

Al Mamoun University College

Laser and Optoelectronics Engineering Department

Chemistry

Analytical Chemistry



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Chapter four

Chemical Equilibrium

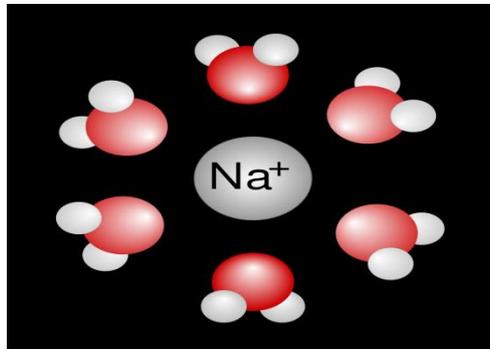
1 Aqueous Solutions and Chemical Equilibrium

.2 Effect of Electrolytes on Chemical Equilibrium

Chemistry

An **aqueous solution** is a solution in which the solvent is water. It is mostly shown in chemical equations by appending (aq) to the relevant chemical formula.

For example, a solution of table salt, also known as sodium chloride (NaCl), in water would be represented as $\text{Na}^+(\text{aq}) + \text{Cl}^-(\text{aq})$. The word aqueous (which comes from aqua) means pertaining to, related to, similar to, or dissolved in, water. As water is an excellent solvent and is also naturally abundant, it is a ubiquitous solvent in chemistry. Since water is frequently used as the solvent in experiments



Properties of Aqueous Solution

Aqueous solutions often allow conducting electricity. Solutions that contain strong electrolytes tend to be very good electrical conductors such as seawater.

On the other hand, solutions that contain weak electrolytes tend to be poor conductors such as tap water. It is because of that strong electrolytes completely dissociate into ions in water, whereas weak electrolytes incompletely dissociate

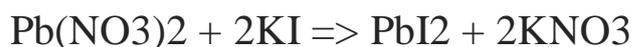
Reactions with Aqueous Solution

An example of an aqueous solution is sodium chloride i.e. common salt dissolved in water. Three different types of reactions with aqueous solutions are as follows:

1. Precipitation Reactions

These reactions take place when two aqueous reactants, one solid and one liquid, react to form an insoluble product which is called a precipitate.

For example when lead nitrate mixes with potassium iodide as shown in the following chemical reaction:



Lead iodide which produces here is not soluble product and hence is the precipitate.

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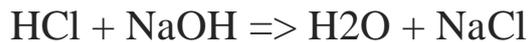
2. Acid-base Reaction

As we know acid contains positive hydrogen ions. On the other hand, a base is a substance that accepts hydrogen ions and produces negative hydroxyl ions in water.

Due to acid and base reaction, a neutralization reaction occurs.

For example, a neutralization reaction occurs when HCl acid combines with NaOH to produce water and sodium chloride.

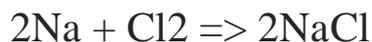
The chemical equation is:



3. Oxidation-Reduction Reactions

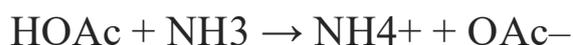
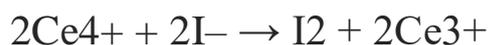
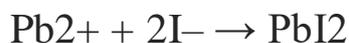
Oxidation is the process in which a chemical loses electrons and hence becomes more positive. Whereas Reduction is the opposite process in which a chemical gains electrons and hence becomes more negative.

An oxidation-reduction reaction takes place between a metal and a non-metal. For example when sodium reacts with chlorine and they produce sodium chloride:



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Q: What are the following reactions examples of?



- A) Acid-base reactions
- B) Precipitation, acid-base, and redox reactions, respectively
- C) Redox, acid-base, and precipitation reactions, respectively
- D) Precipitation, redox, and acid-base reactions, respectively

Electrolyte: a substance that dissolves in water (or other polar solvent) to produce ions and a solution that conducts electricity

Strong, Electrolytes	Weak Electrolytes	Non-Electrolyte
Dissociate completely	Dissociate slightly.	Do not dissociate
Conduct electricity well.	Conducts weakly.	Does not conduct.
Strong Acids & Bases Soluble Salts	Weak Acids & Bases Slightly Soluble Salts	Covalent Compounds

Chemistry

Strong Acids	Strong Bases
HClO ₄ perchloric acid	LiOH lithium hydroxide
HCl hydrochloric acid	NaOH sodium hydroxide
HBr hydrobromic acid	KOH potassium hydroxide
HI hydroiodic acid	Ca(OH) ₂ calcium hydroxide
HNO ₃ nitric acid	Sr(OH) ₂ strontium hydroxide
H ₂ SO ₄ sulfuric acid	Ba(OH) ₂ barium hydroxide

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