



INTERMOLECULAR BONDING

DIPOLE-DIPOLE

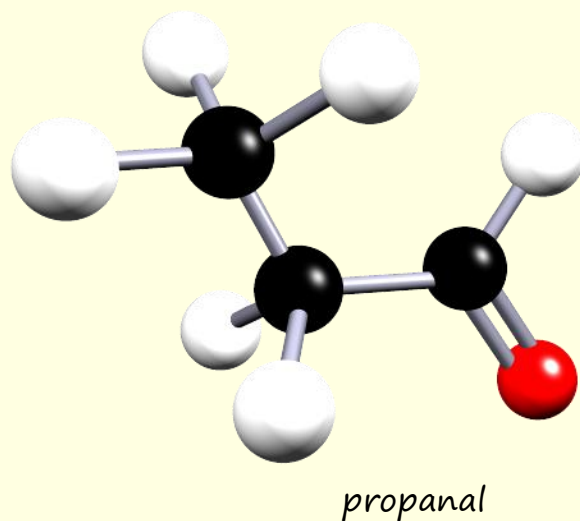
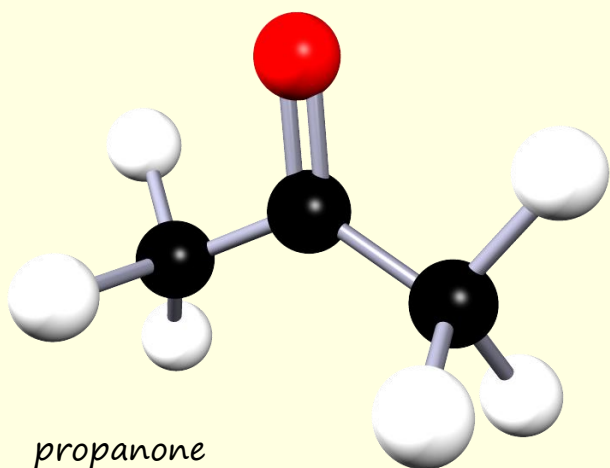
HYDROGEN BONDING

LONDON DISPERSION FORCES

Answer the questions below then check your answers.

1. *Name 3 types of intermolecular bonding and place them in order of bond strength, strongest first.*
 - b. *Explain why dipole-dipole forces are stronger than London dispersion forces (Van der Waals forces for those of you doing aqa a-level!)*
2. *What are dipole-dipole forces of attraction between molecules?*
 - a. *What can you say about any molecule involved in intermolecular dipole-dipole bonding?*
 - b. *Draw a diagram to show the dipole-dipole interactions between HCl molecules.*
3. *What is a polar molecule?*
4. *Describe how the shape of a molecule affects its polarity and hence the strength of its dipole-dipole interactions*

5. Propanone (CH_3COCH_3) and propanal ($\text{CH}_3\text{CH}_2\text{CHO}$) have similar molecular weights. Explain why propanone has lower boiling point than propanal.



6. What effect will dipole-dipole bonding have on the physical properties of molecules? Give an example.

Answers

1. Name 3 types of intermolecular bonding and place them in order of bond strength, strongest first.

- Hydrogen bonding – strongest type of intermolecular bonding
- Dipole-dipole bonding
- Van der Waals bonding (London dispersion bonds) – weakest form of intermolecular bonding

b. Explain why dipole-dipole forces are stronger than London dispersion forces (Van der Waals forces for those of you doing aqa a-level!)

Dipole-dipole forces involve attractions between permanent dipoles, which are stronger and more persistent than the temporary dipoles involved in London dispersion forces (Van der Waals forces).

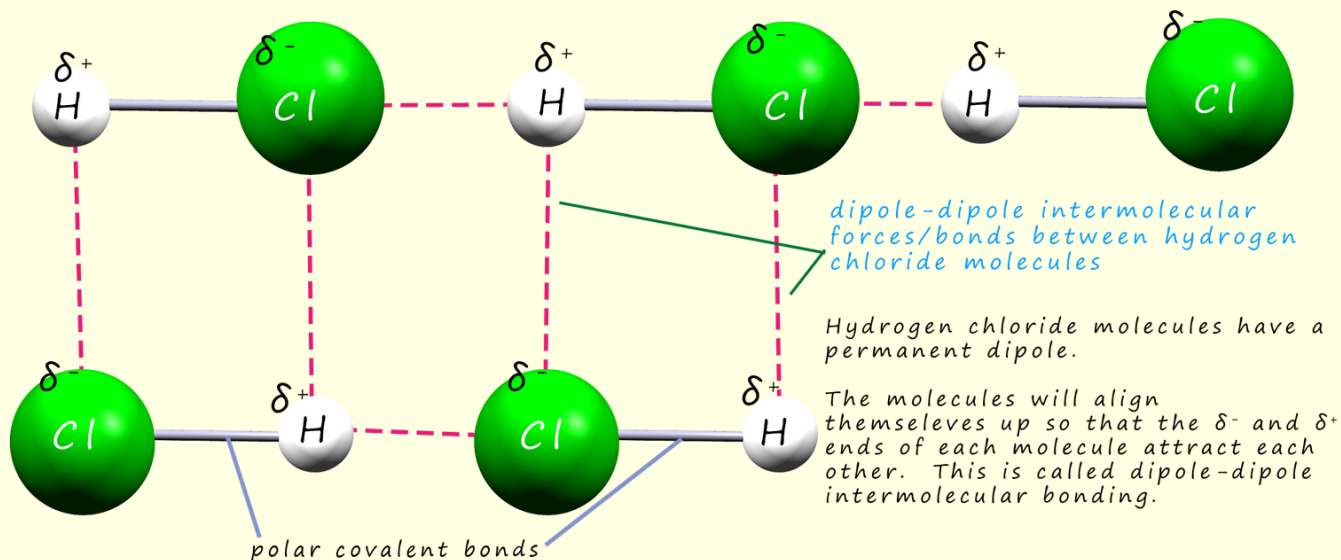
2 What are dipole-dipole forces of attraction between molecules?

Dipole-dipole forces are the attractions between the positive end of one polar molecule and the negative end of another polar molecule.

a. What can you say about any molecule involved in intermolecular dipole-dipole bonding?

It must be a polar molecule to undergo dipole-dipole bonding.

b. Draw a diagram to show the dipole-dipole interactions between HCl molecules.



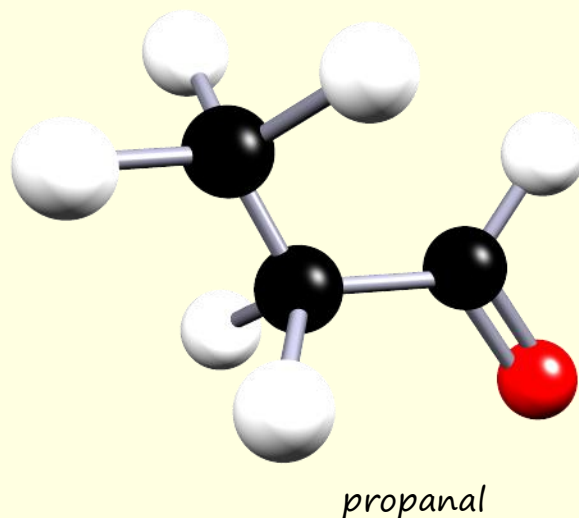
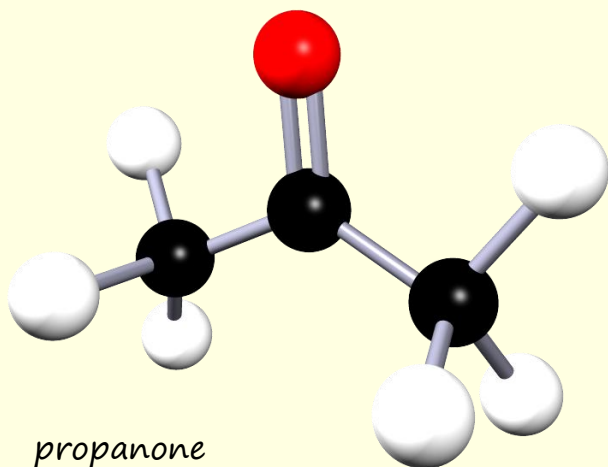
3. What is a polar molecule?

A polar molecule has a slightly positive end and a slightly negative end due to an uneven distribution of electrons within its chemical bonds. This unevenness is caused by differences in electronegativity between the bonded atoms. All polar molecules also have a dipole moment, this is a measure of the separation of charge within the molecule.

4. Describe how the shape of a molecule affects its polarity and hence the strength of its dipole-dipole interactions.

Even if a molecule contains polar bonds, it may be nonpolar overall due to its shape. Symmetrical molecules, where polar bonds cancel each other out, will not exhibit dipole-dipole forces. Examples: CCl_4 (tetrahedral), CO_2 (linear).

5. Propanone (CH_3COCH_3) and propanal ($\text{CH}_3\text{CH}_2\text{CHO}$) have similar molecular weights. Explain why propanone has lower boiling point than propanal.



Propanal has the ability to form hydrogen bonds (a stronger type of dipole-dipole interaction) due to the $\text{O}-\text{H}$ bond within the aldehyde functional group. Propanone can only exhibit dipole-dipole forces.

6. What affect will dipole-dipole bonding have on the physical properties of molecules? Give an example. Physical properties which depend upon mass; such as melting and boiling points and viscosity will all be higher than expected. The dipole-dipole bonding will make the molecules behave as if it was much larger in size and mass.