

Introduction to Solution Chemistry

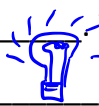
What is solution?

- Homogeneous mixture made of smaller Solute and bigger solvent.
 - E.g., Steel (^{Fe+C}), brass (^{Cu+Zn}) (s), soy sauce (aq), air (^{78% N₂, 21% O₂, 1% others}) (g)
- Different from pure substance (substance like water_(l) and mercury_(l))

What is solubility?

- The maximum amount of solute (that can dissolve in solvent (at a given temperature (e.g., of unit used for solubility = g, kg, g/mL, M = mol/L))
- Soluble = Miscible (IN) means "dissolvable" (NOT) (e.g., table salt is soluble in water, but insoluble in oil)
- When you have a solution that has max amount of solute dissolved in the solvent, the solution is saturated. In a saturated solution, you should see some undissolve material. (solute)
- Solubility depends on
 1. Nature & amount of solute
 2. Nature & amount of solvent
 3. Temperature (In general, ↑ temp, ↑ solubility)

e.g., A spoonful of sugar can dissolve in 1L of water at room temperature, but spoonful of sugar does not dissolve in 1L of oil at room temperature.

Electrolyte (eg) gatorade lyte
 Some aqueous solutions can **conduct electricity**. These solutions are known as electrolyte. When electrolyte makes a complete circuit with a battery and a light bulb, the bulb will glow . This is because there is something in the solution that can carry electric charge from one end of the circuit to the other end.

||
 IONS
 (charged particles)

Guiding question: What kind of solution is electrolyte?

Summary from the mini lab:

→ Solution is an electrolyte if it:

1. has dissolved ionic compound (e.g., NaCl → Na⁺ + Cl⁻)

cut
 dissociate

2. has dissolved inorganic acid or base e.g., (HCl → H⁺ + Cl⁻), (NaOH → Na⁺ + OH⁻)
 HO Metal OH
 dissociate

3. has dissolved organic acid ending with COOH (e.g., vinegar = acetic acid = CH₃COOH → H⁺ + CH₃COO⁻)
 dissociate

→ Solution is non-electrolyte if it:

- is covalent compound (e.g., CCl₄)
- is an organic compound (e.g., C₆H₁₂O₆ = sugar, CH₃CH₂OH = ethanol)
 - Made of C, H, N and/or O.
 Covalent C₆H₁₂O₆ → not acid
 no product

What makes electrolyte an electrolyte? → IONS (aq)

Note: A species must be dissolved in water and must form IONS to make an electrolyte.
 (1) dissolved (aq) (2) IONS

HF:
 Hebden Q6.17.8
 Circle electrolytes

E.g., Practice question: Is the following electrolyte? Explain your answer.

- | | |
|---|--|
| 1. Ca(OH) ₂ → Ca ²⁺ + 2OH ⁻
Base = E | 5. HCOOH → H ⁺ + HCOO ⁻
Organic acid = E |
| 2. FeCl ₃ → Fe ⁺³ + 3Cl ⁻¹
Ionic = E | 6. PS ₂ →
Covalent = NE |
| 3. CH ₃ OH →
not base, organic = NE | 7. Ba(CN) ₂ → Ba ²⁺ + 2CN ⁻
Ionic = E |
| 4. CH ₃ CH ₂ CH ₂ CH ₂ OH →
∴ ∴ = NE | 8. (Special) CuS → Cu²⁺ + S²⁻
Ionic = E |

NOT electrolyte b/c CuS does not dissolve in H₂O... Rules are coming....!

Ion Dissociation and Ion Concentration

When ionic compounds are dissolved in solvent, they dissociate (produces ions).

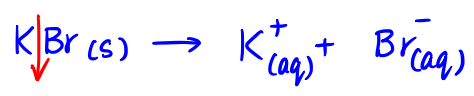
We can write a dissociation equation for this. As usual, the equation must be balanced.

General form of dissociation equation:

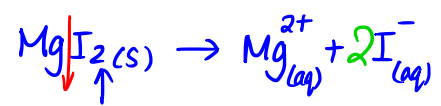
$$\text{Salt}_{(s)} \rightarrow \text{Ion}^+_{(aq)} + \text{Ion}^-_{(aq)}$$

Pay attention to the state!

E.g., dissociation of KBr_(s) Ionic = E



E.g., dissociation of MgI_{2(s)}



eg) Dissociate organic acid CH₃CH₂COOH

