



# REVISION

WORKBOOK



COVALENT  
BONDING

## RECAP

Dot and cross diagrams are a visual way to represent how atoms share electrons to form covalent bonds in molecules. In these diagrams, dots and crosses represent the outer shell (valence) electrons of different atoms. The shared pairs of electrons (in the overlap between atoms) show the covalent bonds, while the unshared pairs (lone pairs) are shown around the atoms.

Each atom aims to achieve a stable electron arrangement (often resembling that of a noble gas) by sharing electrons. For example, hydrogen atoms each share one electron to form a pair, while oxygen atoms share two pairs to form a double bond. Dot and cross diagrams help us visualize the bonding in molecules such as hydrogen ( $H_2$ ), Chlorine ( $Cl_2$ ), Oxygen ( $O_2$ ), Nitrogen ( $N_2$ ), Hydrogen chloride ( $HCl$ ), Water ( $H_2O$ ), Ammonia ( $NH_3$ ) and Methane ( $CH_4$ )

## TASK 1 - MCQ

Choose the correct answer from the choices for each question

Q1 - How many pairs of electrons are shared in a nitrogen molecule

- A) 1
  - B) 2
  - C) 3
  - D) 4
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Q2 - Which molecule has two lone pairs of electrons on the central atom?

- A) Methane ( $\text{CH}_4$ )
  - B) Water ( $\text{H}_2\text{O}$ )
  - C) Nitrogen ( $\text{N}_2$ )
  - D) Hydrogen ( $\text{H}_2$ )
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Q3 - In the dot and cross diagram for ammonia ( $\text{NH}_3$ ), how many covalent bonds are there?

- A) 1
  - B) 2
  - C) 3
  - D) 4
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## TASK 1 - MCQ

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Q4 - Which of the following correctly describes the dot and cross diagram for chlorine

- A) One shared pair, six lone pairs
- B) Two shared pairs, four lone pairs
- C) Three shared pairs, two lone pairs
- D) One shared pair, ten lone pairs

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Q5 - What do the "dots" and "crosses" represent in a dot and cross diagram?

- A) Different types of atoms
  - B) Protons and neutrons
  - C) Electrons from different atoms
  - D) Covalent bonds only
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## TASK 2 - CHECK UNDERSTANDING

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Answer the questions below using what you have learned from the video and text. Use details from the video and reading to explain your answers.

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Q1 - Explain why oxygen forms a double bond in its dot and cross diagram.

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Q2 - Draw and describe the dot and cross diagram for ammonia ( $\text{NH}_3$ )

## TASK 2 - CHECK UNDERSTANDING

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Q3 - Compare the dot and cross diagrams of methane ( $\text{CH}_4$ ) and water ( $\text{H}_2\text{O}$ )

## ANSWERS

Q1 - Explain why oxygen forms a double bond in its dot and cross diagram.

Oxygen has six electrons in its outer shell and needs two more to complete its octet. Each oxygen atom shares two electrons with the other, forming two shared pairs (a double bond) so both atoms achieve a full outer shell.

Q2 - Draw and describe the dot and cross diagram for ammonia ( $\text{NH}_3$ )

In ammonia ( $\text{NH}_3$ ) the nitrogen atom is at the center with three hydrogen atoms around it. Nitrogen shares one electron with each hydrogen atom (three bonding pairs) and has one lone pair of electrons that are not shared.

Q3 - Compare the dot and cross diagrams of methane ( $\text{CH}_4$ ) and water ( $\text{H}_2\text{O}$ )

central carbon atom bonded to four hydrogen atoms, each sharing a pair of electrons (no lone pairs on carbon). Water has an oxygen atom bonded to two hydrogen atoms, but oxygen also has two lone pairs of electrons. Thus, methane has four bonding pairs and no lone pairs on the central atom, while water has two bonding pairs and two lone pairs on the central atom.