PENANG SANGAM HIGH SCHOOL
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P.O.BOX 44, RAKIRAKI

LESSON NOTES

WEEK 23

Year/Level: 13A/B **Subject:** Chemistry

Strand 3	**Reactions**
Sub Strand 3.3	**Aqueous Chemistry**
Content Learning Outcome	By the end of this lesson students should be able: • Define acids and bases and give examples • Define an amphiprotic substance and give examples

Acid and Bases

There are three general concepts about acids and bases.

1. *The Arrhenius concept*

- An acid is a substance which gives H^+ ions when dissolved in water and a base is a substance which gives OH- ions when dissolved in water.

Example

Acid

$HCl\,(aq) \rightarrow H^+(aq) + Cl^-(aq)$

Base

$NaOH\,(aq) \rightarrow Na^+(aq) + OH^-(aq)$

2. *The Bronsted-Lowry concept*

- An acid is a proton (H^+ ion) donor and a base is a proton acceptor.

Example:

$$NH_3\,(g) + H_2O\,(l) \rightleftharpoons NH_4^+\,(aq) + OH^-\,(aq)$$
base *acid.*

Conjugate Base

- Species formed when a proton is removed from an acid. E.g. OH^- in the above example.

Conjugate Acid

- Species formed when a proton is added to base. E.g. NH_4^+.

Note:

- A strong conjugate base has a weak conjugate acid and vice-versa.

- A weak conjugate base has a strong conjugate acid and vice-versa.

Amphiprotic

- Substance which can either accept or donate a proton.

Example:

1. *Water*
   - Water accepts a proton from HCl.

$$HCl(g) + H_2O \rightleftharpoons H_3O^+(aq) + Cl^-(aq)$$

However, it donates a proton when it reacts with NH_3

$$NH_3(g) + H_2O(l) \rightleftharpoons NH_4^+(aq) + OH^-(aq)$$

Note:

- Strong conjugate base has a weak conjugate acid and vice-versa.
- Weak conjugate base has a strong conjugate acid and vice-versa.
- Conjugate base can form by removing an H^+ from an acid.

  $HCl \longrightarrow Cl^-$

  Acid conjugate base
- Conjugate acid is formed by adding an H^+ to a base.

  $OH^- \longrightarrow H_2O$

  Base conjugate acid

In a neutralization reaction a conjugate acid reacts with a conjugate base to form water.

e.g. $H_3O^+_{(aq)} + OH^-_{(aq)} \longrightarrow H_2O$

Exercises

1. Give the conjugate acids of the following:
   a. OH^- b. HS^- c. CH_3NH_2

2. Give the conjugate bases of the following
   a. NH_4^+ b. H_2PO_4