**Chapter 12: Sulphur:**

**Sulphur is a non metal element in group 6 of the periodic table. Sulphur has many useful properties which make it widely used in the industry.**

**Sources of Sulphur:**

**Sulphur is found in many places in the world in different forms. It usually exists in volcanic regions in USA, Mexico and Sicily. Sulphur could also be obtained from some metal ores like Copper pyrites (CuFeS2) and Blende (ZnS).**

 **Properties of Sulphur:**

**In room temperature, sulphur is a yellow, brittle solid which doesn’t conduct electricity as it is a non-metal. Sulphur is insoluble in water. It is able to react with both metals and non-metals.**

**Sulphur Dioxide:**

**Sulphur dioxide is the product of combustion of sulphur or sulphur-containing fuels. As you have studied in the previous chapter, it is an air pollutant as it causes acid rain. However, SO2 has important uses too:**

* **Bleaching wood pulp for the manufacturing of paper**
* **It is used as a food preservative as it kills bacteria**
* **Manufacturing of Sulphuric acid**

**Contact Process (Manufacturing of Sulphuric Acid):**

**Sulphuric acid is one of the most important chemicals in the industry since it has a role in the manufacturing of almost every product. Sulphuric acid is manufactured by a process called Contact Process and it involves several steps:**

* **Sulphur is first burned in air producing sulphur dioxide:**

**S + O2** $\rightarrow $ **SO2**

* **The product of the previous step is them cleaned of any dirt or dust. Then sulphur dioxide is burned in more air producing sulphur trioxide. This is a reversible reaction and it has to be done in the following conditions:**
1. **Catalyst: Vanadium (V) Oxide (V2O5)**
2. **Temperature: 450oC**
3. **Pressure: 2 atm**

**2SO2 + O2** $⇋$ **2SO3**

* **Next, Sulphur trioxide is dioxide is dissolved in concentrated sulphuric acid. The two substances react producing a third sulphur compound called oleum.**

**H2SO4 + SO3** $\rightarrow $ **H2S2O7**

* **Lastly, the produced oleum is dissolved in water. It reacts with it producing sulphuric acid:**

**H2S2O7 + H2O** $\rightarrow $**2H2SO4**

**The amount of sulphuric acid produced in this reaction is twice the amount of concentrated sulphuric acid used in the 3rd stage.**

**Long ago, they did the same approach but when they reached the third stage they reacted sulphur trioxide with water instead of sulphuric acid. This gave sulphuric acid directly, but the reaction was very violent and produces a harmful acidic mist which hard to deal with. This is why the other approach is preferred.**

**Properties & Uses of Sulphuric Acid:**

**Sulphuric acid is a very strong acid. It is a dibasic acid which means it every molecule of it produces two hydrogen ions when it is dissolved in water. Sulphuric acid has some other unique properties. For example, it is a dehydrating agent. This means it eliminates water from compounds.**

**Concentrated H2SO4**

**E.g: CuSO4.5H2O CuSO4 + 5H2O**

**Concentrated H2SO4**

**E.g: C6H12O6 6C + 6H2O**

**It is also a drying agent. This means it removes water from mixtures. Don’t confuse that dehydrating agent.**

**Manufacturing of fertilisers**

**Manufacturing of Paint & Detergents**

**As an electrolyte in car batteries**

**Uses of Sulphuric Acid**