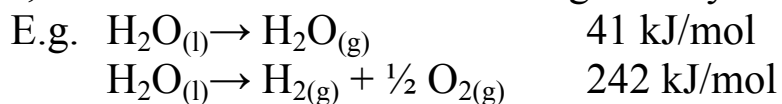


4.5 Intermolecular Forces

- Intermolecular Force: the force of attraction and repulsion between molecules.
- Real world examples: surface tension and capillary action
- Intermolecular forces are much weaker than covalent bonds. As an approximate comparison, if covalent bonds are assigned strength of about 100, then intermolecular forces are generally 0.001 to 15.



Dipole-Dipole Force

- Dipole-dipole force: a force of attraction between polar molecules
- The force is due to the simultaneous attraction of one dipole by its surrounding dipoles.
- The strength of the dipole-dipole force is dependent on the polarity of the molecule.
- Give rise to the rule: like dissolves like.

London Force

- London Force is the simultaneous attraction of an electron by nuclei within a molecule and by nuclei in adjacent molecules.
- The strength of the London force is directly related to the number of electrons in the molecule.
- Also called “dispersion forces” and are often referred to as “van der Waal’s Forces”
- If it has electrons it will have London Forces.

Predicting Boiling Points

- As the number of electrons in a non-polar molecule increases so does its boiling point. See table 1 on page 259.
- London Forces + Dipole-dipole forces further increase the boiling point. All variations need to be considered.

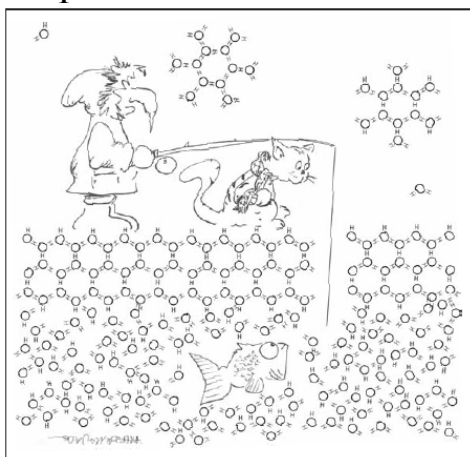
Hydrogen Bonding

- Hydrogen bonding is the attraction of hydrogen atoms bonded to N, O, or F atoms to a lone pair of electrons of N, O, or F atoms in adjacent molecules.
- Often explains the high boiling point of hydrogen compounds.
- E.g. Water

- Things to think about: Covalent bond → sharing electrons
 Hydrogen bond → sharing a proton

Other Physical Properties of Liquids

- Surface tension: forces acting sideways and downward unlike in the liquid that is in all directions.
- Meniscus: cohesion is the attraction between like molecules; adhesion is the attraction between unlike molecules. E.g. Water creates a concave meniscus because it has a greater adhesion and cohesion. Which would also explain capillary action.
- Water is odd: less dense as a solid than a liquid. Due to hydrogen bonding it forms a hexagonal cage and other water molecules can sit inside the cage increasing the mass per volume.



Homework

- Practice 1,2,3,4,5,6,9,11,12,13
- Questions 1,2,3,4,5,6,7