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Class 12
Chemistry

Chapter 23
Industry
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INDUSTRY

Raw Materials and their Resources for Chemical Industry

23.3 and 23.5
not included

Raw materials for the chemical industry are obtained from the environment, which includes the atmosphere, hydrosphere, biosphere, and lithosphere.

- **Atmosphere:** The atmosphere provides important gases such as nitrogen, oxygen, hydrogen, carbon dioxide, and noble gases. Nitrogen + hydrogen $\rightarrow$ ammonia, used to make urea and fertilizers. Nitrogen + Oxygen $\rightarrow$ nitrogen oxides and nitric acid. Oxygen is used in steel industries and hospitals.
- **Hydrosphere:** Sea water contains dissolved salts like sodium, potassium, magnesium, calcium, chlorides, sulfates, and bromides, which are extracted for making various chemicals.
- **Biosphere:** Plants and living organisms provide many useful raw materials. Cellulose gives paper. Starch and Oils $\rightarrow$ food and chemical industry. Biomass $\rightarrow$ biogas, bioplastics, biochemicals. Microorganisms $\rightarrow$ enzymes used in fermentation and biotechnology. Plant and animal products are widely used in the pharmaceutical industry.
- **Lithosphere:** The lithosphere is the largest source of raw materials and varies from region to region. It provides; fossil fuels (coal, petroleum, natural gas), Metal ores (iron, aluminium, chromium, gold, uranium), Non-metals (limestone, gypsum, rock salt). These materials are used in metallurgy, cement, fuel, and chemical industries.

Chemical Raw Materials in Pakistan

Pakistan has about 1.427 billion tons of iron ore. Pakistan exports chromite. Reserves of gold and copper in Balochistan. Natural gas and coal in Sui and Sandak. Coal reserves of about 185 billion tons (high in sulphur). Gypsum reserves of about 5.5 billion tons, used for cement industry. Pakistan also has other minerals, limestone, rock salt, marble, granite. Northern areas contain gemstones like aquamarine, tourmaline, peridot, emerald, ruby, topaz, zircon, rhodochrosite etc.

Important Chemical Processes

- **Polymerization:** Small precursors called monomers, are converted into long-chain molecules called polymers.
- **Calcination:** Limestone converted into calcium oxide and carbon dioxide by heating.
- **Reforming:** Petroleum fractions $\rightarrow$ fuels, hydrogen, methanol
- **Smelting:** Metal oxides + coke $\rightarrow$ metals
- **Hall-Heroult Process:** Aluminium metal is obtained from its oxide.
- **Bessemer Process:** Manufacturing of steel
- **Haber Process:** Nitrogen + Hydrogen $\rightarrow$ ammonia (fertilizers)
- **Bosch Process:** Industrial production of hydrogen
- **Frasch Process:** Extraction of Sulphur
- **Down's Method:** Sodium metal is obtained by electrolysis of molten halite.
- **Solvay's Process:** Manufacture of sodium carbonate or soda ash
- **Burgius Process:** Coal $\rightarrow$ synthetic fuels and lubricants
- **Contact Process:** Sulphur dioxide gas is converted into sulphur trioxide gas which is further used for making sulphuric acid.

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