

KARACHI EDU COACHING CENTER • CLASS X CHEMISTRY

Chapter 8: Chemical Industries

Comprehensive study notes on metallurgy, basic chemical manufacturing, urea, and soap industry



Introduction to Chemical Industries

Transforming raw materials into valuable commercial products to drive national economy.

Metallurgy

The science and procedure used in extracting metals from their natural ores, purifying them, and forming useful metal alloys.

Basic Terminology

- **Mineral:** Naturally occurring inorganic solid in earth's crust.
- **Ore:** Mineral from which metal is profitably extracted.
- **Gangue:** Unwanted rocky impurities attached with ores.

Metallurgical Operations

Sequential steps for extracting pure metal from raw extracted ore.

STEP 01

Crushing & Grinding

Breaking massive ore lumps into fine powder.

STEP 02

Concentration

Removing gangue via gravity or froth floatation.

STEP 03

Extraction (Smelting)

Reduction of fused ore using coke and flux.

STEP 04

Refining

Purifying impure metal via electro-refining.

Metallurgy of Copper

Extraction of copper from copper pyrites (CuFeS_2).

Roasting & Smelting

- ✓ **Roasting:** Excess air converts sulfide partially to oxide.
- ✓ **Smelting:** Heated with silica sand in blast furnace.
- ✓ **Slag Formation:** $\text{FeO} + \text{SiO}_2 \rightarrow \text{FeSiO}_3$ (Slag).

Bessemerization & Blister Copper

- ✓ **Converter:** Molten matte blown with air blast.
- ✓ **Blister Copper:** Product is 98–98.5% pure copper.
- ✓ **Electro-Refining:** Further purified to 99.9% purity.

Manufacture of Sodium Carbonate (Solvay Process)

Industrial production of washing soda (Na_2CO_3) using cheap raw materials.

Raw Materials

Sodium chloride (brine), limestone (CaCO_3), and ammonia (NH_3).

Carbonation Tower

Ammoniated brine reacts with CO_2 to precipitate sodium bicarbonate crystals.

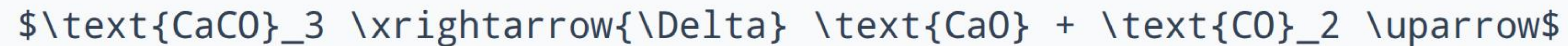
Calcination

Heating NaHCO_3 yields pure sodium carbonate, water vapor, and CO_2 .

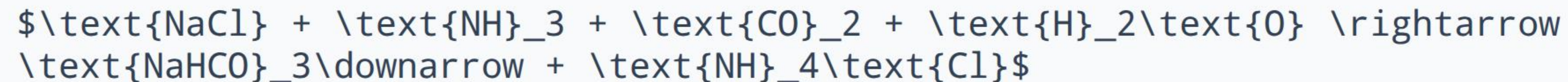
Solvay Process: Chemical Equations

Core chemical reactions occurring at different stages of the manufacturing plant.

1. Preparation of Carbon Dioxide



2. Carbonation Reaction in Tower



3. Calcination to Form Sodium Carbonate



Manufacture of Urea (CO(NH)_2)

Vital nitrogenous fertilizer containing 46.67% nitrogen content.

Raw Materials

Ammonia (NH_3) and Carbon Dioxide (CO_2).

Ammonia is synthesized via Haber's process, and CO_2 is obtained as a byproduct during ammonia production.

Reaction Stages

- **Combination:** $\text{CO}_2 + 2\text{NH}_3 \rightarrow \text{CO(NH)}_2 + \text{H}_2\text{O}$ (Ammonium carbamate)
- **Dehydration:** Heating carbamate gives urea and water.
- **Prilling:** Dropping liquid urea down a tower forms solid beads.

Soap Industry & Saponification

Manufacture of sodium salts of long-chain fatty acids.

Raw Materials

Natural fats or oils (triglycerides) and caustic soda (NaOH).

Saponification

Hydrolysis of fats with NaOH produces soap and glycerol.

Salting Out

Adding sodium chloride precipitates solid soap from the aqueous mixture.

Chapter Summary & Key Takeaways

Review of major chemical industries covered in Sindh Board syllabus.

- ✓ **Metallurgy:** Extraction of copper involves roasting, smelting, and bessemerization.
- ✓ **Solvay Process:** Efficient industrial method for manufacturing washing soda.
- ✓ **Agro-Chemicals & Soap:** Urea production and saponification are key pillars of commercial chemistry.

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Questions & Discussion

Prepare your chemical equations and exercise answers for the upcoming coaching assessment.

