Day 1 Metals and Metallurgy Duration: 3hr

Topics of discussion:

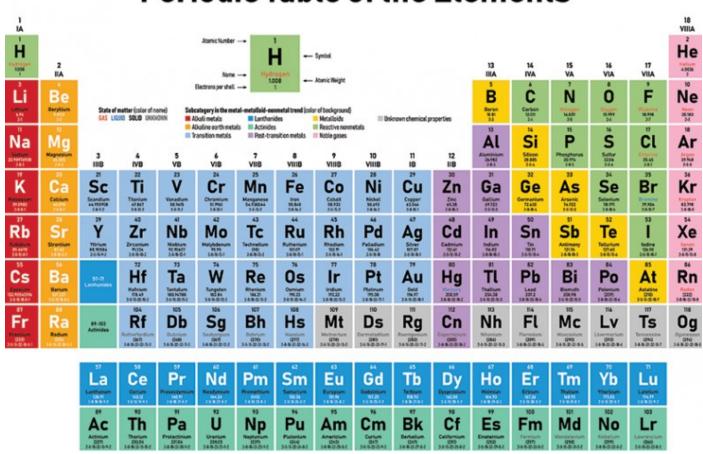
- 1) Introduction
- 2) Metals and periodic table
- 3) Metallurgy and principles
- 4) Ores and minerals
- 5) Different ores and their compositions
- 6) Discussion

Introduction

- Metallurgy is defined as a process that is used for the extraction of metal in their purest form
- Multistep process
- Applicable for all metals from lump to minute quantities

Metals and periodic table

Periodic Table of the Elements



Principles of metallurgy

The metallurgical process can be classified as the following:

- 1. **Crushing and grinding:** The first process in metallurgy is crushing of ores into a fine powder in a jaw crusher or ball/stamp mill. This process is known as pulverization.
- 2. **Washing of powdered ore:** The washing of ore by gravity washing or in wilfey table
- 3. **The concentration of ores:** The process of removing impurities from ore is known as a concentration of minerals or ore dressing. In metallurgy, we concentrate the ores mainly by the following methods.
- 4. Conversion of the concentrated ores to their oxides: By roasting and calcination
- 5. Reduction of metal oxides to free metal: By different reducing agents like carbon, charcoal, aluminium or electrolytic process
- 6. **Purification of metals**: By different processes like liquation, electro refining, zone refining, cupellation etc.

Ore and minerals

- Minerals are the natural materials in which the metals and their compounds are found in earth.
- Ores are those minerals from which metal are extracted conveniently and profitably. These ores contain good percentage of metal.

"All ores are minerals but all minerals are not ores"

Different ores and their composition

Types of ores	Element	Name of ores
Oxides	Aluminium	Bauxite (Al ₂ O ₃ .2H ₂ O)
	Copper	Cuprites (Cu ₂ O)
	Iron	Hematite (Fe ₂ O ₃)
	Tin	Casseterite (SnO ₂)
Carbonate	Calcium	Limestone (CACO ₃)
	Zinc	Calamine (ZnCO ₃)
	Iron	Siderite (FeCO ₃)
Sulphide	Zinc	Zinc blende (ZnS)
	Copper	Copper glance (Cu ₂ S)
	Lead	Galena (PbS)
	Mercury	Cinnabar (HgS)
Halide	Sodium	Rock Salt (NaCl)
	Fluoride	Fluorspar (CaF ₂)
	Silver	Horn silver (AgCl)

Metals	Occurrence	
1. Lithium	Spodumeme LiAl(SiO ₃) ₂ Lipidolite	
2. Sodium	Rock salt (NaCl)	
3. Magnesium	Carnallite (KCl.MgCl ₂ .6H ₂ O) Magnesium (MgCO ₃)	
4. Calcium	Limestone (CACO ₃) Dolomite (MgCO ₃ .CaCO ₃) Gypsum (CaSO ₄)	
5. Copper	Cuprites (Cu ₂ O) Copper glance (Cu ₂ S)	
6. Aluminum	Bauxite (Al ₂ O ₃ .2H ₂ O) Cryolite (Na ₂ AlF ₆)	
7. Zinc	Zinc blende (ZnS) Zencite (ZnO) Calamine (ZnCO ₃)	
8. Lead	Galena (PbS)	
9. Iron	Hematite (Fe_2O_3) Magnetite (Fe_2O_4) Siderite $(FeCO_3)$ Iron pyrite (FeS_2) Limonite $(Fe_2O_3.3H_2O)$	

Discussion

- 1. What do you mean by metallurgy?
- 2. Explain "All ores are minerals but all minerals are not ores"
- 3. Difference between metal, non metal and metalloids