Cambridge IGCSE Chemistry

Topic 8: Acids, bases and salts

The characteristic properties of acids and bases

Notes

Describe the characteristic properties of acids as reactions with metals, bases, carbonates and effect on litmus and methyl orange

acid + metal ⟶ salt + hydrogen
acid + base ⟶ salt + water
acid + metal carbonate ⟶ salt + water + carbon dioxide

- All three of these above reactions are neutralisation reactions
- The salt produced depends on the acid used:
    - Hydrochloric acid produces chlorides
    - Nitric acid produces nitrates
    - Sulfuric acid produces sulfates
    - It also depends on the positive ions in the base, alkali or carbonate i.e. the metal
- Red litmus (for the above reactions would just stay red- assuming that you start with the acid and add the metal)
    - Stays red in acidic
    - Stays red in neutral
    - Turns blue in alkaline
- Blue litmus (for the above reactions would just stay blue- assuming that you start with the base then add the acid)
    - Turns red in acidic
    - Stays blue in neutral
    - Stays blue in alkaline
- Methyl orange (for the above reactions would change from red to yellow)
    - Red in acidic
    - Yellow in neutral
    - Yellow in alkaline

(Extended only) Define acids and bases in terms of proton transfer, limited to aqueous solutions

- Protons are H^+ ions
- Acids are proton donors and bases are proton acceptors, therefore there is a proton transfer from acids to bases

Describe the characteristic properties of bases as reactions with acids and with ammonium salts and effect on litmus and methyl orange

- Acid + ammonia -> ammonium salt
    - E.g. $HCl + NH_3 \rightarrow NH_4Cl$
- Effect would be going from alkaline to neutral (assuming that you start with the base or ammonia then add the acid)

- Methyl orange: stays yellow
- Red litmus: blue to red
- Blue litmus: stays blue

(Extended only) Describe the meaning of weak and strong acids and bases

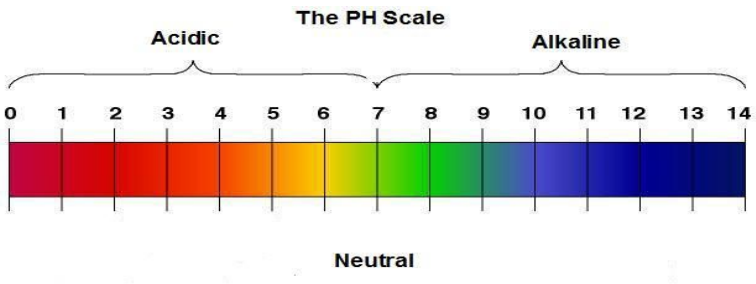
- Acids release H^+ ions in aqueous solution
- Strong acid = completely dissociates to release H^+ ions in aqueous solution
  - Hydrochloric, nitric and sulfuric acids
- Weak acid = partially dissociates to release H^+ ions in aqueous solution
  - Ethanoic, citric and carbonic acids
- Stronger an acid, lower the pH (for a given conc. of aq. solutions)
- As the pH decreases by one unit, the H^+ conc. of the solution increases by a factor of 10.

- bases release OH^- ions in aqueous solution
- strong bases fully dissociate to release OH^- ions in aqueous solution
- weak bases partially dissociate to release OH^- ions in aqueous solution
- the stronger a base, the higher the pH

- Strong and weak is NOT the same as concentrated and dilute – the latter refers to the amount of substance whereas, the former refers to the above – the H^+ ion conc. in aq. solutions

Describe neutrality and relative acidity and alkalinity in terms of pH measured using Universal Indicator paper (whole numbers only)

- Acids produce H^+ ions in aqueous solutions
- Alkalis produce OH^- ions in aqueous solutions
- The pH scale (0 to 14) measures the acidity or alkalinity of a solution, and can be measured using universal indicator of a pH probe
  - pH 7 is neutral
  - < pH 7 is acidic
  - > pH 7 is alkaline
- $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$ is the ionic equation of any neutralisation reaction



Describe and explain the importance of controlling acidity in soil

- If the pH of soil is too low i.e. too acidic, this would mean that crops would be unable to grow in these acidic soils
- Farmers use lime (calcium oxide) to neutralise acid soils