some of the outer electrons in a particle of chlorine.

Fig. 11.2



(i) Complete Fig. 11.2 by drawing in the missing outer electrons.

[1]

Q11.b(2023)

Complete the sentences about the bonding in a particle of chlorine.

Put a ring around each correct option.

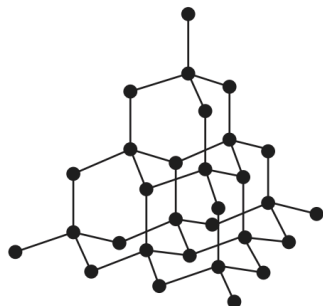
The particles of chlorine are called **isotopes** / **molecules** / **polymers**.

The atoms of chlorine are joined together by a **covalent** / **ionic** / **metallic** bond. [2]

Q12.a(2024)

This question is about diamond and graphite.

The diagram shows the structure of diamond.



Which element is diamond made from?

..... [1]

Q12.b(2024)

What is the maximum number of covalent bonds that each atom in diamond can form?

..... [1]

Q12.c(2024)

The atoms in diamond have a diameter of 0.000000000154 m.

What is the diameter of the atoms in standard form?

Tick (✓) **one** box.

$1.54 \times 10^{-13} \text{ m}$ ☐

$1.54 \times 10^{-10} \text{ m}$ ☐

$1.54 \times 10^{-3} \text{ m}$ ☐

[1]

Q12.d(2024)

The properties of diamond can be explained in terms of its structure and bonding.

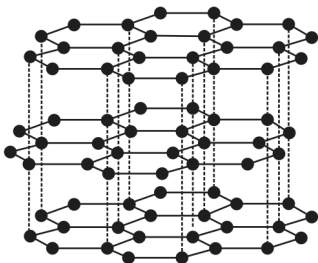
Draw lines to connect each **property** with its correct **explanation**.

Property	Explanation
	It has many strong covalent bonds.
High melting point	It has no free electrons.
Does not conduct electricity	It is a simple molecule.
	It is made from ions.

[2]

Q13.(2024)

This diagram shows the structure of graphite.



Which statements about the properties of graphite are **true** and which are **false**?

Tick (✓) **one** box in each row.

Properties of graphite	True	False
It conducts electricity.		
It is as hard as diamond.		
It has a high melting point.		

[2]