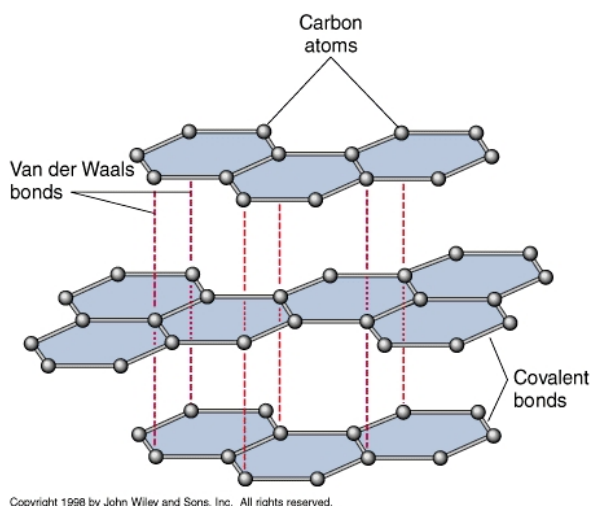


Molecular Bonds

- You learned about the bonds formed **between atoms** to create molecules
 - ionic and covalent bonds form dependent upon the electronegativity of the atoms
 - called **intramolecular** bonds
 - very strong bonds which cannot be broken by normal physical means
- Bonds also form **between molecules** (called **intermolecular** bonds) and affect properties such as boiling point and melting point
- There are three types of bonds between molecules

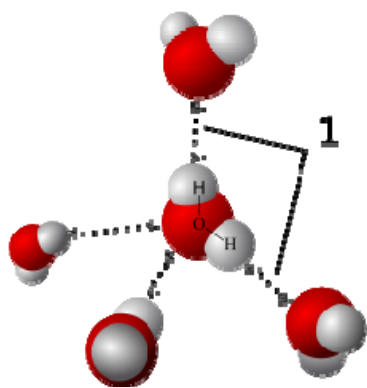
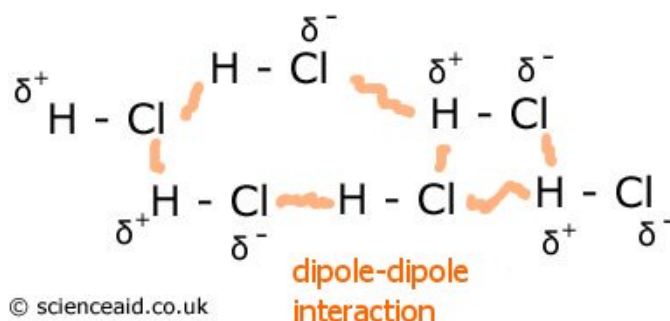


- **van der Waal (London) Forces** – the electrons of one molecule are **weakly** attracted to the protons in the nuclei of the neighbouring molecules.

- All liquid and solid molecules have this force

DiPole-DiPole – polar molecules are moderately attracted to the polar molecules next to them

- Look at the molecular structure and determine if it is polar (look for O, N, or halogens in the formula)
- **Moderate** intermolecular attraction/bond strength



- **Hydrogen Bonds** – when an oxygen or nitrogen atom is bonded to a hydrogen, the hydrogen's sole proton becomes “exposed” and can form

bonds with the lone pair electrons of neighbouring oxygen, nitrogen, or fluorine atoms.

- **Very Strong** intermolecular attraction.
 - Look for OH, or NH in the molecular formula
 - Just an O, N, or F does not make hydrogen bonds, must be an exposed H proton available to bond with the lone pairs of electrons
-
- In order to melt or boil an organic compound the temperature (and related heat energy) must be increased to affect or completely overcome the intermolecular forces between molecules
 - Affect → melting
 - Overcome → boiling
 - The **more bonds** present, and the **stronger** the type of bonds present between molecules, the harder they are to pull apart.
 - The harder molecules are to pull apart, the **higher their boiling point and melting point** (solids have molecules close together, liquids farther apart, and gases widely spread apart)
 - There are no intermolecular forces between gas molecules because they are too far apart to interact with each other