

Management Topic in Environmental Studies)

B. Tech 7TH Semester



Mineral Resources

Unit 2

Natural Resources

Department: Chemistry
Subject: MTES (CHM2049)



Mineral Resources



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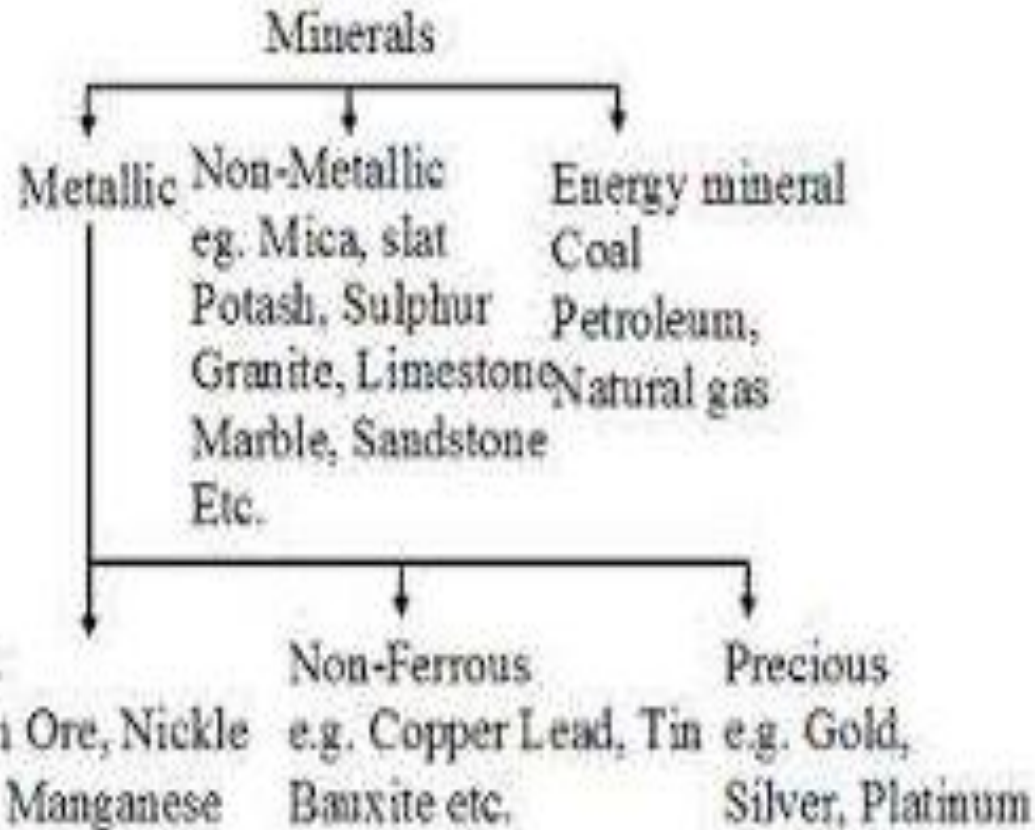
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Introduction

- Minerals are naturally occurring, inorganic, crystalline solids having a definite chemical composition and characteristic physical properties.



Critical minerals: are essential for the economy of a nation
e.g. iron, aluminium, copper, gold etc.

Strategic minerals: required for the defence of a country
e.g. Uranium, Manganese, cobalt, platinum, chromium
Vanadium, tungsten, molybdenum, cobalt etc.

Uses and exploitation

- The main uses of minerals are as follows:
- (i) **Development of industrial plants and machinery.**
- (ii) **Energy Source:** coal, lignite, uranium.
- (iii) **Construction**, housing, settlements.: Iron,
- (iv) **Defence equipments-weapons**, armaments.
- (v) **Transportation means.**; Rail, Vehicle
- (vi) **Communication**- telephone wires, cables, electronic devices.
- (vii) **Medicinal system**- Ayurvedic/Allopathic System: Ag, Au, Zn
- (viii) **Formation of alloys** for various purposes (e.g., Bronze, Brass).
- (ix) **Agriculture:** fertilizers, seed dressings and fungicides (e.g. **zineb** containing zinc, **Maneb**-containing manganese etc.).
- (x) **Jewellery:** Gold, silver, platinum, diamond.

Metals and minerals in a Smart Phone



- Copper (16 grams) ¹
 - Silver (0.35 grams) ¹
 - Gold (0.034 grams) ¹
 - Palladium (0.015 grams) ¹
 - Platinum (0.00034 grams) ¹
 - Ceramic magnetic switches containing rare earths ²
 - Indium²
 - Titanium dioxide ²
 - Indium tin oxide ²
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- ¹ source – USGS <http://pubs.usgs.gov/fs/2006/3097/>
 - ² source – NRC critical minerals report

Major uses of some non-metallic minerals

Non-metal Mineral	Major Uses
Silicate minerals	Sand and gravel for construction, bricks, paving etc.
Limestone	Used for concrete, building stone, used in agriculture for neutralizing acid soils, used in cement industry
Gypsum	Used in plaster wall-board, in agriculture
Potash, phosphorite	Used as fertilizers
Sulphur pyrites	Used in medicine, car battery, industry.

- **Maximum quantity used:** Iron and steel (740 million metric tons annually)
- followed by manganese, copper, chromium, aluminium and Nickel.

Major reserves and important uses metals

Metal	Major World Reserves	Major Uses
Aluminium	Australia, Guinea, Jamaica	Packaging food items, transportation, utensils, electronics
Chromium	CIS, South Africa	For making high strength steel alloys, In textile/tanning industries
Copper	U.S.A., Canada, CIS, Chile, Zambia	Electric and electronic goods, building, construction, vessels
Iron	CIS, South America, Canada, U.S.A.	Heavy machinery, steel production transportation means
Lead	North America, U.S.A., CIS	Leaded gasoline, Car batteries, paints, ammunition
Manganese	South Africa, CIS, Brazil, Gabon	For making high strength, heat-resistant steel alloys
Platinum group	South Africa, CIS	Use in automobiles, catalytic converters, electronics, medical uses.
Gold	South Africa, CIS, Canada	Ornaments, medical use, electronic use, use in aerospace
Silver	Canada, South Africa, Mexico	Photography, electronics jewellery
Nickel	CIS, Canada, New Caledonia	Chemical industry, steel alloys

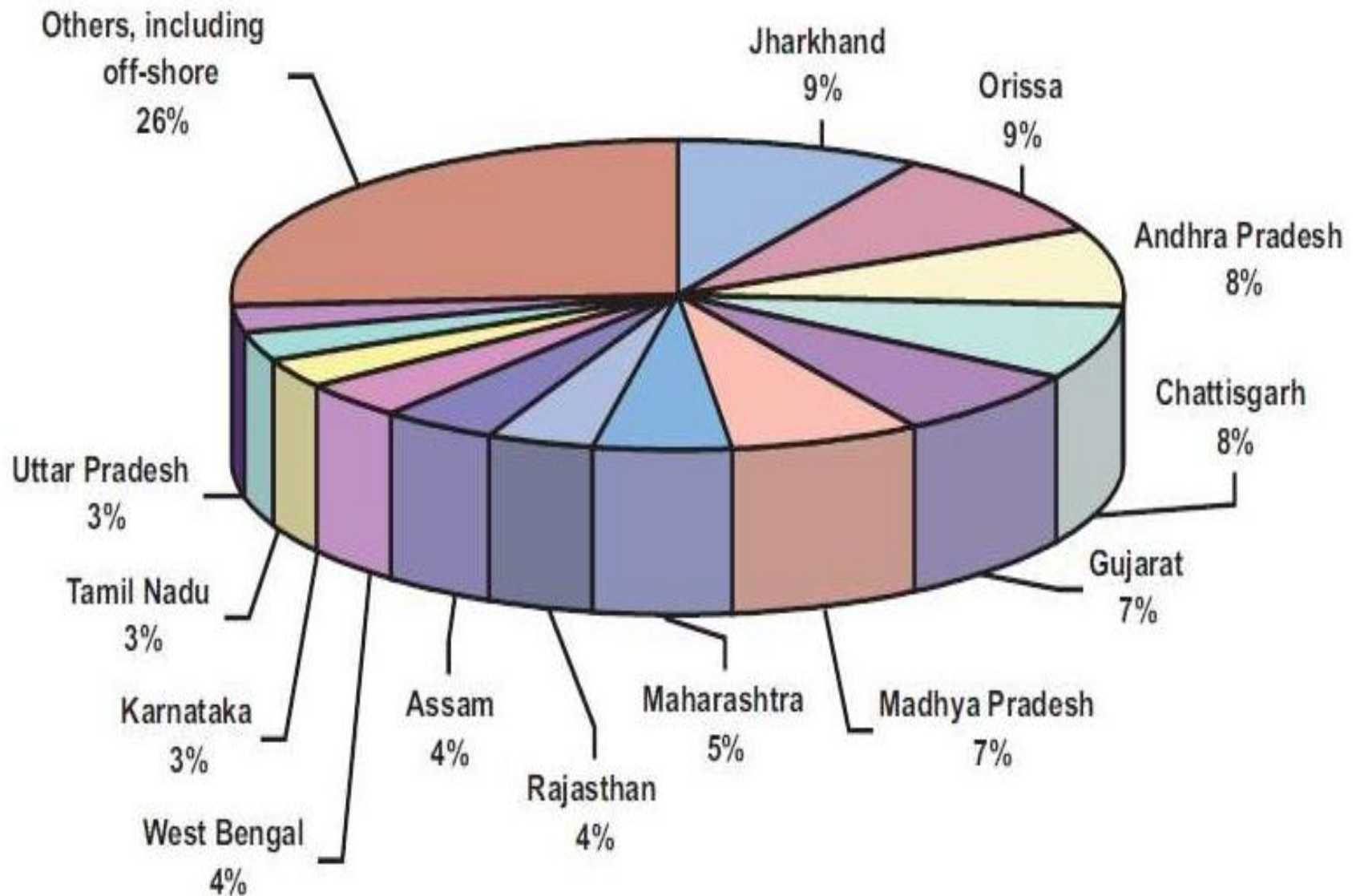
- **Major world reserves of most of the metallic minerals are:**
- USSR, USA, Canada, South Africa and Australia
- Japan virtually no metal reserves

Major Minerals of India

- (a) **Energy generating minerals:** Coal and lignite: West Bengal, Jharkhand, Orissa, M.P., A.P.
- **Uranium (Pitchblende or Uranite ore):** Jharkhand, Andhra Pradesh (Nellore, Nalgonda), Meghalaya, Rajasthan (Ajmer).
- (b) **Other commercially used minerals** Aluminium (Bauxite ore): Jharkhand, West Bengal, Maharashtra, M.P., Tamilnadu.
- **Iron (haematite and magnetite ore):** Jharkhand, Orissa, M.P., A.P., Tamilnadu, Karnataka, Maharashtra and Goa.
- **Copper (Copper Pyrites):** Rajasthan (Khetri), Bihar, Jharkhand, Karnataka, M.P., West Bengal, Andhra Pradesh and Uttaranchal.

India is the producer of 84 minerals the annual value of which is about Rs. 50,000 crore

State wise share of minerals Production in India



Production of major metallic minerals in India

Item	Production (Rs. Crore)	% Share
Iron ore	9695.12	75.4
Chromite	1171.68	9.1
Zinc Concentrate	647.29	5.0
Manganese ore	477.48	3.7
Bauxite	303.22	2.4
Copper Concentrate	259.84	2.0
Primary Gold	199.61	1.6
Lead Concentrate	89.37	0.7
Total Metallic Minerals	12858.71	100.0

Mineral Reserves in Odisha

Odisha is the hub of minerals resource in India

Mineral	Reserves (000 Tonnes)	Percentage of Country's Reserves
Bauxite	607997	67.6
Iron ore(hematite)	2251777	32.1
Pyrophyllite	6452200	33.1
Silver ore	1079500	93.1
Limestone	997830	76.9
Chromite	65033	98.3

Major mines causing severe Environmental problems

- i) Jaduguda Uranium Mine: , Jharkhand.exposing local people to radioactive hazards.
- (ii) Jharia coal mines: Jharkhand.underground fire leading to land subsidence and forced displacement of people.
- (iii) Sukinda chromite mines, Orissa. seeping of hexavalent chromium into river posing serious health hazard, Cr^{6+} being highly toxic and carcinogenic.
- (iv) Kudremukh iron ore mine, Karnataka.causing river pollution and threat to biodiversity.
- (v) East coast Bauxite mine, Orissa.Land encroachment and issue of rehabilitation unsettled.
- (vi) North-Eastern Coal Fields: Assam.Very high sulphur contamination of groundwater.

Impacts of mining:

- (i) **Devegetation and defacing of landscape:** The topsoil as well as the vegetation are removed deforestation leads to several **ecological losses, increase the landscape. prone to soil erosion.**
- (ii) **Subsidence of land:** Mainly associated with underground mining. results in tilting of buildings, cracks in houses, buckling of roads, sudden change in structure bending of rail tracks and leaking of gas from cracked pipelines leading to serious disasters.
- (iii) **Groundwater contamination:** pollutes the groundwater
- **Sulphur containing ore** converted into sulphuric acid through microbial action, thereby making the water acidic which enhances toxic **metal leaching posing health hazards.**

Impacts of mining:

- (iv) **Surface water pollution:** The acid mine drainage often contaminates the nearby streams and lakes.

Sometimes uranium, Cr, Pb, Cd, As contamination by mine wastes kill aquatic animals and creating human health hazards.

- (v) **Air pollution:** Ore, smelting emits air pollutants damaging the vegetation and serious environmental damage and human health hazard .

The suspended particulate matter (SPM),
SO_x, soot, arsenic particles,
cadmium, lead etc.

Occupational Health Hazards

Most of the mining worker suffer

- Respiratory and skin diseases due to constant exposure to the suspended particulate matter and toxic substances.
Suffer by Asbestosis, silicosis, black lung disease etc.
- **Statistical data:** , on an average, there are 30 non-fatal but disabling accidents per every ton of mineral produced
- one death per 2.5 tons of mineral produced.
- **Remedial measures:**
 - i) **Adopt eco-friendly mining technology:** Microbial-leaching technique
 - *Thiobacillus ferrooxidans* used for extracting gold embedded in iron sulphide ore
it remove sulphur from ore

Remedial measures

- ii) Restoration of mined areas by re-vegetating: them with appropriate plant species, stabilization of the mined lands, gradual restoration of flora,
- iii) prevention of toxic drainage discharge and need suitable treatment.
- iv) Controlling the standards of air emissions are essential for minimizing environmental impacts of mining.



Thank You
All