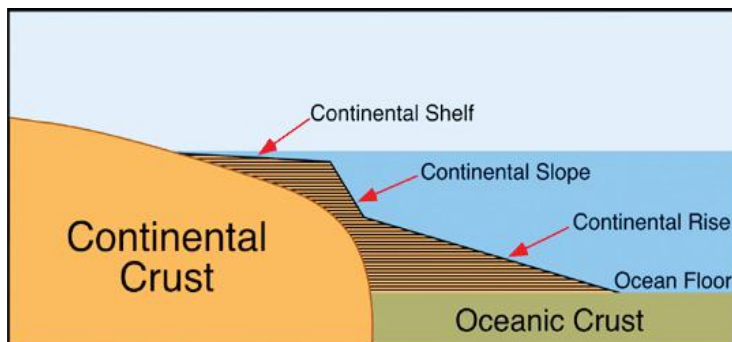


The Earth is primarily composed of rocks. They can be in solid, semi-plastic (semi molten) or liquid (molten) state. They exist in all the three forms in the interior of the Earth. The Earth is made up of several concentric layers with one inside another. There are essentially three layers—crust, mantle and core.

The uppermost and thinnest layer over the Earth's surface is called the **crust**. It is about 35 km on the continental masses and only 5 km on the ocean floors. The main mineral constituents of the continental mass are silica and alumina. It is, therefore, called sial (si-silica, al-alumina)


in short. The oceanic crust is mainly made of silica and magnesium. It is thus called sima (si-silica, ma-magnesium). Since sial is lighter (density = 2.7) than sima (density = 3), continents are said to be floating on a layer of denser sima.



Continental Crust and Oceanic Crust

Just beneath the crust is the **mantle** which extends upto a depth of about 2900 km below the crust. It is made up of semimolten rocks called **viscous magma**. The density of the mantle is from 4.3 to 10. The mantle is semi-molten because the temperature goes on increasing from the surface towards the interiormost part of the Earth. Mantle is divided into two parts—Upper mantle and Lower mantle. The whole mantle extends upto 2900 km in depth. The upper mantle is only about 100 km thick.

The innermost layer or shell is the **core** which is in the molten (liquid) form mainly made up of nickel and iron (ferrum). It is, therefore, called nife (ni-nickel, fe-ferrum). The radius of the core is about 3500 km. Thus the centre of the Earth is about 6400 km from the surface. The density of the core is from 12.3 to 13.6. The core is also comprised of two parts—the outer core and the inner core. Because of very high pressure of overlaying layer, the inner core is found in solid form and the outer core in liquid form. The radius of the inner core is about 1221



km and the thickness of the outer core is about 2250 km. The density of inner core is 13.6 while the density of the outer core varies from 12.3 to 13.3.

The crust forms only 0.5% of the volume of the Earth, 16% volume consists of the mantle and 83% makes the core. The radius of the Earth is 6371 km (about 6400 km, estimated to the hundreds).

Rocks and Minerals

The crust is made up of eight most abundant elements—oxygen, silicon, aluminium, iron, magnesium, calcium, potassium, and sodium. Two or more of these elements unite to form compounds which are known as minerals as they are mined from the crust. The rocks are formed of these minerals. Minerals are solid inorganic compounds and have definite chemical composition. Any natural solid mass of mineral matter that makes up the Earth's crust is called a **rock**. The Earth's crust is made up of various types of rocks.


Rocks can be of different colour, size and texture. The most common physical properties useful for identifying minerals in rocks are texture, colour, hardness, lustre etc. **Hardness** of rocks is tested by scratching them with some sharp object. Talc is the softest and diamond is the hardest of the minerals. Rocks are also tested on the basis of their **porosity**, i.e., how much water penetrates them. If different types of rocks were placed in water for an hour, chalk will absorb the maximum weight of water closely followed by sandstone. Marble will show only a nominal difference and granite the least.

Types of Rocks

There are three major types of rocks based on the mode of formation—igneous, sedimentary and metamorphic.

1. **Igneous Rocks** : The liquid form of molten rocks in the interior of Earth is called **magma**. When the molten magma cools, solidifies and crystallizes inside the Earth's crust or on the Earth's surface, **igneous rocks** are formed. The word 'igneous' means coming out of fire. They are also known as Primary Rocks or Parent Rocks because these rocks were first to form and all other rocks derived from these. There are two types of igneous rocks : extrusive igneous rocks and intrusive igneous rocks.

Molten magma which comes out from the interior of the Earth on its surface through joints and cracks in rocks is called **lava**. This lava rapidly cools down and becomes solid. Rocks formed in such a way are called **extrusive igneous rocks**. Owing to rapid cooling of lava, they have a very fine grained structure. For example, basalt rocks. The Deccan plateau is made up of basalt rocks. At some depth where the heat is not enough, the lava starts cooling down slowly. Solid rocks so formed are called **intrusive igneous rocks**. For example, granite Strong grinding stones used to grind grains and spices are made of granite.



Igneous rocks do not have any strata although lava solidifies layer upon layer. Water does not penetrate these rocks except through cracks. They do not contain fossils (remains of animals and plants) as they are formed from molten rocks in which life form does not survive.

2. **Sedimentary Rocks** : Rocks roll down, hit each other and crack and they are broken down into small fragments. **Weathering** is the long process of breaking up of rocks (expanding by the heat of the Sun in the day and contracting by cooling at night). **Erosion** is the wearing away of the rocks by water, wind and ice. This eroded material is transported and deposited in layers by wind, water, etc. These deposits are called **sediments**. For example, continuous deposition on sea bed by the rivers. They may also contain fossils (remains of dead animals and plants). These loose sediments are compressed by the huge burden of the upper layers and hardened to form layers of rocks. These types of rocks are called **sedimentary rocks**. For example, sandstone is made from grains of sand.



Chalk



Sand stone



Fossils

Some Sedimentary Rocks



Marble



Mica

Sedimentary rocks cover about 75% of the Earth's crust. They have a layered arrangement. Hence, they are also known as **stratified rocks**. Sedimentary rocks may contain rock pieces of various types and/or fossil fuels (coal or oil). Most rocks are porous.

3. **Metamorphic Rocks** : 'Metamorphic' means change in form or nature. Igneous and sedimentary rocks can change into **metamorphic rocks** under great heat and pressure though without melting, often deep inside the Earth. The process of change itself is called **metamorphism**. The heat does not melt the rocks but brings about changes in their texture and structure. For example, granite changes into gneiss, shale or clay changes into slate and limestone into marble. Sandstone changes to quartzite.

There is a limit to the temperature and pressure for metamorphism because if a rock melts under high temperature and pressure and new rock solidifies out of the molten form, it is an igneous rock.

Uses of Rocks : Hard rocks are used for making roads, houses and buildings. Rocks are made up of different minerals. Minerals are used in industries—iron, aluminium, copper, gold, uranium, etc., in medicine, in fertilisers etc. Some are used as fuels—coal, petroleum and natural gas obtained from rocks.



Kailash temple (Ellora) is made of granite (an igneous rock)



The Red Fort is made of red sandstone (a sedimentary rock).

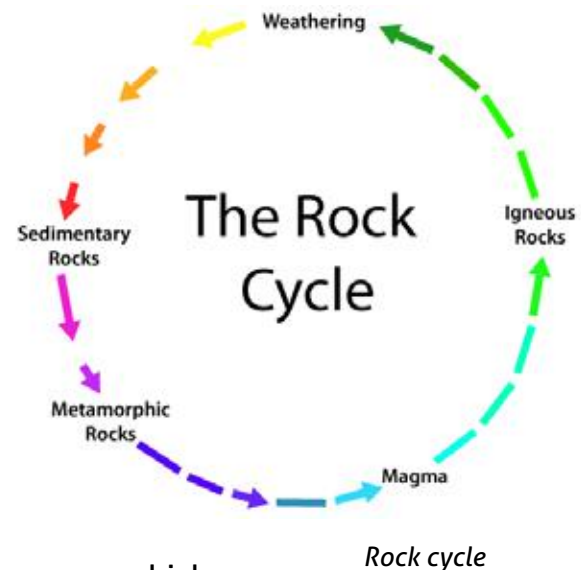


The Taj Mahal is made of white marble (a metamorphic rock)

Rock Cycle

One type of rock can change to another type under certain conditions like weathering and erosion, deposition, pressure, temperature or melting and cooling. This interchange, i.e. the process of transformation of the rock from one to another is known as the **rock cycle**. The rock cycle is an endless process by which rocks are formed, destroyed and formed again.

Igneous as well as metamorphic rocks may be weathered and eroded to form sedimentary rocks. Sedimentary and metamorphic rocks subjected to enormous heat and pressure melt into magma which may cool down to form igneous rocks. Igneous rocks and sedimentary rocks under heat and pressure, without melting, may change to metamorphic rocks.



Key Words

- » Crust : the topmost layer of the Earth.
- » Mantle : the layer of the Earth beneath the crust, about 2900 km thick.
- » Core : the innermost shell of the Earth.
- » Rocks : the hard solid material of the Earth's crust formed of minerals.
- » Minerals : solid inorganic compounds found in rocks.
- » Magma : the molten rock material in the interior of the Earth.
- » Lava : hot molten rock material coming out of Earth through cracks in rocks.
- » Volcano : the crater through which lava erupts from beneath the surface of the Earth.
- » Orbit : the path on which the planets revolve around the Sun.



SUMMARY

- ▶ There are essentially three layers—crust, mantle and core, the Earth is composed of.
- ▶ The layers of the Earth are made up of rocks which can be in solid, semi-molten or molten state.
- ▶ Just beneath the crust is the mantle which extends upto a depth of about 2900 km below the crust. It is made up of semi-molten rocks.
- ▶ The innermost layer or shell is the core which is in the molten form and of about 3500 km radius.
- ▶ The temperature goes on increasing from the surface towards the interiormost part of the Earth.
- ▶ Rocks are the hard solid material of the Earth's crust formed of minerals
- ▶ Minerals are solid inorganic compounds found in rocks.
- ▶ There are three major types of rocks based on the mode of formation—igneous, sedimentary and metamorphic.

Exercise Time

A. Tick (✓) the only correct choice amongst the following :

1. The innermost layer of the Earth is
 - a. Crust
 - b. Core
 - c. Mantle
 - d. Magma
2. The rock made up by the cooling of molten magma is
 - a. Igneous
 - b. Sedimentary
 - c. Metamorphic
 - d. Fossils
3. The thinnest layer of the Earth is
 - a. Mantle
 - b. Core
 - c. Crust
 - d. Upper mantle
4. Rocks which contain fossils are
 - a. Igneous rocks
 - b. Sedimentary rocks
 - c. Metamorphic rocks
 - d. Crust
5. The inner core is made up of
 - a. Ni and Fe
 - b. Sial
 - c. Sima
 - d. Calcium

B. Fill in the blanks :

1. Fossils are trapped in layers of _____ rocks.
2. Red stone is a _____ rock.
3. The molten material inside the Earth is called _____.
4. Granite is _____ rock.
5. Marble is a _____ rock.

C. Match the Following :

- | | |
|-------------|--------------------------------------|
| 1. Rocks | a. made of silicon and alumina |
| 2. Clay | b. has definite chemical composition |
| 3. Sial | c. innermost layer |
| 4. Core | d. changes into slate |
| 5. Minerals | e. used for roads and buildings |



D. Write true (T) or False (F) against the following statements in given brackets :

1. Igneous rocks are crystalline rocks.
2. Lava is the molten rock material inside the Earth.
3. Rock cycle is the endless process of formation, destruction and transformation of rocks.
4. Limestone changes to marble after metamorphism.
5. Fossils are common with igneous rocks.

E. Define the following terms :

1. Magma
2. Lava
3. Core
4. Mantle
5. Crust
6. Minerals
7. Rock cycle
8. Igneous rocks
9. Sedimentary rocks
10. Metamorphic rocks

F. Answer in one word or one phrase :

1. Name the two mineral constituents of the inner core of the Earth.
2. In which three forms are the rocks in the interior of the Earth found ?
3. Name three types of rocks ?
4. What is the radius of the core of the Earth ?
5. What does the word 'metamorphic' means ?

G. Answer these questions briefly :

1. Describe the mantle of the Earth.
2. Name two rocks of each of the three types of rocks.
3. How have Himalayas been formed ?
4. What are the three layers of the Earth ? Give thickness of each.
5. What are metamorphic rocks ?

H. Answer these questions in detail :

1. What are known as rocks ? Describe the formation of each type of the rocks.
2. How are extrusive igneous and intrusive igneous rocks are formed ?
3. What is known as core ? Why is the outer core in liquid form and inner core in solid form ?
4. What do you know about the crust of the Earth ? Give details.
5. Discuss the formation and chief characteristics of sedimentary rocks.

PROJECT WORK

1. Make a clay model of the Earth showing its interior. Colour the layers differently and name them.
2. Collect different types of rocks in the form of stones and pebbles. Identify the type and label them.
3. Marble is found in many colours and patterns. Go to a marble dealer in your city and collect a few small pieces useless for him.