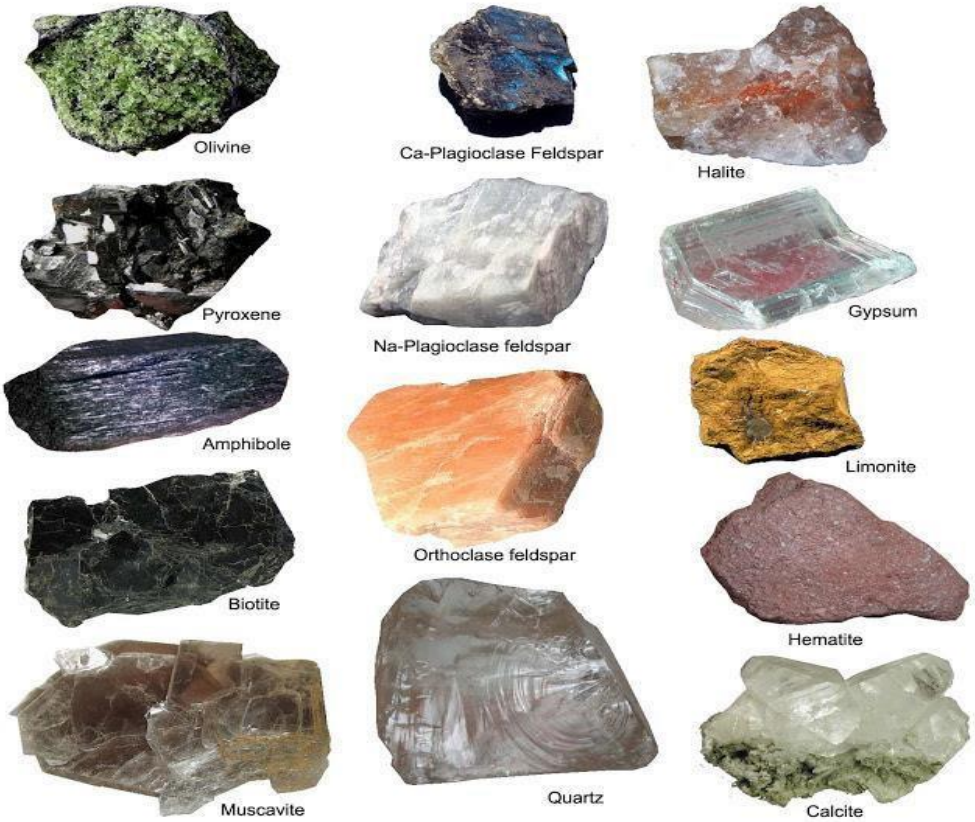
2.1 PHYSICAL PROPERTIES AND CHEMICAL OF MINERALS

Physical Properties of Minerals:-

These are diagnostic from identification in the fields.

1. Colour
2. Streak
3. Lusture
4. Hardness
5. Cleavage
6. Fracture
7. Tenacity
8. Special gravity
9. Form/Structure
10. Odour
11. Fluorescence
12. Phosphorescence
13. Magnetism
14. Habit


Olivine
Ca-Plagioclase Feldspar
Halite
Pyroxene
Na-Plagioclase feldspar
Gypsum
Amphibole
Limonite
Orthoclase feldspar
Biotite
Hematite
Muscavite
Quartz
Calcite

1. **Colour :-**

- Colour of the mineral is due to the absorption and reflection of light.
- Any minerals that appear white will absorb and reflect all the seven colours of the light.
- Any minerals that appear black will absorb all colours, but reflect none of the colours of light.

2. **Streak:-**

- The colour of mineral powder is called as streak.
- The streak may or may not be the same as that of the mineral's colour
- Color of powder scraped off when it is rubbed against a hard, rough surface
- Streak may be a different color than the mineral itself.

Eg:-

Minerals	Colours	Streak
Quartz	White / colourless	white
Pyrite	Golden yellow	Black
Hematite	Cherry red	Black

3. Lusture :-

Lusture is defined as the shining efficiency of a mineral, due to the intensity of light from its surface.

- The natural reflection of surface.
- The light absorption capacity of mineral.
- The refractive index of minerals.
- The way a mineral reflects light from its surface

Non-metallic luster:

– Don’t have much of a reflection; known as glassy, pearly, and dull

Different types of lusture:-

Sl No.	Type of lusture	Represented by	Example
1.	Vitreous lusture	Glassy shine	Quartz
2.	Pearly lusture	Pearly shine	Muscovite
3.	Silky lusture	Silky shine	Asbestos
4.	Metallic lusture	Metallic shine	Magnetite
5.	Adamantine	Diamond like shine	Diamond

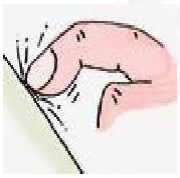
4. Hardness:-

Hardness of a mineral is defined as the resistance against external force of the mineral.

Hardness is a diagnostic and qualitative property of minerals.

Scale of hardness popularly known as Moh's scale.

- The ability to resist being scratched
- Most useful properties for identifying a mineral
- Numbered1-10.
  - 1-Talc-softest
  - 10-Diamond- hardest



The harder white mineral (calcite) scratches the softer one (gypsum).
(Adapted from Jones, 2001: Laboratory Manual for Physical Geology, 3rd edition.)

Moh's scale of hardness

Mineral name	Hardness
Talc	1
Gypsum	2
Calcite	3
Flourite	4
Apatite	5
Feldspar (orthoclase)	6
Quartz	7
Topaz	8
Corundum	9
Diamond	10

Moh's scale of hardness:-

In the scale, the higher hardness minerals will scratch lower hardness minerals .i.e. Diamond will scratch all the nine minerals, but talc will scratch none of the other minerals.

5. Cleavage:-

Cleavage is defined as the direction along which a mineral tends to break with smooth and plane surfaces.

It is the plane of weakness with least cohesion.

Cleavage is a diagnostic property of minerals.

Types of cleavage:-

i. Cubic cleavage: (.E.g.) Galena, Halite

ii. Rhombohedral cleavage: (.E.g.) Calcite

iii. Basal cleavage: (E.g.) Mica

iv. Prismatic cleavage: (E.g.) Natrolite

Further, cleavage of a mineral may be in 1 direction, 2 direction or 3 directions.

(E.g.)

1. Directional cleavage: Mica

2. Directional cleavage: feldspar

3. Directional cleavage: Calcite

6. Fracture:-

Fracture is defined as the appearance of broken surface of a mineral in a direction other than the cleavage direction.

Sl.No	Types of fractures:-	Appearance of broken surface	Example
1.	Even	Smooth and flat	Chert
2.	Uneven	Irregular with minute ridges and depressions	Flourite
3.	Conchoidaol	Concave	Quartz
4.	Splintry	Resembling of broken wood	Kyanite
5.	Hackly	Highly irregular	Native copper
6.	Earthy	Smooth, soft and porus	Chalk

7. Tenacity:-

Tenacity is defined as the resistance of mineral to any external forces that tend to break, bend, cut, crush, or deform it.

Sl.No	Type of tenacity	Description	Example
1.	Brittle	Powdered under hammer.	Calcite
2.	Sectile	Can be cut with a knife.	Talc
3.	Malleable	Can e flattened under hammer.	Tin
4.	Flexible	Can be bent or deformed.	Clay
5.	Elastic	Regain original shape after removal of external force applied	Mica
6.	Plastic	Does not Regain original shape after removal of external force	Clay

8. Specific Gravity:

Where'd' = Density of water = 1

$$\text{Specific Gravity} = \frac{\text{Weight of the mineral in air}}{\text{Loss of weight in water}} \times d$$

9. Form & Structure:-

i. Form:

The internal atomic structure of mineral and the external geometrical shapes together constitute of that mineral.

Types:-

1. **Crystal:** When both internal atomic structure and external geometric forms are perfectly present

   e.g.: calcite

2. **Crystalline:** External geometric form may or may not be present but internal atomic structure is present

   e.g.: Quartz

3. **Amorphous:** Both external geometric formed and internal atomic structure are lacking

e.g.: Obsidian. It is also called powder form.

ii. Structure:-

The physical appearance of mineral in terms of its shape is referred as its structure.

1. **Acicular** : Needle like crystal (e.g.) Natrolite
2. **Bladed** :Blade like (eg) Kyanite
3. **Botryoidal** :Resembling bunch of grapes (eg) Psilomelane
4. **Columnar** :Column like (eg) Beryl
5. **Foliated** :Paper thin sheets like easy separable (eg) Mica
6. **Fibrous** :Made up of fibres (eg) Asbestos, Gypsum
7. **Radiating** : Needle like fibrous crystal, radiating from a common centre (eg) Iron pyrites
8. **Reni form** : Kidney shaped aggregates (eg) Hematite
9. **Tabular** :Flattened – Table like(eg)Calcite, Barite, Feldspar
10. **Lamellar** : Thick leaf like sheets (eg) Vermiculite
11. **Granular** :Densely packed small grains (eg) Chromite
12. **Mammillary** : Rounded grains, overlapping in arrangement (e.g.) Malachite

10.Special properties:-

i. Magnetism

Some minerals are naturally magnetic ink character

a. **Strongly Magnetic** (eg) Magnetite

b. **Feebly Magnetic** Slightly Magnetic (eg) Spinel

c. **Non – Magnetic** (eg) Quartz, Calcite

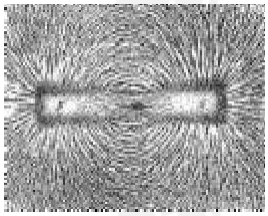
ii. Electricity(Pyroelectricity and Piezoelectricity):

1. **Pyroelectric**: Minerals producing electric charge when heat applied, are called Pyroelectric (eg) Quartz, Tourmaline
2. **Piezoelectricity:** When Pressure applied certain minerals will glow (eg) fluorite.

iii. Fluorescence: When exposed to sun's radiation, certain minerals will glow (eg) Fluorite.

iv. Phosphorescence: Some minerals continue to glow even when bringing to the dark room after exposure to sun's radiation (eg) diamond

- **Magnetite:** Naturally magnetic



- **Halite:** Tastessalty

- **Sulfur:** Smells like rotten egg

v. Fusibility: It refers temperature of fusion.

vi. Transparency : It refers transmission of light of minerals

vii. Translucency: Partial transmission of light through a mineral.

viii. **Opaque:** No transmission of light through a mineral. (eg) Agate.

Uses of Minerals:-

- Minerals are raw materials used for a wide variety of products from dyes to dishes and from table salt to televisions