CHAPTER 4

Solution – homogeneous mixture
solute dissolves in the SOLVENT
aqueous soln's → solvent = H_2O

HYDRATION
↳ a type of SOLVATION
↳ solvent molecules surround solute particle

H_2O → universal solvent
- polar, H-bond

SOLUTES IN H_2O

1) NON ELECTROLYTES
2) ELECTROLYTES → produce conducting solutions

A) STRONG ⇒ 100% DISSOCIATION or IONIZATION

DISSOCIATION $NaCl_{(s)} \xrightarrow{H_2O} Na^+_{(aq)} + Cl^-_{(aq)}$

IONIZATION $HCl_{(g)} \xrightarrow{H_2O} H^+_{(aq)} + Cl^-_{(aq)}$

STRONG ACIDS, BASES, SOLUBLE IONICS

B) WEAK ⇒ some dissociation or ionization
→ weak acids, weak bases ($K_a, K_b < 10^{-3}$)
slightly soluble ionics (K_{sp})
often ⇌ reach ⊜

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NONPOLAR SOLUTE → INSOLUBLE in H_2O
→ hydrocarbons, benzene C_6H_6

SOLUTIONS ⇒ unsaturated / saturated / supersaturated
↳ crystallization
large crystals
cool slowly

miscible → liquids that dissolve in each other
coffee/cream H_2O/CH_3CH_2OH
immiscible → oil / H_2O

MOLECULAR VIEW OF SOLUTION
→ solute particles take up spaces formerly occupied by solvent molecules

3 Steps
1) Separate solvent particles (DISRUPT IMF) ENDOTHERMIC
2) Separate solute particles (Break IMF)
3) Solute – solvent interaction favors EXOTHERMIC

$$\Delta H_{SOLN} = \Delta H_1 + \Delta H_2 + \Delta H_3$$

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how can a solid with $+\Delta H_{SOLN}$ dissolve spontaneously

$$\Delta G = \Delta H - T\Delta S$$

dissolving is always $+\Delta S$

the nature of the solute – solvent interaction plays a role

"like dissolves like"

$NaCl_{(s)} \xrightarrow{H_2O} Na^+_{(aq)} + Cl^-_{(aq)}$

$NaCl_{(s)} \xrightarrow{C_6H_6}$ NO SOL'N FORMED

SOLUBILITY → depends on T (& P for gases)

T dependance

① in general, solid solubility ↑ solvent T ↑

② in general, gas solubility ↓ solvent T ↑

Pressure effect

Henry's Law: the solubility of a gas in a liquid is proportional to the pressure of the gas over the liquid

→ when the P of the gas above the liquid decreases, the concentration of dissolved gases will also decrease

→ if the dissolved gas reacts with the solvent → dissolve more than expected