Predicting Physical Properties of Organic Compounds

Types of attractive forces between organic molecules (in order of increasing strength)

- **London forces**: occur between any two molecules; very weak
- **Dipole-dipole forces**: occur between any two polar molecules; stronger
- **H-bonding:** occurs between molecules that contain OH or NH groups; strongest

Determining Polarity of an Organic Molecule

- Sections of a molecule that only have C and H are very non-polar since C (2.5) and H (2.2) have very similar electronegativities.
- A carbonyl group (C=O) or a C bonded to a halogen is polar and allows for dipole-dipole forces.
- -OH and -NH groups allow for H-bonding

Solubility: requires attractive forces between solute and solvent.

- Polar molecules are strongly attracted to polar solvents (like water) by dipole-dipole forces and H-bonds
- Non-polar molecules are soluble in non-polar solvents; London forces of attraction
- Molecules with intermediate polarity (e.g. Ketones, aldehydes, long chain alcohols) may be soluble to a lesser degree in both polar and non-polar solvents

Melting Point and Boiling Point

- Melting and boiling both require molecules in a substance to separate from each other. The stronger the forces between molecules, the more heat is required to do this.
- Polar molecules are strongly attracted to each other by dipole-dipole forces and H-bonds and therefore have high MP and BP
- Non-polar molecules are weakly attracted to each other and therefore have low MP and BP
- Linear molecules vs. branched molecules
- longer vs. shorter molecules

Odour

- In order to smell something, some of the molecules must vapourize and travel in the air to your nose. Molecules which are strongly attracted to each other will do this to a lesser degree.

Compare the following sets of molecules:

1. methanol and methane
2. 2,2-dimethylpropane and pentane
3. propanoic acid and propanal
4. 1-aminopropane and propanamide
5. benzene and 1,2-dichlorobenzene
6. ethanoic acid and nonanoic acid