

Exercise walk-through

Simple molecules and covalent bonds ■ 2.5

eXercise

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

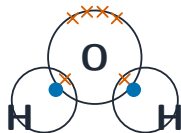
Method — Covalent bonding

- **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.

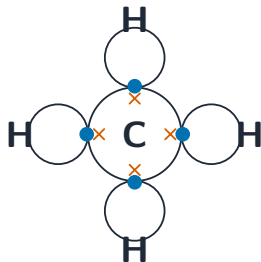
Method — Covalent bonding



hydrogen, H_2
one shared pair



water, H_2O
two shared pairs



methane, CH_4
four shared pairs

Dot-and-cross diagrams for H , H O and CH

Practice 2.1 ■ 1 mark

Define a covalent bond.

Solution 2.1

Method: Covalent bonding

Worked steps

a shared pair of electrons between two (non-metal) atoms **B1**.

Practice 2.2 ■ 1 mark

State how many shared pairs of electrons there are in a molecule of methane, CH_4 .

Solution 2.2

Method: Covalent bonding

Worked steps

four shared pairs **B1**.

Exam-style 3.1 ■ 1 mark

Simple molecular substances have low melting points because:

- A** the covalent bonds are weak
- B** the forces between molecules are weak
- C** they contain ions
- D** they have delocalised electrons

Solution 3.1

- A the covalent bonds are weak
- B the forces between molecules are weak**
- C they contain ions
- D they have delocalised electrons



Worked steps

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

Exam-style 3.2 ■ 2 marks

Water, H_2O , is a simple molecule.

- (a) Describe how the bonds in a water molecule form.
- (b) Explain why water does not conduct electricity (when pure).

Solution 3.2

Worked steps

- (a) the oxygen atom shares one pair of electrons with each of the two hydrogen atoms **M1**; so each atom reaches a full outer shell **A1**.
- (b) the molecules have no overall charge and there are no free electrons or ions **M1**; so there is nothing to carry the charge **A1**.

Exam-style 3.3 ■ 2 marks

Explain why chlorine, Cl_2 , has a low boiling point.

Solution 3.3

Worked steps

chlorine is made of simple molecules with weak intermolecular forces **M1**; little energy is needed to separate them, so the boiling point is low **A1**.