**5:6:A**

## Acid-base reactions

| ACIDS | BASES |
|---|---|
| Sour taste | Bitter taste |
| Color changes in plant-based pH indicators;<br>Acid turns litmus red | Color changes in plant-based pH indicators;<br>Base turns litmus blue |
| Acids burn exposed skin: severity depends on the concentration (Molarity) of the acid | Bases feel slippery. May cause some burning and irritation. |
| Acids react with metals above Hydrogen in the Activity series to produce a metal salt and $H_2$ gas | |
| Acids react with carbonates and bicarbonates to produce salts and $CO_2$ (g) | |
| Acids are electrolytes and conduct electricity | Bases are electrolytes and conduct electricity. |
| Arrhenius acids: dissociate in aqueous solutions to produce $H^+$ | Arrhenius bases: dissociate in aqueous solutions to produce $OH^-$ |
| Brønsted-Lowry Acid: A proton ($H^+$) donor | Brønsted-LowryBase: A proton ($H^+$) acceptor |

**5:6:B**

Acid dissociations:

Monoprotic:

$HCl(aq) \rightleftarrows H^+(aq) + Cl^-(aq)$

$H^+$ may be written in aqueous media as the hydronium ion: $H_3O^+$

$CH_3COOH(aq) \rightleftarrows H^+(aq) + CH_3COO^-(aq)$

$HNO_3(aq) \rightleftarrows H^+(aq) + NO_3^-(aq)$

Diprotic: (two step dissociation)

$H_2SO_4(aq) \rightleftarrows H^+(aq) + HSO_4^-(aq)$

$HSO_4^-(aq) \rightleftarrows H^+(aq) + SO_4^{2-}(aq)$

Triprotic (three step dissociation)

$H_3PO_4(aq) \rightleftarrows H^+(aq) + H_2PO_4^-(aq)$

$H_2PO_4^-(aq) \rightleftarrows H^+(aq) + HPO_4^{2-}(aq)$

$HPO_4^{2-}(aq) \rightleftarrows H^+(aq) + PO_4^{3-}(aq)$

Base dissociations:

Monobasic:

$NaOH(aq) \rightleftarrows Na+(aq) + OH^-(aq)$

Dibasic:

$Ba(OH)_2 \rightleftarrows Ba^{2+}(aq) + 2OH^-(aq)$

**5:6:C** **ELECTROLYTES:**

An electrolyte is a substance that when dissolved in water conducts electricity.

| Strong Electrolytes | Weak Electrolytes |
|---|---|
| HCl, $HNO_3$, $H_2SO_4$, NaOH, $Ba(OH)_2$, any ionic compound | $H_3CCOOH$ (acetic acid), any haloacid except HCl, $NH_3$(ammonia), $H_2O$ |
| **Non-electrolytes: Any organic compound and most covalently bonded compounds | |

A reaction between an acid and a base is a neutralization reaction and always produces a salt and water. Since a salt consists of a cation other than $H^+$ and an anion other than $OH^-$, a salt is always an ionic compound and will dissociate to produce ions.

$HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$

[Molecular equation]

$H^+(aq) + Cl^-(aq) + Na^+(aq) + OH^-(aq) \rightarrow Na^+(aq) + Cl^-(aq) + H_2O(l)$

[Complete ionic equation]

$H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

[Net ionic equation]

$Na^+$ and $Cl^-$ are spectator ions.

**5:7:A**

## GRAVIMETRIC ANALYSIS/ TITRATIONS

Gravimetric analysis is a technique based on the measurement of mass.

A 0.7889 g mass of an unknown ionic compound is dissolved in water. The unknown compound is known to contain bromide ions. An excess of $AgNO_3(aq)$ is added in order to precipitate the chloride ions as AgBr. If 1.1211 g of precipitate forms, what is the percent by mass of the Br in the original compound?

1.1211 g AgBr @187.80 g/mole = $5.9696 \times 10^{-3}$ mole AgBr

$$5.9696 \times 10^{-3} \text{ mole AgBr} \times \frac{1 \text{ mole Br}}{1 \text{ mole AgBr}}$$

$= 5.9696 \times 10^{-3}$ mole Br

$5.9696 \times 10^{-3}$ mole Br @ 79.90 g/mole= 0.477 g Br

$$\text{Mass Percent Br} = \frac{0.477 \text{ g Br}}{1.1211 \text{ g sample}} \times 100\% = 42.55\ \%$$