MINERAL RESOURCES

The natural inorganic / organic substances found in the interior of earth and possesses a definite chemical composition and definite physical and chemical properties are known as minerals. Minerals have following features.
They are solids. They are formed naturally in the earth.
They are not alive or made of living things.
They have definite shape.

Mineral Exploration

To discover the metallic or non metallic minerals from the earth.

Mineral Extraction

Taking out the minerals from the earth by different methods.

Mineral Exploitation

Means to utilize the available mineral resources for development purposes.

Types of Mineral

1. Metallic Mineral

Metallic minerals are those which are made up of a metallic compound e.g. Iron, copper. The pure metal can be separated by heating. Mineral resources are non-renewable although many can be recycled and used again. Though we obtain most minerals from quarries and mines, the seabed and sea-water are also rich in minerals.

Characteristics (Metallic Minerals)

1. Economically more valuable e.g. Gold.
2. Generally hard, tough and shiny e.g. Iron.
3. Can change shape without breaking e.g. copper
4. Can be stretched and compressed e.g. Iron.
5. Many are good thermal and electrical conductors e.g. copper.
6. More reactive with water and acid e.g. copper.

1. Chromite (Uses)

It gives hardness and electrical resistance to steel. It is used for bridges and railway carriages. It is used as lining in metallurgical furnaces and for making engineering tools and stainless steel. It is found in large quantity in Zhob Valley and Muslim Bagh (Balochistan). It has fairly large deposits and extraction 134 million tons (2011-12).

Photograph of Chromite.
Study **Fig.1**, which shows chromite extraction in Pakistan.

![Fig.1](image)

**Q.3.** Describe the changes in production from 1992 to 2008.  
**Ans.** Fluctuations  
Increases overall  
Lowest 1994 and highest in 2008  

**Q.4.** Suggest why the production of minerals, such as chromite, varies from year to year.  
**Ans.** Problems with machinery  
Reserves reducing / new reserves exploited / geological problem.  
Fear of terrorism  
Lack of funds / less investment.

Study **Figs 2 & 3** which give information about the extraction of three metallic minerals.

![Figs 2 and 3](image)

**Q.5.** State the difference between the type of information being provided in Fig.2 compared to that in Fig.3.  
**Ans.** **Fig.2** shows quantities / amounts / tons whereas **Fig.3** shows percentage of the total amount.
2. **Iron Ore** (Uses)

It is used in steel making, construction and in transport industry. Iron ore has 430 million tons reserves and extraction 274211 million tons (2011-12). It can be divided into four groups according to grade. They are

1. Magnetite
2. Limonite
3. Hematite
4. Siderite

It is found in Kalabagh, Chaghi, Langrial and Donal Nisar.

**Photograph of Iron Ore.**

3. **Copper** (Uses)

It is used to make copper wire and other electrical appliances specially switches, that carry current. It is also used in making Alloys, water pipes and tanks. It is found at Sandak near chaghi.

**Saindak Copper and Gold Mining Project**

Two Australian companies have explored the proven deposits of copper, Gold and Silver in district Chagai. The Chinese Metallurgical Construction Company and two other companies will do the extraction of metal for the next six years on lease.

The Chinese built the Saindak plant and also arranged for the water supply. The German and French companies provided the power supply system ensuring a power generation of 40 MGW at the plant site. The project will provide job opportunities to the skilled and unskilled labour. According to an estimate there will be a turnover of around $80 million a year.

4. **Manganese** (Uses)

It is used in making dry cell and paints. It is found in Zhob, Lasbella and Galdanian (Balochistan). It has large reserves and extraction is 2378 million tons (2011-12).

5. **Bauxite** (Uses)

Aluminium is mainly obtained from bauxite and is a valuable metal. It is used in utensils, tins, cans and many other products. It is found in Muzaffarabad. It has reserves of over 74 million tons and extraction 166565 million tons (2011-12).

6. **Celestite** (Uses)

It is used in tracer bullets, fireworks, ceramics, paints and plastics. It is found in Dandot. It has moderate deposits and extraction 1855 million tons (2011-12).
2. Non - Metallic Mineral

Are those which are made up of a non metallic compound e.g. Limestone, Gypsum.

Characteristics  (Non-Metallic Minerals)

1. Economically less valuable except power resources e.g. oil, gas and coal e.g. rock salt.
2. Softer, rough and may not shine e.g. clay.
3. Breaks away when shape is changed except oil and gas.
4. Cannot be stretched or compressed except natural gas e.g. gypsum.
5. Poor thermal and electrical conductors e.g. rock salt.
6. Less reactive with water and acid except limestone and salt e.g. clay.

1. Rock Salt  (Uses)

Rock salt is white and pink in color. It is used for the manufacturing of Soda Ash, Bicarbonate of soda, Caustic soda and sodas for Laundry, Textile, Food processing and Tanning industry. Important mines are Khewra, Warcha and Kalabagh. It has over 100 million tons reserves and extraction 1445 million tons (2011-12).

For People

Used in cooking / to flavor food.
Used as a preservative.
Employment at mine.

Rock Salt

2. Gypsum  (Uses)

For Industry

It is used in the manufacturing of paints, rubber, plaster of paris
Raw material in cement and fertilizer industry. It has 350 million tons reserves and 552 million tons extracted (2011-12).

For Agriculture

Spread on saline soils to aid reclamation.
Making fertilizer.
Cement is used for lining the canals.
It is mined from Khewra, Dandot and Daudkhel.
3. **Limestone**  (Uses)

**For Industry**

It is a main raw material for cement industry and cement is used for building the factories and construction industry, also used in the manufacturing of Lime. Bleaching powder. Glass. Soap. Paper and paints. Chemical industry. Flux for iron and steel industry.

It is found widespread in Pakistan e.g. Daud khel, Zinda pir, Kot Digi, Harnai, Ganjotaker, Mangopir and Murlhills. Limestone has very large deposits and 25014 million tons extracted 2011-12.

**For Agriculture**

Lime is used as a fertilizer.
Lime reduces acidity / salinity.
Lime is painted onto the trunks of fruit trees to counteract termites /attacks.
Cement is used to build dams / line canals for irrigation.
Cement may be used for road building / bridges which helps to transport the raw material.

Study Fig.4, which shows limestone and rock salt extraction

![Fig.4](image)

**Q.1.** Describe the distribution of limestone extraction in Pakistan.

**Ans.** Widespread.
- Potowar Plateau / NWFP-Punjab border.
- North Balochistan.
- Central and southern Sindh (Karachi).

**Q.2.** Rock salt and limestone are both ‘bulky goods’. What is the cheapest form of transport for these goods?

**Ans.** Railway.

**Q.3.** Why is the supply of limestone to most areas of Pakistan likely to be cheaper than that of rock salt?

**Ans.** Does not have to travel so far.
- Quarried in many areas / more widely available.
Q.4. What is a mixture of rock salt and water called?
Ans. Brine.

Study Fig.5

Q.5. Name the area A which has many mineral resources.
Ans. Salt Range.

Q.6. Name two minerals that can be extracted in this area.
Ans. Rock salt, Gypsum and Limestone.

4. Marble (Uses)

It is found in bands of white, grey, yellow and brown. It is used in buildings and for making chips for flooring and decorative pieces. It is found at Chaghi, Thano Bula khan and Mullagori. Mullagori is a popular place for the extraction of white marble. This type of marble is exported to other countries. Marble has very large deposits and 758 million tons extracted 2011-12.

5. Sulphur (Uses)

Used to manufacture sulphuric acid, explosive materials, paints, dyes, pulp, fertilizers and is used in the refining of petroleum. It is found in Sanni and Koh-e-sultan. Sulphur has 0.8 million tons deposits and 19919 million tons extracted 2011-12.

6. Clays (Uses)

It can be differentiated into China Clay, Fire Clay and Fuller’s Earth.
i. **China Clay**  (Uses)

It is used in ceramic industry and found in shah deri. It has 4.9 million tons deposits and 38 million tons extracted 2011-12.

ii. **Fire Clay**

It is used in refractories for insulation and preparation of bricks and also used in making pottery and found in salt ranges. It has over 100 million tons deposits and 254 million tons extracted 2011-12.

iii. **Fuller’s Earth**

It is used in steel mills, oil drilling and oil refining and found in Sulaiman ranges. It has fairly large deposits and 17 million tons extracted 2011-12.

7. **Soapstone**  (Uses)

It is found in the form of stone and then crushed to make powder. It is used as a filler in soap, ceramics and face powder. It is found Sherwan (Abbotabad).

8. **Barite**  (Uses)

Used in oil industry and for manufacturing the paints, glass and insecticides and found in Kundi.

**Importance of Minerals**

1. Increases GNP i.e. 0.5 %.
2. Raw material for industry.
3. Employment opportunities.
4. Rock salt and marble is exported.
5. Save / earn foreign exchange.
6. Power for industry.
7. Fuel for transport.

Study Fig.6, which shows mineral extraction in 2008 in Pakistan.
Q.1. Name two minerals shown on Fig.6 that are used to make cement.

Q.2. State the amount of gypsum extracted.
Ans. 640 – 680 thousand tones.

Study Fig.7, which shows the distribution in Pakistan of deposits of three minerals.

Q.1. Which of the minerals has the most widespread deposits?
Ans. Limestone.

Q.2. Which of the mineral has deposits only towards the north of Pakistan?
Ans. Rock salt

Q.3. Name one source of limestone that has led to the development of a cement factory in Karachi.
Ans. Manghopir / Murli Hills.

Q.4. Name one source of limestone that has enabled a cement factory to be built in Hyderabad.
Ans. Ganjo Takar.

Q.5. Explain your choices in (iii) and (iv).
Ans. Limestone / lime is bulky / very heavy / needed in large amount
Not a valuable mineral
Not economic to transport it far.

Q.6. Look at Fig.7 and name one gypsum deposit in the Salt Ranges.
Ans. Dandot / Daud Khel / Khewra.
Mining Processes

Mining is a process of digging rocks and minerals from the earth. Minerals are found at different depths.

Methods of Mining. There are two methods of mining.

1. Open Cast Mining
2. Underground Mining.
   i. Adit Mining
   ii. Shaft Mining

1. Open Cast Mining

It is a type of surface mining in which mineral resources are removed from the earth through large holes or pits dug into the surface.

Some minerals like coal and iron often lie near the surface. Open cast mining scoops up these minerals from near the surface. The minerals bearing rocks are stripped off by giant excavators and power shovels, which then loaded into lorries and railway wagons to be carried away.

Advantages (Open Cast Mining)

Easier access to materials
Easier to transport material to the destination
Cheaper
Safer and faster
No problem of ventilation
Dangers and hazards are less as compared to underground mining.

Disadvantages (Open Cast Mining)

Destroy the landscape
Destroy the natural habitat
Air, water and Noise pollution
Deforestation
Work is affected by weather.

2. Adit Mining

An adit is an opening or passage. Adit mining is done in hilly areas where a mineral seams are exposed on a hillside.
Horizontal shaft into hillside
Possibly several shafts at different levels.
Pick and shovel.
Transported by trucks / trolleys.

3. Shaft Mining

Main shaft (vertical or sloping).
Tunnels / side shafts along seams.
Pick and shovel.
Lifted to surface.
Transported by trucks / trolleys.
Problems (Underground Mining)

2. Dangerous gases may produced which are dangerous for workers life.
3. Due to use of explosive material, the roofs of tunnel may be collapse.

Problems in Mineral Sector

1. Lack of finance.
2. Lack of experts.
3. Low priority given to mineral extraction.
4. Lack of technical knowledge.
5. Inaccessible mineral deposits.

Study Fig. 9, a cross section showing two types of coal mine.

Q.1. For each of the mine A and B, name the type of mine.
Ans. A - adit / drift
     B - Shaft

Q.2. Explain why that is the type of mine there.
Ans. A – Coal (seam) exposed on a slope / can dig tunnels along the seem.
     B – Coal (seam) underground.

Q.3. Name three ways by which coal is mined.
Ans. Shaft, Adit / Drift, Open cast.
Effects (Mining on Environment)

1. Starting extraction of minerals
2. Vegetation cut down resulting in soil exposure
3. Natural landscape deformed due to construction of roads and miners’ houses
4. Rock blasting or digging of earth.
5. Depressions caused by subsidence of land may become flooded.
6. Noise pollution and ground vibration from blasting.
7. Traditional mining methods are hazardous to the health of miners.
8. Land pollution due to mining waste.
10. Air pollution from dust and smoke.
11. Environmental loss.

Q.4. Describe the environmental problems that can be caused by mineral extraction.
Ans. Loss of vegetation / deforestation
Land deformation
Loss of soil, dust
Smoke / gasses produced
Soil erosion
Loss of farmland, noise / vibration.

Q.5. How can these problems be reduced?
Ans. Tree planting
Laws / legislation
Land restoration
Personal health and safety measures
Medical check ups.

Q.6. What are the benefits of extracting mineral resources for local people and the national economy?
Ans. Local People
Employment opportunities in mines
Higher / more stable incomes
Higher living standards / settled lifestyle
Business opportunities for local people / ancillary industries / service
Improvement to local infrastructure such as roads / electricity
Local use of raw material.

National economy
Raw material for industry and agriculture
Revenue / taxes for government
Increase exports and foreign exchange
Reduces national debt / deficit
Reduces imports.

Protection (of the Environment from Mining Hazards)

In order to minimize the environmental degradation due to mining, the following points should be considered.

1. Mining should be done on scientific lines to maximize the benefits and minimize the negative effects.
2. When mining is done in an area, special precautions must be taken to prevent environmental losses.
3. The land should be leveled and the depressions should be filled in after the mining activity to avoid deformation.
4. All the mining waste including gases, fumes and semi-solid waste should be properly treated before their final disposal.
5. The people involved should be provided with proper protective clothing to prevent the effects of gases and dust.
6. The area around the mine should be properly planted with trees so that the atmosphere may remain healthy and when minors come out of the mines, they may have fresh air to breathe.
7. Water treatment plants should be set up to supply clean water to the workers living near mines.

In order to conserve the environment and prevent its degradation there should be:
1. Compulsory afforestation programmes near the mining centers.
2. Proper disposal of the mining waste products, better safety measures in the mines.
3. Improved working conditions for the miners.

**Policies and Measures** (Development of Mineral Resources)

1. **Geological Survey of Pakistan**
   
   It was opened in 1947 for the investigation and mapping of mineral deposits in the country.

2. **Oil and Gas Development Corporation (OGDC)**
   
   It was established in 1961, to explore, develop, produce, refine and sell oil and gas.

3. **Pakistan Mineral Development Corporation (PMDC)**
   
   It was established in 1974 for the exploration and marketing of all the minerals.

4. **Resources Development Corporation (RDC)**
   
   It was established in 1974 to investigate and develop copper mines at Saindak (Baluchistan).

5. **Gemstone Corporation of Pakistan (GCP)**
   
   It was established in 1979 for investigation of gemstone resources.

   A number of Provincial organizations are coordinated with the federal board namely Mineral Investment Facilities Board (MIFB). These are responsible for exploration and utilization of minerals. The provincial agencies include

   - **PMDC** (Punjab Mineral Development Corporation).
   - **BDA** (Baluchistan Development Authority).
   - **SDA** (Sarhad Development Authority).
   - **SCDA** (Sindh Coal Development Authority).

Q. 6. To what extent can more extraction of mineral resources help to increase development in Pakistan?

**Ans.** In favour

- Increase trade / exports / reduce imports
- Rise in GDP / GNP / increase the economy
- Increase employment
- Government earnings
- Foreign investment, industrialization / more industry
- Rural development, Better infrastructure
- Provides more fuel or raw material, Education / skills.
Against
Lack of funds, lack of machinery
In remote areas
Lack of infrastructure
Competition from other countries
Environmental damage
Lack of skills / expertise.

Q.7. Study Fig. 10 which is a map showing the locations where three different non-metallic minerals are extracted in Pakistan.

For any two locations, state the name of the mineral extracted and a use for this mineral. Write your answers in the spaces provided on Fig. 10. You should choose from the following list: gypsum limestone rocksalt

Ans. Location
NW – rocksalt / limestone / gypsum
Central – limestone / gypsum
S – limestone

Uses
Rocksalt: Cooking / preservation / soda (used in laundries / textiles / tanning) / flavouring food.

Gypsum: Paints / fertilisers / boards / cement / to treat saline soil / plaster of paris.

Limestone: For building / cement / bleach / glass / soap / paints / to treat saline soil / bleaching powder / paper.
Q.8. Using Fig. 10 and your own knowledge, suggest difficulties there may be in getting minerals to export markets.

Ans. Heavy / bulky commodities
Expensive to transport
Roads and railways from mining areas poorly developed / or not connected
Mostly extracted far inland / away from ports / Karachi / distance from markets / takes a long time / remoteness
Mountainous / rugged terrain
Theft
Inappropriate / inadequate vehicles to transport minerals.

Q.9. Study Fig. 11 which is a diagram of a coal mine. Choose two terms from the list below and use them to label the diagram in the spaces provided.
adit cage shaft open-cast seam tunnel.

Type of mine ........ Shaft Mining ..............

Cage ........................................

Tunnel ......................................

Seam ........................................

Shaft ......................................

Fig.11

Q.10. Suggest two reasons for using this type of mine and one disadvantage of using it.

Ans. Reasons
To access seams deep below surface
To access seams of different depths
Can exploit further along the seams
Where seam does not appear at / near surface / hillside

Disadvantage
More expensive
Greater risk of accident / flooding / gas build-up – credit all reasonable ways that accidents can happen
Dependent on [power for] lift to the surface.

Q.11. Name the hand tools used in mining.

Ans. Drill, Hammer, Wedge, Power saws and power shovels.

Q.12. Name the metallic products used at domestic level.

Ans. Spoon, Opener, Iron scale and scissors.
Sustainable Mineral Resources

The use of natural products and energy in a way that does not harm the environment. OR

The available mineral resources meet the needs of the present and the future generation but not harm the environment.

Sustainable Development and Mining

- Mining should be done on modern lines to maximize the benefits and minimize the negative effects.
- The discharge of toxic substances and the release of heat, which is harmful to the environment should be strictly checked.
- Proper training should be given to workers.
- The land should be leveled and the depressions should be filled in after the mining activity to avoid deformation.
- Hi-tech knowledge and experts should be available.
- Provision of infrastructure (transport, power, telephone lines, water supply etc).
- Explore more mineral resources.
- Reprocess the mineral waste.

Unsustainable Mineral Resources

The available mineral resources could not meet the needs of the present and the future generation but harm the environment. e.g.

- Deforestation
- Pollution i.e air, water and noise
- Soil erosion
- Lack of infrastructure.
- Corruption

Q.13. What is GDP and how can we increase the GDP in mineral sector?

Ans. The total domestic output of the country including exports called Gross Domestic Product. We can increase the GDP in mineral sector by the following factors:

- Mining should be done on modern lines to maximize the benefits and minimize the negative effects.
- Proper training should be given to workers.
- Provision of infrastructure (transport, power, telephone lines, water supply etc).
- Hi-tech knowledge, machinery and experts should be available.