# Covalent structure and bonding

**1** Which of the following usually have covalent bonding?

Circle the **two** correct answers.

**(2 marks)**

**A** compounds of metals and non-metals

**B** compounds of non-metals only

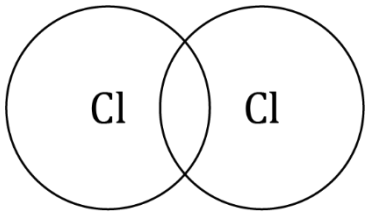
**C** molecules of non-metals

**D** mixtures of two metals

**E** pure metals

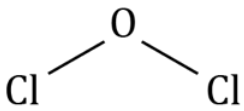
**2** The electron configuration of a chlorine atom is 2, 8, 7.

(a) Complete the dot and cross diagram for a chlorine molecule. Show the outer shells of electrons only.




**(2 marks)**

(b) Chlorine reacts with oxygen to form the compound $Cl_2O$. The structure of $Cl_2O$ is shown in the diagram.




Draw a dot and cross diagram for a $Cl_2O$ molecule. Show the outer electron shells only.

**(3 marks)**

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(c) i. Predict the state (solid, liquid or gas) of $Cl_2O$ at room temperature (25 °C).

_____ **(1 mark)**

ii. Give a reason for your answer.

_____

_____

_____

_____

_____

**(3 marks)**

(d) Explain why the polymer poly(chloroethene) is solid at room temperature.

_____

_____

_____

_____

**(3 marks)**

**3** Covalent bonds are formed when electrons are shared.

(a) How many electrons are shared in a double covalent bond?

_____ **(1 mark)**

(b) The electron configuration of an oxygen atom is 2, 6. The electronic configuration of a carbon atom is 2, 4. Draw a dot and cross diagram to show a carbon dioxide molecule, $CO_2$. Show the outer electrons only.

**(2 marks)**

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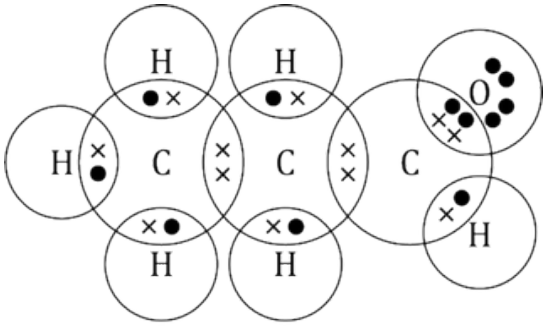
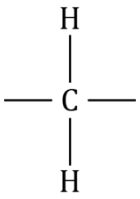
**4** The diagram shows the dot and cross diagram for propanal.




(a) Complete the diagram to show the displayed formula for a propanal molecule.

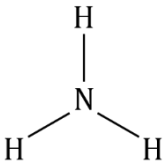
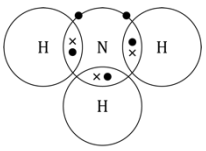
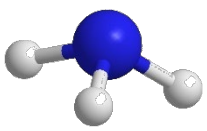



**(2 marks)**

(b) What is the molecular formula for propanal?

_____ **(1 mark)**

(c) The table shows different ways of representing an ammonia molecule. Add ticks (✓) and crosses (x) to describe what the representations show.

| **Does the representation show:** | $NH_3$ |  |  |  |
|---|---|---|---|---|
| the types of atoms in the molecule? | | | | |
| the number of each type of atom? | | | | |
| how the electrons are shared? | | | | |
| the 3-D structure? | | | | |

**(4 marks)**

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**5** Different covalent substances have different structures. They may be simple molecules, polymers or have giant covalent structures.

(a) Complete the table to predict the structures of substances X, Y and Z.

| Covalent substance | Melting point /°C | Type of structure |
|---|---|---|
| X | About 4000 | |
| Y | –101.5 | |
| Z | 120–130 | |

**(3 marks)**

(b) Name the type of attractions that are overcome when a simple molecular covalent substance melts.

_____ **(1 mark)**

(c) Explain why a simple molecular substance cannot conduct electricity.

_____

_____

**(1 mark)**

[Total: 29 marks]

**Which question(s) did you get wrong? Why?**

**What will you do next time you're asked a similar question?**

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