Rocks

The Earth's crust is made of different types of rocks. Rocks play an important role in the formation of soil. Soil is formed because of weathering and decomposition of rocks. Rocks also contain many minerals.

Differences between rocks and minerals

Rocks	Minerals
Rocks are solid substances which may have the combination of more than one mineral.	Minerals are inorganic substances which occur naturally.
Rocks do not have a definite chemical composition.	Minerals have a definite chemical composition.
Rocks are mainly classified as igneous, sedimentary and metamorphic.	Minerals are mainly classified into four groups—silicates, carbonates, sulphides and metallic minerals.
Examples: Marble, slate, limestone	Examples: Iron, aluminium, calcium

Types of Rocks

On the basis of origin, there are mainly three types of rocks—igneous, sedimentary and metamorphic.

Igneous Rocks

The igneous rocks are also known as **primary rocks** as they form the basis of formation of other types of rocks. Igneous rocks are formed because of cooling, solidification and crystallisation of molten material known as magma. Igneous rocks mainly consist of the alumino-silicate minerals such as quartz and feldspar.

Characteristics of igneous rocks:

- Igneous rocks are hard and resistant to erosion.
- They may be fine grained, smooth and compact or may have large crystals with coarse texture.
- Water may seep into igneous rocks only along cracks and joints. Thus, these rocks are not much affected by chemical weathering.
- These rocks may go through mechanical weathering.
- Igneous rocks are mainly associated with volcanic activities and are generally found in volcanic regions.

Igneous rocks may be classified into extrusive igneous rocks and intrusive igneous rocks.

Extrusive Igneous Rocks

- Extrusive igneous rocks are formed by cooling molten magma on the surface of the Earth. The molten magma comes on to the Earth's surface through cracks, fissures and volcanic eruption.
- They are also known as volcanic rocks. Because these rocks solidify at a faster pace, they are smooth, crystalline and fine grained.
- Basalt is a common example of extrusive igneous rock.

Intrusive Igneous Rocks

- Intrusive igneous rocks are formed when magma cools and solidifies below the surface of the Earth.
- Because these rocks cool down slowly, they have coarse texture with large crystals. Dolomite and granite are some examples of intrusive igneous rocks.
- There are different types of intrusive igneous rocks such as batholiths, laccoliths, dykes and sills.
    - **Batholiths**: Batholiths are formed because of the cooling and solidification of magma below the surface of the Earth. They are generally dome-shaped. They have been exposed to the surface of the Earth because of the action of the agents of erosion.
    - **Laccoliths**: When magma is not fully able to reach the crust of the Earth, it solidifies just below the crust. The upper layers of laccoliths are dome-shaped, but the bottom is almost flat.
    - **Sills**: When magma is forced to rise, it pushes itself between two layers of rocks and solidifies. The sills are horizontal rocks.
    - **Dykes**: When the magma is forced in the upward direction, it fills the cracks and fissures in the existing rocks. It solidifies in these cracks forming dykes. Dykes are often vertical or slanting in position and are often an offshoot of a rock.
    - **Necks**: When the passage of an extinct volcano is filled with magma, it solidifies. This is known as the volcanic neck or plug.

On the basis of chemical composition, igneous rocks are classified into the following:

- Acid Igneous Rocks: These rocks have between 65% and 85% of silica but generally lack in iron and magnesium and so are light. Example: Granite
- Basic Igneous Rocks: These rocks are generally heavy and dark. Example: Basalt

Sedimentary Rocks

Sedimentary rocks are formed when the fragments of igneous rocks are broken down because of weathering and are carried away by the agents of gradation such as water, glaciers and ocean waves. Deposition of these fragments of rocks results in the formation of sedimentary rocks. Lithification is a process where loose sediments are turned into a rock.

Characteristics of sedimentary rocks:

- Sedimentary rocks are also known as secondary rocks as they are formed from the sediments of other rocks denuded and deposited by the agents of gradation.
- They are largely found on the Earth's surface, covering 75% area of the Earth.
- These rocks are generally not crystalline. They are soft and have many layers as they are formed because of the deposition of sediments.
- These rocks may have remains of plants and animals in between various layers.
- Sedimentary rocks may be subdivided on the basis of the nature of sediment, origin and composition.

Classification of sedimentary rocks on the basis of various factors:

On the basis of processes	**Evaporation: When the water evaporates, it leaves behind deposits of one or more chemicals. These chemicals are compacted and cemented to form rocks.** **Compaction: When soft and loose sediments are squeezed by overlying layers of rocks and rocks lying beneath them, they become hardened. For example, sandstone is formed after compacting of sand.** **Cementation: Binding together of compacted sediments by natural materials such as silica and iron is called cementation.**
On the basis of formation	**Mechanically formed rocks**: When old rocks are denuded and broken into fragments by running water or moving glaciers, they are deposited on new lands resulting in the formation of rocks. **Chemically formed rocks**: They are formed when chemical sedimentation takes place generally because of evaporation of water containing salts in the solution. **Organically formed rocks:** These rocks are formed when the remains of plants and animals get compressed forming a rock. For example, limestone and lignite.
On the basis of agents of formation	**Riverine rocks**: These rocks are formed by deposition of alluvial soil by streams of water. **Lacustrine rocks**: These are found on the bed of a lake after long periods of deposition. **Glacial rocks**: These are formed because of the deposition of debris by glaciers. **Aeolian rocks**: The cementation of sand particles brought by winds result in the formation of Aeolian rocks. **Marine rocks**: These rocks are formed at the ocean floor. There are two types of marine rocks. Calcareous marine rocks are formed by deposition of shells and skeletons of sea organisms. Carbonaceous rocks are formed when sea plants and animals are buried under the sea for a long period of time.

Metamorphic Rocks

When existing rocks are subjected to high temperature and pressure, metamorphic rocks are formed. **Metamorphism** is a process by which these metamorphic rocks are formed. It is of three kinds:

Thermal metamorphism: Metamorphism caused by extreme temperature is called thermal metamorphism. It occurs because of the heat generated by magma or due to the friction caused by two moving rocks. Example: Forming of slate from clay

Dynamic metamorphism: It occurs when changes in rocks take place because of large-scale movements of the Earth's crust. The rock may get pushed to greater depths under the surface of the Earth resulting in the formation of new rocks. Example: Shale gets converted to hornfels.

Regional metamorphism: When metamorphism is caused by large-scale changes such as mountain building, the igneous and sedimentary rocks may get buried to form new rocks. This is known as regional

metamorphism. When only a small area is affected, it is called local or contact metamorphism. Example: Sandstone changes into quartzite.

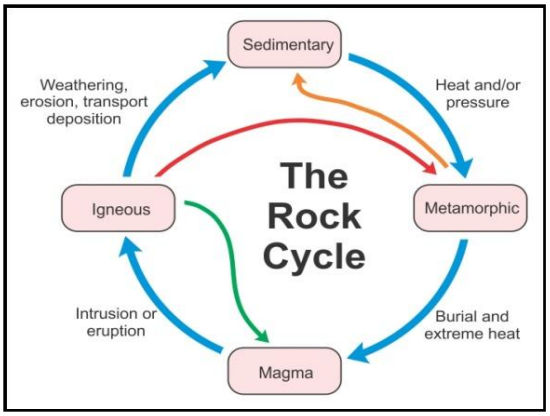
Processes of Metamorphism

Mechanical metamorphism: It occurs when the texture of rocks is changed by crushing and rubbing processes. In this process, shales develop into slaty splits.
Chemical recombination: This process takes place when rocks containing more than one mineral are metamorphosed into one rock.
Chemical replacement: When liquids and gases enter the surface of the Earth through small cracks, they undergo chemical changes and new rocks are formed.
Recrystallisation: It takes place when minerals present in rocks are changed into large crystals before metamorphism.

Rock Cycle

The process of the transformation of rocks from one form to the other in a cyclic manner is known as the **rock cycle**. It includes the following processes:

- Hot lava cools down to form igneous rocks.
- These igneous rocks are then broken down by agents of gradation into small particles which are transported and then deposited. This results in the formation of sedimentary rocks.
- When these igneous and sedimentary rocks are subjected to great heat and pressure, they change into metamorphic rocks.
- These metamorphic rocks break down under heat and pressure and form hot lava.
- This hot magma then again cools down and forms igneous rocks.



The Rock Cycle

Economic Importance of Rocks

Important uses of rocks:

- Rocks have played a great part in the development of civilisations.
- Early men made tools out of rocks and stones. Quartzite was mostly used to make various stone tools.
- Rocks are also used for building many structures. For example, the Red Fort is made of red sandstone and the Taj Mahal is made of white marble.
- Small stones made of rocks are used in playing various games.
- Rocks are used in the construction of many buildings such as granite.
- Rocks have invaluable deposits of minerals. Coal and petroleum are used as fuel. Iron, gold and aluminium are used in various industries.
- Fossils are found in sedimentary rocks. They are a great source of energy.