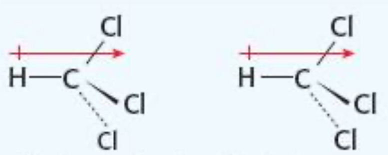
SL & HL Answers to Intermolecular forces questions

1. Propane (London dispersion forces, B.Pt. -42.2 °C) < methoxymethane (weak dipole-dipole, B.Pt. -24.8 °C) < ethanal (dipole-dipole, B.Pt. 20.8 °C) < ethanol (hydrogen bonding, B.Pt. 78.5 °C) < methanoic acid (strong hydrogen bonding, B.Pt. 101 °C).

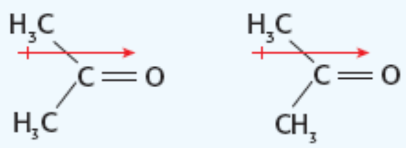
2. 2,2-dimethylpropane (B.Pt. 9.5 °C) < 2-methylbutane (B.Pt. 27.9 °C) < pentane (B.Pt. 36.3 °C) The more spherical the molecule the less surface area there is to attract another molecule of the same type.

3. Because the oxygen atom in water has two hydrogen atoms bonded to it the polarity of the molecule is greater than ethanol where only one hydrogen atom is bonded directly to the oxygen atom. The dipole on the oxygen atom in water will effectively be $2\delta^-$ and will attract the δ^+ hydrogen atom of another water molecule more strongly.

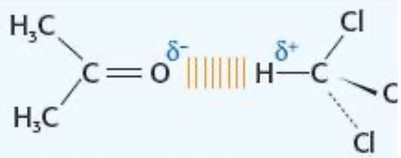
4. Both trichloromethane and propanone are polar molecules and there will be dipole-dipole interactions between the molecules in the pure liquids. When they are mixed the δ^+ hydrogen atom in trichloromethane can form a type of hydrogen bond with the δ^- oxygen atom in propanone resulting in a stronger intermolecular force – more energy will be required to break this attraction and hence the higher boiling point.



dipole–dipole attraction between trichloromethane molecules



dipole–dipole attraction between propanone molecules



stronger dipole–dipole attraction between propanone and trichloromethane

5. London (dispersion) forces < dipole-dipole interactions < hydrogen bonding < ionic bonding.