Contact Process: Sulfuric Acid- H_2SO_4 : Properties of Sulphuric Acid Are Listed below (For CBSE, ICSE, IAS, NET, NRA 2022)

Title: Contact Process

- It is said that, if one could estimate the amount of sulfuric acid produced in a country, then that information is more than enough to estimate the industrial growth of that particular country.
- This is because sulfuric acid is an essential raw material for almost everything that is industrially made.
- The contact process is the current method of producing sulfuric acid in the high concentrations needed for industrial processes.
- It is commonly used in fertilizer manufacturing, oil refining, mineral processing and it is even used in wastewater processing. Some other uses include domestic acidic drain cleaners, the electrolyte in lead-acid batteries, as a dehydrating agent, etc.
- Platinum was initially used as the catalyst for this reaction; however, as it is susceptible to reacting with arsenic impurities in the sulfur feedstock, vanadium (V) oxide is now preferred.
- One of the most popular or common methods to manufacture sulphuric acid is via the contact process.
- This process was invented by a British merchant named Peregrine Phillips. It was patented in the year 1831.
- Apart from being an economical process for manufacturing sulfuric acid, sulfur trioxide and ileum are also obtained from this process.

Sulfuric Acid (H_2SO_4)

- In a nutshell, sulfuric acid is a strong mineral acid characterized by its strong dehydrating and oxidizing nature. It has a chemical formula H_2SO_4 . This acid is colourless with a pungent smell.
- It is soluble in water and releases heat on contact.

- This acid is corrosive to metals and most other organic matters like tissue, wood, etc.
- On contact with such organic substances, sulfuric acid instantly dehydrates those causing char to form. Sulfuric acid has a density of $1.83 \frac{g}{\text{cm}^3}$.
- The molecular structure of sulfuric acid is represented below in the form of a line-wedge-dash structure.

Properties of Sulphuric Acid

Chemical formula	$H_2\ SO_4$
Molar mass	$98.079\ \frac{g}{\text{mol}}$
Appearance	Clear, colourless liquid
Density	$1.8302\ \frac{g}{\text{cm}^3}$
Melting point and boiling point	$50.56°F$ and $639°F$
Solubility in water	Exothermic, miscible
Viscosity	26.7 Cp

Properties of Sulphuric Acid

Manufacture of Sulfuric Acid by Contact Process

- There are several ways to manufacture sulfuric acid. Each of them varies in effort, cost, and purity of the sulfuric acid that is produced.
- Though, the most common process among these is the contact process. Let us discuss this process in detail below.

Manufacture of sulfuric acid using contact process involves four steps.

- Extraction of sulfur.
- Preparation of sulfur dioxide.
- Conversion of sulfur dioxide to sulfur trioxide.
- Conversion of sulfur trioxide to sulfuric acid.

Extraction of Sulfur

$$2\text{PbS} + 3O_2 \rightarrow 2\text{PbO} + 2\ \text{SO}_2$$

Conversion of Sulfur Dioxide to Sulfur Trioxide

$$2\ \text{SO}_2\ (g) + O_2\ (g) \rightleftharpoons \text{SO}_3\ (g)\ \Delta H = -196\ \text{KJ mol}^{-1}$$

Conversion of Sulfur Trioxide to Sulfuric Acid

$$SO_3\,(g) + H_2\,SO_4 \rightarrow H_2S_2O_7$$

Oleum can be further diluted in water to obtain concentrated sulfuric acid.

$$H_2S_2O_7 + H_2O \rightarrow 2H_2\,SO_4$$

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