Hydrogen and Its Compounds

These notes are your ultimate revision weapon to revise Hydrogen and its Compounds. We've distilled years of previous exam questions (PYQs) into one powerful, concise resource. Everything you need to know, nothing you don't.

- **PYQs, Decoded:** All key concepts from past exams, organized and simplified.
- **Revise in Record Time:** Short, precise, and designed for last-minute review.
- **Focus on What Matters:** Master high-probability topics and boost your confidence.

Hydrogen and Its Compounds

Chemical Properties

- **Combustion:** Burning hydrogen gas produces water.
- **Fuel Property:** Hydrogen gas is a very clean fuel, causing minimal air pollution compared to kerosene, coal, and diesel.

Reaction Stoichiometry

- **Heat of Combustion:** Burning one mole of hydrogen gas in excess oxygen releases 290 kJ of heat.
- **Molar Mass:** The molar mass of hydrogen gas (H_2) is 2 g/mol.

Forming Compounds

- An element with four valence electrons will form a compound with hydrogen with the formula XH_4 (e.g., Carbon forms CH_4, methane).

Composition of Water (H_2O)

- **Molecular Formula:** H_2O.

- **Composition by Weight:**
  - Hydrogen constitutes approximately 11.11%.
  - Oxygen constitutes the remaining 88.89%.

Water (H_2O)

Properties of Water

- **pH Level:** The pH of pure water is 7 (neutral).
- **Solvent Properties:**
  - Water is an excellent solvent, capable of dissolving more substances than any other liquid.
  - This property is due to its **dipolar nature** (high dipole moment).
  - It is particularly effective at dissolving ionic salts.
- **Purity and Forms:**
  - The purest form of water is **distilled water**.
  - **Rainwater** is a relatively pure natural form.

Heavy Water (D_2O)

- **Definition:** A form of water where hydrogen atoms are replaced by the heavier isotope, deuterium (D).
- **Formula:** D_2O.
- **Properties:**
  - Higher molecular weight (20) than ordinary water (18).
  - Chemically similar to ordinary water but has different physical properties.
- **Discovery:** Discovered by **H.C. Urey**.
- **Uses:** Used as a **moderator** (to slow down neutrons) and a **coolant** in nuclear reactors.

Hard Water

- **Definition:** Water that contains dissolved minerals, specifically insoluble salts of calcium and magnesium.
- **Problems and Unsuitability:**

    - **Washing:** Not suitable for washing with soap; it forms an insoluble scum, reducing lathering.
    - **Boilers:** Not suitable for boilers; it causes scale formation, reducing efficiency and potentially causing damage.
    - **Drinking:** Generally not considered suitable for drinking (context-dependent, often due to taste and scaling).
- **Cause of Permanent Hardness:** Caused by dissolved **chlorides and sulfates of calcium and magnesium**.

Water Purification Methods

Desalination

- **Purpose:** Large-scale purification of seawater into drinking water.
- **Common Process: Reverse osmosis**.
- **Other Method: Distillation**.

General Purification Techniques

- **Disinfection: Chlorine gas** is used to kill microorganisms in drinking water.
- **Demineralization: Ion-exchange** processes are used to prepare large quantities of drinking water from impure water.
- **Clarification: Alum** is used to clean muddy water through **coagulation**, causing suspended particles to clump together and settle.

Related Chemistry (Hydrogenation)

- **Process: Hydrogenation** is the chemical process of adding hydrogen gas.
- **Application:** Used in the manufacture of Vanaspati Ghee from vegetable (Vanaspati) oil.
- **Catalyst:** A common catalyst for this reaction is **Nickel**.

Know More About Hydrogen and its Compounds:

- Hydrogen and its Compounds – Old Year Questions
- Hydrogen and its Compounds One Liner Questions & Answers