

## Solutions 6.3

Electrolytic Solutions

Solubility

Precipitation Reactions

Net Ionic Equations

## Solutions

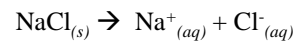
- A homogeneous mixture of a solvent and solute(s).
  - Solvent
    - The substance you have more of
  - Solute
    - The substance you have less of
- Aqueous Solutions
  - Solutions in which water is the solvent

## Electrolytic Solutions

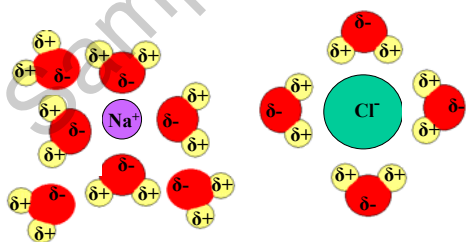
- An ionic compound dissolved in a polar solvent (e.g. NaCl in Water)
  - Most ionic compounds do this.
- Electrolytes (ions) conduct electricity in solution.
- If a solution conducts electricity, it must contain ions.
- The more ions the solution contains, the better able it is to conduct electricity.

## Ionic Compounds in Polar Solvents

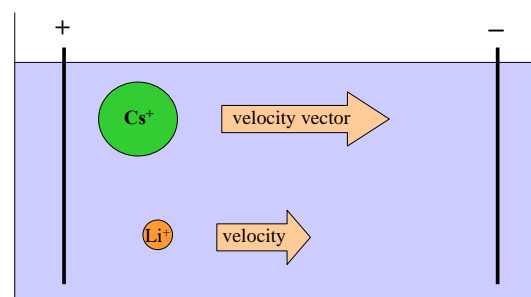
e.g. NaCl dissolves in water



$\text{Na}^+_{(aq)}$  and  $\text{Cl}^-_{(aq)}$



Smaller ions have stronger electric fields so they drag more water molecules around with them.

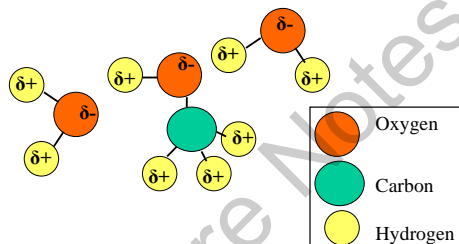


### Molecular Compounds in Water

- Non-electrolytes
  - Most molecular compounds do not dissociate in water and therefore do not conduct electricity.
  - e.g. sugar, methanol
- Weak-electrolytes
  - Weak acids – some dissociation (low conductivity).
  - e.g. acidic acid:  $\text{CH}_3\text{COOH}_{(aq)} \rightleftharpoons \text{H}^+_{(aq)} + \text{CH}_3\text{COO}^-_{(aq)}$
- Strong-electrolytes
  - Strong acids – complete dissociation (high conductivity).
  - e.g. hydrochloric acid:  $\text{HCl}_{(aq)} \rightarrow \text{H}^+_{(aq)} + \text{Cl}^-_{(aq)}$

### Like Dissolves Like

Non-Polar Molecules Dissolve in Non-Polar Solvents.  
Polar Molecules Dissolve in Polar Solvents.  
e.g. Water and Methanol



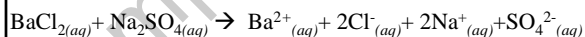
### Precipitation Reactions

- In a precipitation reaction, the attractive forces between oppositely charged ions is greater than the forces of attraction between the  $\text{H}_2\text{O}$  molecules and the ions.

### Ex1) Precipitation Reaction

Ex1) Write the balanced net ionic equation, showing the reactants and products, for the reaction that takes place when an aqueous solution of barium chloride is added to an aqueous solution of sodium sulfate.

### Ex1) Precipitation Reaction



### Solubility Table

Soluble Ions	Exceptions
Group 1A metals	
$\text{NH}_4^+$	
$\text{NO}_3^-$	
$\text{Cl}^-$	not with $\text{Ag}^+$ , $\text{Hg}_2^{2+}$ , $\text{Pb}^{2+}$
$\text{Br}^-$	not with $\text{Ag}^+$ , $\text{Hg}_2^{2+}$ , $\text{Pb}^{2+}$
$\text{I}^-$	not with $\text{Ag}^+$ , $\text{Hg}_2^{2+}$ , $\text{Pb}^{2+}$
$\text{SO}_4^{2-}$	not with $\text{Ca}^{2+}$ , $\text{Sr}^{2+}$ , $\text{Ba}^{2+}$ , $\text{Ag}^+$ , $\text{Hg}_2^{2+}$ , $\text{Pb}^{2+}$

### Insolubility Table

Insoluble Ions	Exceptions
OH <sup>-</sup>	alkali metals, NH <sub>4</sub> <sup>+</sup> , Ca <sup>2+</sup> , Sr <sup>2+</sup> , Ba <sup>2+</sup>
S <sup>2-</sup>	alkali metals, NH <sub>4</sub> <sup>+</sup> , Ca <sup>2+</sup> , Sr <sup>2+</sup> , Ba <sup>2+</sup>
CO <sub>3</sub> <sup>2-</sup>	alkali metals, NH <sub>4</sub> <sup>+</sup>
PO <sub>4</sub> <sup>3-</sup>	alkali metals, NH <sub>4</sub> <sup>+</sup>

### Colors of Precipitates

Solid Precipitant Formed	Color
PbI <sub>2</sub>	Bright Yellow
CdS	Dark Yellow
PbS	Black
Ag <sub>2</sub> S	Black
Ni(OH) <sub>2</sub>	Green
Al(OH) <sub>3</sub>	White
PbSO <sub>4</sub>	White
BaSO <sub>4</sub>	White
Ca <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub>	White
AgCl	White

### Ex2) Precipitation Reaction

Ex2) Aqueous solutions of Lead (II) Nitrate and Sodium Iodide are mixed in a beaker.

### Ex3) Precipitation Reaction

Ex3) Aqueous solutions of Calcium Hydroxide and Sodium Carbonate are mixed in a beaker.