

2.5 Simple molecules and covalent bonds

Name: _____ Class: _____ Date: _____

Total: 9 marks

KEY WORDS covalent bond 共价键 • intermolecular forces 分子间作用力 • electrons 电子 • ion 离子
• atom 原子

Objective

Build the skills to answer exam questions on **simple molecules and covalent bonds**
简单分子与共价键 — sharing electrons, dot-and-cross diagrams, and the properties of simple molecular substances.

You must be able to:

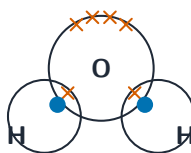
- describe a covalent bond (a shared pair of electrons between non-metals)
- draw/interpret dot-and-cross diagrams (H_2 , H_2O , CH_4 , etc.)
- explain why simple molecular substances have low melting points and don't conduct

1 Worked examples

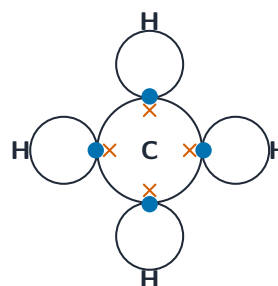
■ Covalent bonding



hydrogen, H_2
one shared pair



water, H_2O
two shared pairs



methane, CH_4
four shared pairs

Atoms share pairs of electrons so each reaches a full outer shell

- **covalent bond:** a shared pair of electrons (between non-metals).
- **low melting point:** weak intermolecular forces between molecules (the bonds inside are strong).
- **poor conductor:** no free electrons or ions to carry charge.

2 Practice

2.1 Define a covalent bond. [1]

2.2 State how many shared pairs of electrons there are in a molecule of methane, CH₄. [1]

3 Exam-style questions

3.1 Simple molecular substances have low melting points because: [1]

- **A** the covalent bonds are weak
 - **B** the forces between molecules are weak
 - **C** they contain ions
 - **D** they have delocalised electrons
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3.2 Water, H₂O, is a simple molecule.

(a) Describe how the bonds in a water molecule form. [2]

(b) Explain why water does not conduct electricity (when pure). [2]

3.3 Explain why chlorine, Cl₂, has a low boiling point. [2]

Solutions

2.1 a shared pair of electrons between two (non-metal) atoms.

2.2 four shared pairs.

3.1 B. The forces between molecules (intermolecular forces) are weak.

3.2 (a) the oxygen atom shares one pair of electrons with each of the two hydrogen atoms; so each atom reaches a full outer shell.

(b) the molecules have no overall charge and there are no free electrons or ions; so there is nothing to carry the charge.

3.3 chlorine is made of simple molecules with weak intermolecular forces; little energy is needed to separate them, so the boiling point is low.