# Ch - 6
# Rocks

## Differentiate between rocks and minerals -

| Rocks | Minerals |
|---|---|
| 1) A rock can be defined as an aggregate of minerals having no definite chemical composition | 1) Minerals are solid inorganic substance that occur naturally and have a definite chemical composition. |
| 2) Rocks can be classified as igneous, sedimentary and metamorphic. | 2) Four chief mineral groups are - silicates, carbonates, sulphides and metallic minerals. |
| 3) Example - Basalt, sandstone, slate. | 3) Example - Iron, magnesium nickel etc. |

The most abundant minerals of the earth as a whole are - iron, silicon, magnesium, nickel, etc.

The most abundant minerals of the crust are - silicon, aluminium, magnesium.

Rocks differ from one another in texture, structure, colour, permeability, mode of occurance, degree of resistance to denudation, etc.

On the basis of origin there are mainly three kinds of rocks.

## Igneous rocks

1. The word 'igneous' is derived from the latin word 'ignis' meaning fire.

2. These rocks were formed by cooling, solidification and crystallisation of molten material.

3. The chemical composition of these rocks vary from alumino-silicate minerals like quartz and feldspar to granite and rhyolite collectively known as **Sialic Rocks**.

4. Since these rocks were the first to be formed on the earth's surface (as the earth was made up of molten material in the beginning) they are also known as **Primary Rocks**.

## Characteristics of igneous rocks

1. All igneous rocks are crystalline in nature. The size of their crystals depend upon the rate of cooling of the molten material.

2. They are hard and compact thus are resistant to weathering.

3. These rocks are impermeable as water does not percolate through them.

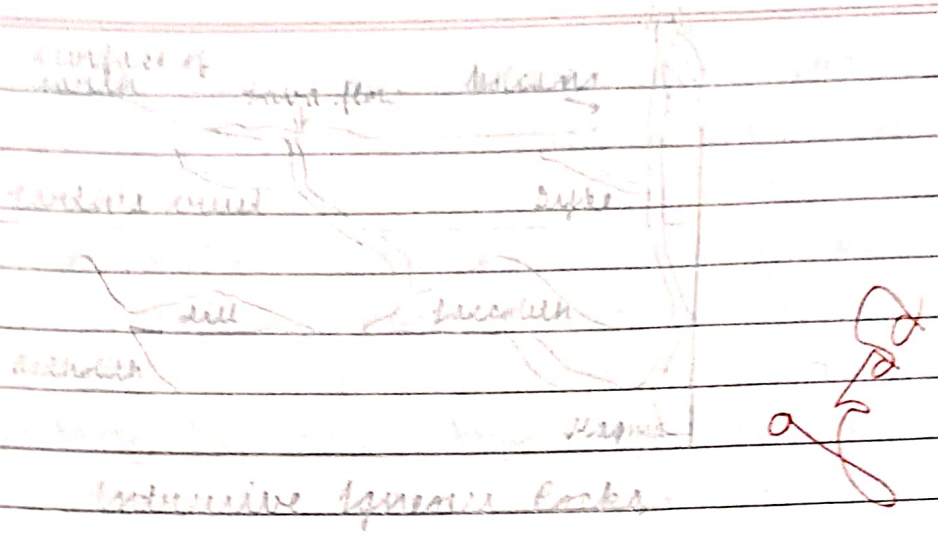
4. They are mostly associated with volcanic activity and are found in the volcanic region.

5. They may be associated with ores of metals.

## Classification of igneous rocks

I. Based on origin

| Extrusive Igneous Rocks (Volcanic) | Intrusive Igneous Rocks (Plutonic) |
|---|---|
| 1. They are formed by the cooling of molten lava on the earth's surface. | 1. They are formed when magma cools within the surface of the earth. |
| 2. Since lava rocks cools faster, these rocks are smooth and fine grained. | 2. As magma solidifies slowly these rocks are coarse textured with large crystals. |
| 3. Example - Basalt. | 3. Example - Granite. |



Types of intrusive igneous rocks

a) Batholiths - They are deep seated intrusion of igneous rocks. They are usually dome-shaped with no definite floor.
They form the cores of mountain ranges.
Example - Ranchi Batholiths.

b) Laccoliths - They are formed when magma solidifies just below the crust.
They are also domed - shaped but the bottom is flat and are smaller in comparison to batholiths.

c) Sills - Sometimes magma flows between layers of rocks horizontally. It then hardens there. This layer of intrusive rock is called sill.

d) Dykes - When magma cools in a vertical column in cracks or fissures it solidifies to form dykes.

e) Volcanic Necks - Sometimes the passage of an extinct volcano is filled with magma. It then solidifies there and is known as volcanic neck or plug.

II Based on Chemical composition

| Acid Igneous Rocks | Basic Igneous Rocks |
|---|---|
| 1. These rocks have a silica content between 65 to 85 per cent. | 1. They have a silica content between 40 to 60 per cent. |
| 2. They generally lack in iron and magnesium thus are lighter in weight and colour. | 2. They have higher percentage of oxides of denser elements thus they are heavy and dark in colour |
| 3. Example - Granite, quartz, mica. | 3. Example - Basalt and dolerite. |

Sedimentary Rocks -

1. Sedimentary rocks are formed by deposition and consolidation of sediments, transported by agents of erosion over a long period of time in subsequent layers.

2. They are also called Secondary rocks as they are formed by the soldification of sediments of original igneous, or sedimentary and

metamorphic rocks.

Characteristics of sedimentary rocks

1. They are formed from materials derived from other rocks, plants and animals thus they contain fossils.

2. They are the most widespread constituting to about 75 per cent the surface area of the earth

3. They are also called stratified rocks as they are formed in layers.

Processes involved in the formation of sedimentary rocks

Lithification means turning the loose sediments into hard rock (lith).
The processes involved in turning the loose materials into hard rocks - evaporation, compaction and cementation.

i) Evaporation - In this case, water from loose materials is evaporated as in the case of rock-salt. The accumulation of rock salt mainly takes place through evaporation before being compacted and cemented.

ii) Compaction - In this process, sediments after piling up are gradually squeezed

by the weight of overlying layers and hardness of underlying layers sand is compacted in this way to sandstone.

iii) Cementation - It is the bonding together of compacted sediments by natural materials such as calcium compounds, silica and iron all of which have the properties of bonding on the loose materials.

I Classification of the basis of formation

i) Mechanically formed sedimentary rocks : In this process sediments are gradually squeezed by the weight of overlying sediments and the lower layers harder to form rocks. Fragments from breaking up of other rocks are called clastic sediments.
Example - shale, sandstone, clay.

ii) Chemically formed rocks : These are formed by direct precipitation of mineral matter from solution. They are compacted through evaporation.
Example - gypsum, rock salt, etc.

iii) Organically formed rocks : These rocks are formed by deposition of dead remains of plants (carbonaceous rocks) and animals (calcareous rocks).
Example of carbonaceous rock is coal and coral reef is an example of calcareous rocks.

II Classification on the basis of agents formation

i) Riverine Rocks - These rocks are formed by the alluvial deposits brought by the flowing water of streams.

ii) Lacustrine Rocks - They are found on the bed of a lake by the deposition of sediments brought by streams.

iii) Glacial Rocks - These rocks are formed by debris brought by glaciers which is left behind in the form of morain which form glacial rocks.

iv) Aeolin Rocks - These rocks are formed by the deposition of sand particles brought by winds, one over the other making them hard to form aeolian sedimentary rocks Example - Loess

v) Marine Rocks - These rocks are of 2 types -

| Calcarious Sedimentary Marine Rocks | Carbonaceous sedimentary rocks |
|---|---|
| 1. These rocks are formed by the deposition of shells and skeletons of sea organisms - corals, clams and | 1. These rocks are formed by the sea plants which remain buried for a very long period. These long |

| | |
|---|---|
| oysters, etc. They live on ocean floor and extract calcium carbonate from ocean water. | preserved remains are known as fossils. They are converted into the form of coal, lignite and peat due to pressure of overlying rocks on them. |
| 2. ex - chalk and limestone. | |

## Metamorphic Rocks -

1. The word 'Metamorphic' is derived from 'metamorphose' which means change in form.

2. These rocks were once igneous or sedimentary and then underwent change through chemical and physical process.

## Characteristics of Metamorphic Rocks -

1. They are harder and more compact than their original form. For example - marble made from limestone is harder.

2. Most of them are impermeable.

3. New minerals are formed during the process of metamorphism.

## Types of Metamorphism

| Thermal Metamorphism | Dynamic Metamorphism |
|---|---|
| 1. It occurs when the transformation of original rocks takes place due to the influence of high temperature. | 1. It occurs when the transformation takes place mainly because of pressure at a great depth within the earth's crust. |
| 2. Example - Slate from clay and graphite from coal | |

| Original Rock → undergoes changes to form | → Metamorphic Rock |
|---|---|
| Limestone | Marble |
| Sandstone | Quartzite |
| Shale | Slate |
| Coal | Graphite |
| Basalt | Schist |
| Granite | Gneiss |
| Dolomite / chalk | Marble |

## Regional Metamorphism

The pressure of overlying rocks and the intense heat caused by large scale earth movements change is known as regional metamorphism.

when a small area is affected by such a change this is known as local or contact metamorphism.

## Economic significance of rocks

1. like minerals, rocks are of great resource value, some directly and some as constituents of minerals.

2. Solis are derived from weathering of rocks.

3. Rocks are a source of precious metals like gold, silver, platinum, etc

4. Apart from minerals and fossil fuels, even rock wastes have now been used in manufacturing various articles.

## Rock cycle -

The continuous process of transformation of old rocks into new ones is known as rock cycle.
In the operation of the rock cycle the earth is kept young and movement of adjustments specially through horizontal flow or convection currents maintain the balance between various elements of the earth.