
Minerals and Energy Resources

Minerals

- Mineral are a “homogenous, naturally occurring substance with a definable internal structure.
- These are found in varied forms in nature, ranging from the hardest diamond to the softest talc.

Mode of Occurrence of Minerals

Minerals are usually found in 'ores'. The accumulation of any mineral mixed with other elements is called ore.

Minerals generally occur in these forms:

- In igneous and metamorphic rocks minerals may occur in the cracks, crevices, faults or joints. The smaller occurrences are called veins and the larger are called lodes. Example: tin, copper, zinc and lead etc.
- In sedimentary rocks, a number of minerals occur in beds or layers. Example: Coal, iron, gypsum, potash salt, sodium salt etc.
- Minerals also found in the decomposition of surface rocks, and the removal of soluble constituents, leaving a residual mass of weathered material containing ores. Example: Bauxite.
- Minerals may occur as alluvial deposits in sands of valley floors and the base of hills known as ‘placer deposits’. Example: Gold, silver, tin and platinum etc.

- The ocean waters contain vast quantities of minerals. Example: Common salt, Magnesium and Bromine etc.

Classification of Minerals

Minerals can be classified into three types:

- a. Metallic Minerals
- b. Non-Metallic Minerals
- c. Energy Minerals

a) Metallic Minerals

These minerals contain metals and are of following types:

1. Ferrous minerals:

- These minerals contain iron and accounts for about three- fourths of the total value of the production of metallic minerals.
- They provide a strong base for the development of metallurgical industries.

Iron Ore

It is the basic mineral and the backbone of industrial development.

Magnetite is the finest iron ore with a very high content of iron up to 70 percent.

Hematite ore is the most important industrial iron ore in terms of the quantity used, but has a slightly lower iron content than magnetite. (50-60 percent).

India is rich in good quality iron ores.

The major iron ore belts in India are:

- Odisha-Jharkhand belt.
- Durg-Bastar-Chandrapur belt in Chhattisgarh and Maharashtra.
- Bellary-Chitradurga-Chikmagalur-Tumkur belt in Karnataka.
- Maharashtra-Goa belt in Goa and Ratnagiri district of Maharashtra.

Manganese

- It is mainly used in the manufacturing of steel and ferro-manganese alloy.
- It is also used in manufacturing bleaching powder, insecticides and paints.
- Orissa is the largest producer of manganese ores in India.

Non-Ferrous Minerals

These minerals do not contain iron.

- They play role in a number of metallurgical, engineering and electrical industries.
- Example of Non-ferrous minerals includes copper, bauxite, lead, zinc and gold.

Copper

- It is malleable, ductile and a good conductor, therefore, copper is mainly used in electrical cables, electronics and chemical industries.
- The Balaghat mines in Madhya Pradesh, Khetri mines in Rajasthan and Singhbhum district of Jharkhand are leading producers of copper.

Bauxite

- It is a clay-like substance from which alumina and later aluminum is obtained.
- Aluminum is an important metal because it combines the strength of metals such as iron, with extreme lightness and also with good conductivity and great malleability.
- In India, mainly found in the Amarkantak plateau, Maikal hills and the plateau region of Bilaspur-Katni.

b) Non-Metallic Minerals

These minerals do not contain metal.

Mica

It is a mineral made up of a series of plates or leaves.

It can be clear, black, green, red yellow or brown.

Mica is one of the most indispensable minerals used in electric and electronic industries due to its excellent di-electric strength, low power loss factor, insulating properties and resistance to high voltage,

Leading producer are northern edge of the Chota Nagpur plateau. Koderma Gaya – Hazaribagh belt of Jharkhand.

Also produced in Ajmer, Rajasthan. Nellore mica belt of Andhra Pradesh.

Limestone

- Limestone is found in association with rocks composed of calcium carbonates or calcium and magnesium carbonates.
- It is the basic raw material for the cement industry and essential for smelting iron ore in the blast furnace.

Conservation of Minerals

Why to conserve minerals?

- Mineral deposits are present in very less quantity in the world i.e. one per cent of the earth's crust.
- The geological processes of mineral formation are so slow while the consumption rate is very fast therefore, mineral resources are finite and non-renewable.
- So, we have to conserve minerals so that it is available for future generation.

How to conserve minerals?

- A joint effort has to be made in order to use our mineral resources in a planned and sustainable manner.
 - Improved technologies need to be constantly evolved to allow use of low grade ores at low costs.
- Recycling of metals, using scrap metals and other substitutes.

c) Energy Resources

Energy is needed to cook, to provide light and heat, to propel vehicles and to drive machinery in industries.

It can be generated from fuel minerals like coal, petroleum, natural gas, uranium and from electricity.

Energy resources can be classified as:

- Conventional sources: include firewood, cattle dung cake, coal, petroleum, natural gas and electricity.
- Non-conventional sources: include solar, wind, tidal, geothermal, biogas and atomic energy.

Conventional sources of Energy.

Coal

- It is the most abundantly available fossil fuel.
- It is used for power generation, to supply energy to industry as well as for domestic needs.
- Coal is formed due the compression of plant material over millions of years.
- There are various types of coals (on the degrees of compression and the depth and time of burial):

Peat: Low carbon and high moisture contents and low heating capacity.

Lignite: Low grade brown coal, which is soft with high moisture content.

Bituminous: Buried deep and subjected to increased temperatures. Most popular coal in commercial use.

Anthracite: Highest quality hard coal.

In India, coal occurs in Gondwana and tertiary rock stages. The major resources of Gondwana coal are located in

- Damodar valley (West Bengal-Jharkhand).
Jharia, Raniganj, Bokaro.
- The Godavari, Mahanadi, Son and Wardha valleys.
- Tertiary coals occur in the north eastern states of Meghalaya, Assam, Arunachal Pradesh and Nagaland.

Petroleum

- It provides fuel for heat and lighting, lubricants for machinery and raw materials for manufacturing industries.
- Petroleum refineries act as a “nodal industry” for synthetic textile, fertiliser and numerous chemical industries.
- About 63 per cent of India’s petroleum production is from Mumbai High, 18 per cent from Gujarat and 16 per cent from Assam.

Natural Gas

- It is used as a source of energy as well as an industrial raw material in the petrochemical industry.
- It is considered an environment friendly fuel because of low carbon dioxide emissions.
- Natural gas have been discovered in the Krishna- Godavari basin, Mumbai High and allied fields, Gulf of Cambay. Andaman and Nicobar islands.

Electricity

It has a wide range of applications in today's world.

Electricity is generated mainly in two ways:

- by running water which drives hydro turbines to generate hydro electricity
- By burning other fuels such as coal, petroleum and natural gas to drive turbines to produce thermal power.

Hydro electricity is generated by fast flowing water

It is a renewable resource.

Multi-purpose projects like the Bhakra Nangal, Damodar Valley Corporation, the Kopili Hydel Project etc. produce hydroelectricity.

Thermal electricity is generated by using coal, petroleum and natural gas.

The thermal power stations use non-renewable fossil fuels for generating electricity.

Non-Conventional Sources of Energy

Nuclear or Atomic Energy

- It is obtained by altering the structure of atoms.
- It is used to generate electric power.
- Uranium and Thorium are available in Jharkhand and the Aravalli ranges of Rajasthan.
- The Monazite sands of Kerala is also rich in Thorium.

Solar Energy

- India is a tropical country, therefore it has enormous possibilities of tapping solar energy.
- Photovoltaic technology converts sunlight directly into electricity.
- Solar energy is fast becoming popular in rural and remote areas which help in minimizing the dependence of rural households on firewood and dung cakes that will contribute to environmental conservation and adequate supply of manure in agriculture.

Wind Power

- India has great potential of wind power.

- Largest wind farm cluster is located in Tamil Nadu from Nagarcoil to Madurai.
- Andhra Pradesh, Karnataka, Gujarat, Kerala, Maharashtra and Lakshadweep have important wind farms.
- Nagarcoil and Jaisalmer are well known for effective use of wind energy in the country.

Biogas

- Shrubs, farm waste, animal and human waste are used to produce biogas for domestic consumption in rural areas.
- Biogas plants using cattle dung are known as 'Gobar gas plants' in rural India.
- Biogas provide twin benefits to the farmer in the form of energy and improved quality of manure.

Tidal Energy

- Oceanic tides can be used to generate electricity.
- In India the Gulf of Khambhat, the Gulf of Kutch in Gujarat on the western coast and Gangetic delta in Sunderban regions of West Bengal provide ideal conditions for utilising tidal energy.

Geo Thermal Energy

The heat and electricity produced by using the heat from the interior of the Earth is called Geo thermal Energy.

- Groundwater in high temperatures area absorbs heat from the rocks and becomes hot. It is so hot that when it rises to the earth's surface, it turns into steam.
- This steam is used to drive turbines and generate electricity.
- Two experimental projects have been set up in India to utilize geothermal energy:
 - Parvati valley near Manikarn in Himachal Pradesh
 - Puga Valley, Ladakh.

Conservation of Resources

Energy is a basic requirement for economic development.

There is an urgent need to develop a sustainable path of energy development.

There are two ways for adopting the path of sustainable development of energy:

- Promotion of energy conservation
- increased use of renewable energy sources

Some steps in this direction are:

- Using public transport systems instead of individual vehicles
- Switching off electricity when not in use
- Using power-saving devices
- Using non-conventional sources of energy.