Acids and Bases

Summary Notes

Key Concepts

This is a summary of the concepts covered in this topic.

- Acids donate protons, bases accept protons, protons can be written as H^+.
- Acids react with metals to produce hydrogen gas (H_2). Acids react with carbonates to form carbon dioxide (CO_2).
- Similarities in the reactions of different acids with metals and bases (including metal oxides, carbonates, and hydroxides) allow products to be predicted from known reactants. You should be able to:
  - Predict the products and write full and ionic equations for reactions between a given acid and metal, metal oxide, hydroxide, carbonate, or hydrogencarbonate.
  - Undertake stoichiometric calculations for these reactions.
  - Highlight the proton transfer between an acid and a base occuring in these reactions by identifying conjugate acid-base pairs and describing the transfer of protons.
- Acids can be classified as monoprotic or polyprotic depending on the number of protons available for donation. Substances that can either donate or accept a proton are called amphiprotic. Polyprotic acids often have an amphiprotic intermediate ion that forms in water.
- Metal oxides are commonly basic, you should be able to:
  - Write equations for the reactions with water of Na_2O, K_2O, CaO, and other similar metal oxides.
- The pH scale is a logarithmic scale that describes the concentration of hydrogen ions in aqueous solutions, specifically: $\text{pH} = -\log([H_3O^+])$. You should be able to
  - Use this relationship to calculate the pH of a given solution.
- Solutions with $\text{pH} < 7$ are acidic, solutions with $\text{pH} > 7$ are basic, and solutions with $\text{pH} = 7$ are neutral.
- The strength of acids is explained by the degree of ionisation in aqueous solution. "Strong" acids ionise completely, while "weak" acids do not.

Extension

These are some additional concepts you could study for this topic, which in combination with the summary above covers all of Topic 5 in the SACE stage 1 chemistry curriculum.

- Something we haven't spoken about but that you could look into is:
  - Draw structural formulae for CO_2, SO_2, SO_3, H_2SO_3, H_2SO_4, and H_3PO_4.
- Rearrange the relationship $pH = -\log([H_3O^+])$ to:
  - Calculate the concentration of H_3O^+ in a solution of a given pH.
- Indicators are weak acids or bases where the acidic form is of a different colour from the basic form.
- Neutralisation (reaction of an acid with a base) is an exothermic reaction.
- The oxides of non-metals are commonly acidic and generate oxyacids when dissolved in water. CO_2 dissolves in rainwater to form carbonic acid, which is a weak acid, giving rainwater a pH of about 5.6. Oxides of sulfur and nitrogen in the atmosphere can produce rain with a pH below 5.6.
  - Write equations for the reaction of CO_2 with water to produce hydrogen ions.
  - Write equations for the reactions of oxides of sulfur (SO_2, SO_3) and nitrogen (NO, NO_2) with water that lead to acid rain.
  - other non-metal oxides also react with water to produce similar oxyacids. Try writing the equation for the reaction of water with P_4O_{10}.