

Chemical Fundamentals II

Hydrogen Bonds

- These bonds occur when a molecule weakly interacts with a neighbouring hydrogen atom that is already part of a polar covalent bond
- Are common in large biological molecules (like between the base pairs of a DNA molecule)
- This attraction is weak compared to covalent bonds but several of these bonds result in a strong attractive force
- H-bonds are also responsible for many of the special properties of water

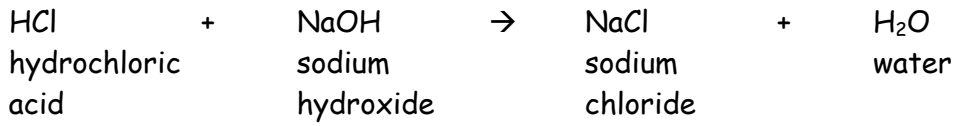
Properties of Water

1. The polarity of the water molecule influences the behaviour of other substances
 - Charges on the water molecule are unevenly distributed (O end is more negative)
 - This allows water to form H-bonds with each other and other polar substances (like sugar)
 - Polar molecules attract to water (hydrophilic)
 - Non-polar molecules repel water (hydrophobic)
 - Ex/ mix oil and water → two layers will form
2. Water has temperature stabilizing effects
 - Temperature is the measure of the motion of molecules
 - Water requires a lot of energy to increase its temperature because the hydrogen bonds absorb much of the incoming energy which makes it difficult for the motion of the molecules to increase quickly
 - This helps to stabilize the temperature of cells (made of mostly water)
3. Water has cohesive properties
 - Water molecules form H-bonds creating a high surface tension
 - Ex/ a water strider is able to walk across the surface of a pond
 - Water molecules form H-bonds with other polar molecules, creating capillary action
 - Ex/ Water can creep up narrow tubes or paper
4. Water has outstanding solvent properties
 - A great solvent in which ions and polar molecules dissolve easily
 - Ex/ When NaCl (table salt) is placed in water, the Na^+ attracts to the negative end and the Cl^- attracts to the positive end
 - See Fig. 15 on p.18

Acids, Bases and Buffers

- Ionization occurs when 2 water molecules break apart into a hydronium ion H_3O^+ and a hydroxide ion OH^-
- See Fig. 16 on p. 20
- Acids are substances that release H_3O^+ ions when dissolved in water
- Bases are substances that increase the concentration of OH^- ions

- When an acid combines with a base, they undergo a neutralization reaction, which produces a salt



- The pH scale, is used to measure the concentration of H_3O^+ in aqueous solutions
- $\text{pH} = -\log_{10} [\text{H}_3\text{O}^+]$
- Buffers are molecule that can combine with hydrogen ions, release them, or both, thereby stabilizing the pH
- Ex/ bicarbonate in the blood helps to restore pH when the blood is too acidic
- See Fig. 18 on p.22
- Buffers help to counter small shifts in the pH of the internal fluid environment that sustains all the cells

Homework:

p.23 #8-11, 13-16