Minerals and Energy Resources - Class 10 Social Science Notes

Chapter Overview

Minerals and energy resources are the foundation of industrial development and economic growth. India is rich in mineral resources but faces challenges in their extraction, processing, and sustainable utilization.

1. Introduction to Minerals

Definition

Minerals are naturally occurring substances that have a definite chemical composition and are formed through geological processes.

Characteristics of Minerals

- Naturally occurring inorganic substances
- Have definite chemical and physical properties
- Formed through geological processes over millions of years
- Uneven distribution on earth's surface
- Non-renewable resources (except a few like salt)

Importance of Minerals

- Raw materials for industries
- Source of energy (coal, petroleum)
- Essential for infrastructure development
- Export earnings and foreign exchange
- Employment generation
- Foundation of modern civilization

2. Classification of Minerals

A. Based on Chemical and Physical Properties

Metallic Minerals

Definition: Minerals that contain metals in raw form

Characteristics:

- Good conductors of heat and electricity
- Malleable and ductile

- Lustrous appearance
- Can be melted to obtain metals

Types:

1. Ferrous Minerals (contain iron)

- **Iron Ore**: Hematite, magnetite, limonite, siderite
- **Manganese**: Used in steel making
- **Chromite**: Used in steel and chemical industries

2. Non-Ferrous Minerals (do not contain iron)

- **Copper**: Electrical industry, utensils
- **Bauxite**: Aluminum extraction
- **Lead**: Batteries, paints
- **Zinc**: Galvanizing, brass making
- **Gold**: Jewelry, electronics
- **Silver**: Jewelry, photography

Non-Metallic Minerals

Definition: Minerals that do not contain metals

Characteristics:

- Poor conductors of heat and electricity
- Not malleable or ductile
- Various colors and luster
- Cannot be melted to obtain metals

Examples:

- **Limestone**: Cement industry, iron smelting
- **Dolomite**: Iron and steel industry
- **Fluorspar**: Chemical industry
- **Gypsum**: Cement, fertilizer industry
- **Mica**: Electrical industry
- **Salt**: Chemical industry, food preservation

B. Based on Formation

Igneous and Metamorphic Rock Minerals

- Formed in cracks, crevices, faults, and joints
- Examples: Iron ore, copper, nickel, chromite
- Found in: Karnataka, Odisha, Jharkhand, Chhattisgarh

Sedimentary Rock Minerals

- Formed through evaporation and sedimentation
- Examples: Coal, petroleum, limestone, gypsum
- Found in: Coal belt areas, western and eastern coasts

Placer Deposits

- Formed through weathering and erosion
- Minerals deposited in riverbeds, seashores
- Examples: Gold, silver, tin, platinum
- Found in: Sands of Kerala (monazite), Karnataka (gold)

C. Based on Use

Energy Minerals

- **Coal**: Thermal power, steel industry
- **Petroleum**: Transportation, petrochemicals
- **Natural Gas**: Domestic fuel, fertilizers
- **Uranium**: Nuclear power

Industrial Minerals

- **Iron Ore**: Steel production
- **Bauxite**: Aluminum industry
- **Copper**: Electrical industry
- **Limestone**: Cement industry

3. Major Minerals of India

A. Iron Ore

Types:

1. **Hematite**: Best quality, 70% iron content
2. **Magnetite**: High grade, 72% iron content
3. **Limonite**: Lower grade, 60% iron content

4. **Siderite**: Lowest grade, 48% iron content

Major Producing Areas:

- **Odisha**: Mayurbhanj, Kendujhar, Sundargarh (55% of India's production)
- **Chhattisgarh**: Bailadila mines (Dantewada district)
- **Jharkhand**: Singhbhum district
- **Karnataka**: Ballari, Chitradurga, Tumkur
- **Goa**: High-grade ore, mostly exported

Uses:

- Raw material for iron and steel industry
- Heavy and light engineering industries
- Export earnings

B. Manganese

Characteristics:

- Used as a flux in iron and steel industry
- Improves strength and hardness of steel
- Used in dry cell batteries, chemicals

Major Producing Areas:

- **Odisha**: Kendujhar, Sundargarh, Kalahandi (largest producer)
- **Karnataka**: Ballari, Chitradurga
- **Madhya Pradesh**: Balaghat, Chhindwara
- **Maharashtra**: Nagpur, Ratnagiri

C. Copper

Characteristics:

- Excellent conductor of electricity and heat
- Malleable and ductile
- Resistant to corrosion

Major Producing Areas:

- **Rajasthan**: Khetri mines (largest producer)
- **Jharkhand**: Singhbhum district

- **Madhya Pradesh**: Balaghat district
- **Karnataka**: Hassan district

Uses:

- Electrical industry (wires, cables)
- Electronics and telecommunications
- Utensils and decorative items
- Alloys (brass, bronze)

D. Bauxite

Characteristics:

- Ore of aluminum
- Formed through weathering of aluminum-rich rocks
- Light weight, non-corrosive metal

Major Producing Areas:

- **Odisha**: Kendujhar, Koraput (largest producer - 45%)
- **Gujarat**: Kachchh, Kheda
- **Jharkhand**: Lohardaga
- **Maharashtra**: Kolhapur, Sangli
- **Chhattisgarh**: Bilaspur

Uses:

- Aircraft industry (lightweight)
- Transportation (automobiles, ships)
- Packaging industry (foils, containers)
- Construction industry

E. Mica

Characteristics:

- Excellent insulator of heat and electricity
- Can be split into thin, transparent sheets
- Heat resistant

Major Producing Areas:

- **Jharkhand**: Hazaribagh plateau (world's largest producer of sheet mica)
- **Bihar**: Gaya, Nawada
- **Rajasthan**: Ajmer, Jaipur
- **Andhra Pradesh**: Nellore

Uses:

- Electrical industry (insulation)
- Electronics industry
- Cosmetics and paints
- Roofing materials

F. Limestone

Characteristics:

- Calcium carbonate compound
- Sedimentary rock mineral
- Basic raw material for cement industry

Major Producing Areas:

- **Rajasthan**: Jodhpur, Jaisalmer (largest producer)
- **Madhya Pradesh**: Satna, Rewa
- **Chhattisgarh**: Bilaspur, Raipur
- **Andhra Pradesh**: Cuddapah, Kurnool
- **Gujarat**: Kutch, Saurashtra

Uses:

- Cement industry (primary use)
- Iron and steel industry (flux)
- Chemical industry
- Paper industry

4. Energy Resources

Classification of Energy Resources

A. Based on Renewability

Renewable Energy Sources (Inexhaustible)

- Solar energy
- Wind energy
- Hydroelectric power
- Tidal energy
- Geothermal energy
- Biomass energy

Non-Renewable Energy Sources (Exhaustible)

- Coal
- Petroleum
- Natural gas
- Nuclear energy

B. Based on Origin

Conventional Energy Sources

- Coal, petroleum, natural gas, hydroelectricity

Non-Conventional Energy Sources

- Solar, wind, biogas, tidal, geothermal

5. Conventional Energy Sources

A. Coal

Formation: Compressed plant remains over millions of years under heat and pressure

Types of Coal:

1. **Peat**: Lowest quality, 40% carbon, high moisture
2. **Lignite**: Brown coal, 40-55% carbon, high moisture
3. **Bituminous**: Most abundant, 55-80% carbon, medium quality
4. **Anthracite**: Highest quality, 80-95% carbon, low moisture

Major Coal Fields:

1. Gondwana Coal Fields (250 million years old)

- **Jharkhand**: Jharia (largest), Bokaro, Giridih
- **Odisha**: Talcher, Sambalpur
- **Chhattisgarh**: Korba

- **West Bengal**: Raniganj
- **Madhya Pradesh**: Singrauli

2. Tertiary Coal Fields (55 million years old)

- **Assam**: Margherita, Ledo
- **Arunachal Pradesh**: Namchik-Namphuk
- **Nagaland**: Wokha
- **Meghalaya**: Cherrapunji, Mawsynram

Uses of Coal:

- Thermal power plants (70% of India's electricity)
- Iron and steel industry (coking coal)
- Cement industry
- Fertilizer industry
- Railways (historically)

Problems:

- Environmental pollution
- High ash content in Indian coal
- Transportation costs
- Mining accidents and health hazards

B. Petroleum (Crude Oil)

Formation: Decomposed organic matter under high pressure and temperature over millions of years

Major Oil Fields:

1. Western Offshore Fields:

- **Mumbai High**: Largest oil field (Arabian Sea)
- **Bassein**: Natural gas
- **Aliabet**: Gujarat coast

2. Western Onshore Fields:

- **Gujarat**: Ankleshwar, Kalol, Mehsana, Navagam
- **Assam**: Digboi (oldest), Naharkatiya, Moran, Rudrasagar

3. Eastern Offshore Fields:

- **Krishna-Godavari Basin**: Andhra Pradesh
- **Cauvery Basin**: Tamil Nadu

Petroleum Refineries:

- **Public Sector**: Barauni (Bihar), Koyali (Gujarat), Mathura (UP), Haldia (West Bengal), Vishakhapatnam (AP), Chennai (Tamil Nadu)
- **Private Sector**: Jamnagar (Gujarat - world's largest), Mumbai, Mangalore

Uses:

- Transportation fuel (petrol, diesel)
- Cooking gas (LPG)
- Petrochemicals (plastics, fertilizers)
- Industrial fuel

C. Natural Gas

Characteristics:

- Cleanest fossil fuel
- Efficient and environmentally friendly
- Found with petroleum deposits

Major Producing Areas:

- **Gujarat**: Hazira, Ankleshwar
- **Assam**: Naharkatiya, Lakshwa
- **Andhra Pradesh**: Krishna-Godavari basin
- **Tamil Nadu**: Cauvery basin
- **Offshore**: Mumbai High, Bassein

Uses:

- Domestic cooking fuel
- Industrial fuel
- Power generation
- Fertilizer industry
- Petrochemicals

D. Electricity

Sources of Electricity in India:

1. Thermal Power (70%)

- Coal-based thermal plants
- Gas-based thermal plants
- Diesel-based plants

2. Hydroelectric Power (22%)

- River valley projects
- Multipurpose projects

3. Nuclear Power (3%)

- Uranium-based power plants

4. Renewable Energy (5%)

- Solar, wind, biogas

Major Thermal Power Plants:

- **Mundra** (Gujarat) - largest
- **Vindhyachal** (Madhya Pradesh)
- **Talcher** (Odisha)
- **Rihand** (Uttar Pradesh)

Major Hydroelectric Projects:

- **Tehri Dam** (Uttarakhand) - largest
- **Sardar Sarovar** (Gujarat)
- **Nagarjuna Sagar** (Telangana)
- **Hirakud** (Odisha)

Nuclear Power Plants:

- **Tarapur** (Maharashtra) - first
- **Kalpakkam** (Tamil Nadu)
- **Narora** (Uttar Pradesh)
- **Kakrapar** (Gujarat)

6. Non-Conventional Energy Sources

A. Solar Energy

Advantages:

- Abundant and free source
- Environment friendly
- No recurring costs after installation
- Suitable for remote areas

Potential Areas:

- Rajasthan, Gujarat, Madhya Pradesh
- Western Himalayas
- Leh-Ladakh region

Major Projects:

- National Solar Mission
- Solar parks in Gujarat, Rajasthan
- Rooftop solar programs

B. Wind Energy

Requirements:

- Wind speed of 15 km/hr minimum
- Steady and consistent winds
- Open areas without obstacles

Major Wind Farms:

- **Tamil Nadu**: Largest producer (Kanyakumari, Coimbatore)
- **Gujarat**: Kutch, Saurashtra
- **Rajasthan**: Jaisalmer
- **Maharashtra**: Western Ghats
- **Karnataka**: Coastal areas

C. Biogas

Source: Organic waste (animal dung, kitchen waste, crop residue)

Advantages:

- Renewable and clean
- Reduces dependence on firewood
- Provides manure for agriculture

- Reduces indoor pollution

Gobar Gas Programme: Government initiative to promote biogas plants in rural areas

D. Tidal Energy

Principle: Rise and fall of ocean tides to generate electricity

Potential Areas:

- Gujarat coast (Gulf of Kachchh)
- West Bengal (Sunderbans)
- Kerala coast

E. Geothermal Energy

Source: Heat from earth's interior

Potential Areas:

- **Himachal Pradesh**: Manikaran
- **Jammu & Kashmir**: Puga valley
- **Ladakh**: Hot springs
- **Chhattisgarh**: Tattapani

7. Conservation of Minerals and Energy

Need for Conservation

Reasons:

- Non-renewable nature of minerals
- Uneven distribution
- Increasing demand due to population growth
- Industrial development requirements
- Export potential and foreign exchange

Methods of Conservation

For Minerals:

1. **Recycling**: Reuse of metals and materials
2. **Substitution**: Using alternatives (aluminum for copper)
3. **Improved Technology**: Better extraction and processing
4. **Reduce Wastage**: Efficient mining and processing

5. **Exploration**: Finding new deposits

For Energy:

1. **Use Renewable Sources**: Solar, wind, hydro
2. **Energy Efficiency**: LED bulbs, efficient appliances
3. **Public Transportation**: Reduce individual vehicle use
4. **Industrial Efficiency**: Better technology and processes
5. **Awareness Programs**: Energy conservation campaigns

Government Initiatives

For Minerals:

- National Mineral Information Centre (NMIC)
- Geological Survey of India (GSI)
- Mineral exploration licensing policy
- National Mineral Policy

For Energy:

- Energy Conservation Act, 2001
- Bureau of Energy Efficiency (BEE)
- Renewable Energy Mission
- Energy efficiency programs

8. Distribution of Minerals in India

Major Mineral Belts

1. North-Eastern Plateau Region

- **States**: Jharkhand, Odisha, Northern Chhattisgarh
- **Minerals**: Iron ore, coal, manganese, bauxite, mica
- **Importance**: Richest mineral belt in India

2. Central Belt

- **States**: Madhya Pradesh, Southern Chhattisgarh
- **Minerals**: Manganese, bauxite, iron ore, coal
- **Features**: Part of Deccan plateau

3. South-Western Plateau Region

- **States**: Karnataka, Goa, Kerala, Tamil Nadu
- **Minerals**: Iron ore, manganese, limestone, bauxite
- **Special**: High-grade iron ore in Karnataka and Goa

4. North-Western Region

- **States**: Rajasthan, Gujarat
- **Minerals**: Petroleum, natural gas, salt, gypsum, limestone
- **Features**: Desert minerals and offshore oil

5. Himalayan Region

- **States**: Jammu & Kashmir, Himachal Pradesh, Uttarakhand
- **Minerals**: Coal (poor quality), limestone, gypsum, slate
- **Limitation**: Difficult terrain for mining

9. Environmental Impact

Mining Impact

- **Land Degradation**: Open cast mining destroys landscape
- **Water Pollution**: Mining effluents contaminate water bodies
- **Air Pollution**: Dust and particulate matter
- **Forest Destruction**: Mining in forest areas
- **Displacement**: Local communities affected

Energy Production Impact

- **Coal Mining**: Land subsidence, water pollution
- **Thermal Power**: Air pollution, fly ash disposal
- **Nuclear Power**: Radioactive waste disposal
- **Large Dams**: Displacement, ecological impact

Mitigation Measures

- **Reclamation**: Restoring mined areas
- **Afforestation**: Planting trees in degraded areas
- **Pollution Control**: Treatment of effluents
- **Renewable Energy**: Shift to clean energy sources
- **Sustainable Mining**: Environment-friendly practices

Key Terms to Remember

- **Ore**: Rock containing sufficient mineral content for extraction
- **Placer Deposits**: Minerals in alluvial deposits
- **Quarrying**: Surface extraction of building materials
- **Smelting**: Extracting metal from ore using heat
- **Refining**: Purifying extracted materials
- **Energy Security**: Assured supply of energy at affordable prices
- **Peak Load**: Maximum electricity demand
- **Grid**: Interconnected power transmission system

Important Statistics

- India ranks 2nd in coal production globally
- 4th largest iron ore producer
- Coal contributes 70% of India's electricity
- Renewable energy target: 500 GW by 2030
- India imports 85% of crude oil requirements
- Jharkhand produces 40% of India's minerals
- Gujarat leads in wind energy production
- Tamil Nadu has maximum wind power capacity

Sample Questions for Practice

1. Distinguish between metallic and non-metallic minerals with examples.
2. Describe the distribution of iron ore in India.
3. Why is coal called a fossil fuel? Explain its formation.
4. Compare conventional and non-conventional sources of energy.
5. Suggest measures to conserve energy resources.
6. Explain the importance of conservation of minerals and energy resources.

Map Work Important Points

Iron Ore: Mayurbhanj (Odisha), Bailadila (Chhattisgarh), Kudremukh (Karnataka) **Coal**: Jharia (Jharkhand), Singrauli (MP), Talcher (Odisha) **Oil Fields**: Digboi (Assam), Mumbai High (Maharashtra), Ankleshvar (Gujarat) **Atomic Power**: Tarapur (Maharashtra), Kalpakkam (Tamil Nadu), Narora (UP)

Tips for Exam Preparation

- Learn the distribution map of major minerals
- Remember the uses of different minerals and energy sources
- Practice drawing and labeling mineral distribution maps
- Understand the formation process of different minerals
- Focus on conservation methods and government policies
- Learn statistics and recent developments in renewable energy