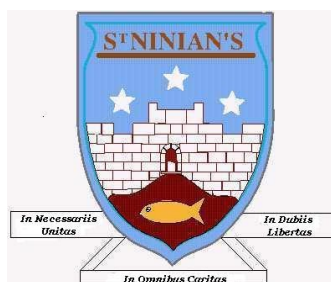


St Ninian's High School



Chemistry Department



National 5 Chemistry

Unit 1: Chemical Changes & Structure

Section 1.5: Acids and Alkalis

Summary Notes

Name _____

Learning Outcomes

After completing this section you should be able to :

- 1 state that the pH scale is a continuous range from less than 0 to above 14
- 2 state that acids have a pH value less than 7 and alkalis (soluble bases) have a pH value greater than 7
- 3 state that neutral substances like pure water have a pH value of 7
- 4 give examples of common acids and alkalis used in the laboratory and in the home
- 5 state that non-metal oxides which dissolve in water produce acidic solutions
- 6 explain that an acidic solution contains a greater concentration of $H^+(aq)$ ions than $OH^-(aq)$ ions
- 7 explain that an alkaline solution has a greater concentration of $OH^-(aq)$ ions than $H^+(aq)$ ions
- 8 state that metal oxides which dissolve in water produce alkaline solutions
- 9 state that a neutral solution has an equal concentration of $H^+(aq)$ and $OH^-(aq)$ ions
- 10 explain that a small number of water molecules dissociate into an equal number of hydrogen and hydroxide ions
- 11 explain the effect of dilution in terms of the decreasing concentrations of hydrogen and hydroxide ions
- 12 state that acids and alkalis conduct electricity due to the presence of ions
- 13 state that water is a poor conductor of electricity due to a small number of ions.


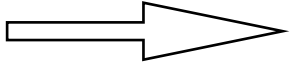
The pH scale

The pH scale ranges from below 0 to above 14 and is used to measure the acidity or alkalinity of a solution. This can be done using a pH meter which gives an electronic reading or using an **indicator** which can change colour depending on the pH value. The colour can be matched on the pH colour chart to indicate the pH number.

Acidic solutions have a pH that is less than 7.

Alkaline solutions have a pH that is greater than 7.

Neutral solutions have a pH value of 7.

pH	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Type of Solution	Acid  increasing acidity							Neutral	Alkali  increasing alkalinity						

Non-metal oxides such as carbon dioxide, sulfur dioxide and nitrogen dioxide all dissolve to form acidic solutions. Food substances such as fruit juice are often acidic while cleaning substances such as toothpaste are often alkaline.

Alkalis

Making Alkalis

Metal oxides are formed when a metal reacts with oxygen. Some **metal oxides** (soluble) will dissolve in water to form an alkaline solution. Soluble **metal hydroxides** will also dissolve forming **alkaline** solutions such as sodium hydroxide.

Insoluble metal oxides such as copper oxide will **not** affect the pH of water.

Some common alkalis are listed in the table below.

Name of Alkali	Chemical Formula	Ions Present
lithium hydroxide	LiOH	Li ⁺ and OH ⁻
sodium hydroxide	NaOH	Na ⁺ and OH ⁻
Potassium hydroxide	KOH	K ⁺ and OH ⁻
Calcium hydroxide	Ca(OH) ₂	Ca ²⁺ and OH ⁻

All alkaline solutions contain hydroxide ions, OH⁻.

Summary So Far

- When an element reacts with oxygen an oxide is formed.
- Some non-metal oxides dissolve in water to form acidic solutions e.g. carbon, sulfur and nitrogen.
- Metal elements react with oxygen to produce metal oxides e.g. sodium and potassium.
- Soluble metal oxides and metal hydroxides dissolve in water to form alkaline solutions. Insoluble metal oxides and metal hydroxides do not effect the pH of water.

Topic 4 Summary Statements

- The pH scale is a continuous range from less than 0 to above 14.
- Acidic substances have a pH value less than 7 and alkaline substances have a pH value greater than 7
- Neutral substances like pure water have a pH value of 7.
- Common acids include:
 - Hydrochloric acid - HCl
 - Sulfuric acid - H₂SO₄
 - Nitric acid - HNO₃
 - Ethanoic acid - CH₃COOH

- Common alkalis used in the laboratory include:
 - Sodium hydroxide - NaOH
 - Potassium hydroxide - KOH

- Non-metal oxides which dissolve in water produce acidic solutions.
- An acidic solution contains a greater concentration of H⁺(aq) ions than OH⁻(aq) ions.
- An alkaline solution has a greater concentration of OH⁻(aq) ions than H⁺(aq) ions.
- Metal oxides and metal hydroxides which dissolve in water produce alkaline solutions.
- A neutral solution has an equal concentration of H⁺(aq) and OH⁻(aq) ions.
- A small number of water molecules dissociate into an equal number of hydrogen and hydroxide ions.
- When a solution is diluted the concentration decreases.
- When an acidic solution is diluted the concentration of hydrogen ions decreases and the pH increases.
- When an alkaline solution is diluted the concentration of hydroxide ions decreases and the pH decreases.
- Acids and alkalis conduct electricity due to the presence of ions.
- When an acidic solution is electrolysed hydrogen gas will form at the negative electrode.
- Water is a poor conductor of electricity due to the low number of ions present.