CHEMISTRY

Historical Development of Ideas about Acids

- Outline the historical development of ideas about acids including those of:
    - Lavoisier
    - Davy
    - Arrhenius

Scientist	**Lavoisier**	**Davy**	**Arrhenius**
Idea about acids	Non-metal oxides reacted with water producing acidic solutions → An acid must contain oxygen	Acids contained hydrogen that could be replaced when combined with metals → Acids must contain hydrogen	Acids dissociate into their ions when dissolving in water → Acids produce H^+ ions in solution i.e. HA → $H^+ + A^-$
Idea about bases	N/A	Compounds of metal with oxygen were bases. They are also, substances which reacted with acid to produce salt and water	Bases release OH^- ions in aqueous solutions i.e. XOH → $X^+ + OH^-$
Improvement on previous model	Although his ideas were incorrect, it was the first attempt to classify and explore acids and bases	Experimentation accounted for acids such as HCl which did not contain oxygen	Differentiated between strong and weak acids by their ionising power (ability to produce H^+)
Problems/ imitations of this model	Discoveries that HCl and HCN which did not contain O_2 but were acidic contradicted his ideas	Still limited and somewhat vague definitions, making it hard to classify all substances	Definition of a base excludes metallic oxides, carbonates etc. or explain why substances can be both acidic and basic

- Outline the Brönsted-Lowry theory of acids and bases

Idea about acids	Acids are **proton donors** i.e. give away H^+ ions **e.g.** $HCl + H_2O \rightarrow Cl^- + H_3O^+$ (Proton leaves the acid and attaches to the base)
Idea about bases	Bases are **proton acceptors** i.e. absorb H^+ ions **e.g.** $H_2O + NH_3 \rightarrow OH^- + NH_4^+$ (Proton leaves water to attach to base-ammonia)
Improvement on previous model	Extended the acid/ base descriptions to a wider range of substances as they did not have to be in solution
Problems/ imitations of this model	This is still the current theory that is used and generally is widely accepted

QUESTIONS

1. **Which model first identified the importance of hydrogen in acids?**

   It was Humphry Davy that first suggested that acids contained hydrogen following work with substances such as Hydrochloric Acid

2. **Which model first identified that hydrogen in acids could be replaced by metals in reactions?**

   Humphry Davy also suggested that hydrogen in acids could be replaced by metals during reactions, as the salt that forms

3. **Which model identified that hydrogen ions were a feature common to all acids?**

   Whilst Davy recognised that all acids must contain Hydrogen, it was Arrhenius that stated that any acid will produce hydrogen ions in solution

4. **Which model first recognised that the amount of ionisation that distinguished if an acid was strong or weak?**

   Arrhenius recognised that the ionising power of an acid is related to its strength and the ability/ amount of H^+ ions it produced in solution

5. **Which model first identified the role of the solvent in determining the extent of ionisations of an acid in solution?**

   As an improvement of Arrhenius' theory, Bronsted and Lowry suggested that the solvent is partially responsible for the properties of the acid and how it reacts in certain situations

6. **Which model identified that bases were substances that produced hydroxide ions in solution?**

   Arrhenius was the first to propose that hydroxide ions were produced when bases were in solution

7. **Which model identified neutralisation as proton transfer, not necessarily involving water?**

   Independently, both Bronsted and Lowry came up with this idea, as they realised that acids donated protons and electrons accepted them. Therefore, in a neutralisation reaction, this is done simultaneously, regardless of the solvent

8. **Which model could explain the formation of salt with pH's that are not neutral?**

   This was explained by Bronsted and Lowry as they found that the acid simply donated a proton to the base, which could cause it to become basic etc. Hence, the pH of the salt was dependent upon the initial strength of the acid and base