

Physical properties of Minerals

• Colour

- Streak → colour of the powder of the mineral. It is the constant property of the mineral. Hence it is important in diagnostic of mineral.

Streak is detected by rubbing the mineral on ^{porcelain} foetaline plate and then determine its colour.

Hematite gives cherry or brownish red on rubbing, whereas Magnetite gives black colour, Chalcopyrite gives greenish black.

Body Colour of the minerals does not reflect its streak.

- Hardness → It is a character by virtue of which the minerals offer resistance to any force of abrasion on its surface.

Hence, on this respect ~~to~~ Glass is Harder than Iron.

Mohs ~~Mohs~~ Scale of hardness

- | | |
|-------------|------------------------|
| 1. Talc | 6. orthoclase feldspar |
| 2. Gypsum | 7. Quartz |
| 3. Calcite | 8. Topaz |
| 4. Fluorite | 9. Corundum |
| 5. Apatite | 10. Diamond |

Hardness of	Brass	is	3-3.5
	Iron	is	4-4.5
	Glass	is	5.5-6

Human Nail has hardness 2.5

- Specific Gravity Minerals with high specific gravity.
SP is the ratio of wt. of mineral to that of an equal volume of water and can be determined conveniently by any standard method.
- | | | |
|------------|---|-----------|
| Argentite | → | 7.0 - 7.4 |
| Wolframite | → | 7.1 - 7.5 |
| Galena | → | 7.6 |
| Uraninite | → | 8-10 |
| Cinnabar | → | 8.1 |
| Iron | → | 7.8 |

Copper	→	8.9
Silver	→	10.1 - 11.1
Gold	→	15-19 (19.3)
Platinum	→	14-19 (21.46)

Let w_1 → wt. of
in air

w_2 → wt. of mineral
in water

Minerals with low specific gravity. $(w_1 - w_2) \rightarrow$ wt. of equal
Volume of water.

Epsomite	→	1.67
Borax	→	1.71
Sylvite	→	1.99
Opal	→	2.0 - 2.2
Gypsum	→	2.32
Halite	→	2.16
Graphite	→	2.09 - 2.23

$$S.P = \frac{w_1}{w_1 - w_2}$$

is the
important

for certain
for certain

rubbing,
white

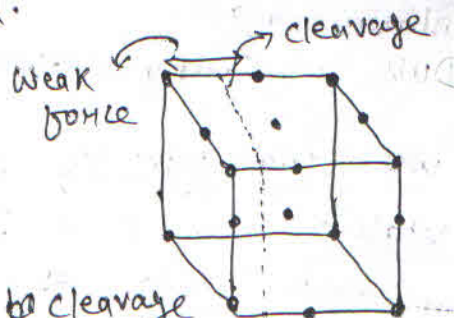
it's streak

he
on

an Iron.

- Cleavage → It is found mostly in crystalline minerals, presence of cleavage confirms the presence of crystalline minerals, but its absence does not indicate that it is amorphous mineral.

Cleavage forms \perp to the atoms which have weak force b/w them.



Quartz does not show cleavage b/c atomic bonding is equally strong in all directions.

Minerals with Cleavage

Calcite, Galena, Selenite, Hornblende, Amphibole, Feldspar, Muscovite, Biotite, Kyanite, Gypsum, Talc etc.

Minerals without cleavage

Quartz, Chromite, Ilmenite, Pyrite, Magnetite, Haematite, Opal, Garnet, Uraninite.

gravity,
of wt. of
of an
of water
determined
by any
method.

- Fracture → It is the nature of the broken surface of the mineral other than cleavage surface.

It can be divided into two parts

- Regular / Even → If the nature of broken surface is smooth then it is regular surface.

Irregular/uneven → If the broken surface is rough then it is irregular fracture.

Conchoidal fracture → Development of more or less smooth curved surfaces

Hackly fracture → E.g. → Kyanite. Sharp needle like structure on broken surface.

● Lustre → It is the property by which ^{minerals} can reflect the ~~amount of~~ light nature and amount of shine, due to reflection.

Degrees of lustre

Splendent → E.g. → Galena

Shining

↳ Glistening

↳ Glimmering

Dull or Earthy → No light reflected. E.g. → Bauxite

There are two types of lustre.

Metallic lustre → If the lustre of the mineral resembles the lustre of a broken piece of metal then it is metallic lustre.
E.g. → Galena, Haematite etc.

Non-Metallic lustre → If the lustre of the mineral does not resemble the lustre of a broken piece of metal then it is non-metallic lustre. E.g. → Quartz.
These are generally dark in colour.

Sub-Metallic lustre

Vitreous lustre → ~~Glass~~ lustre like glassy substance

Adamantine → Diamond; i.e. the nature of shine of diamond

Waxy

Resinous

Greasy

Silky

rough

• Form and Structure

Massive → If minerals occur in large lumps.

1 less

Flaky → Mica.

Granular aggregate → Aggregate of small grains.

Crystalline aggregate → Aggregate of small crystals.

le like

Bladed → appears like blades of knife, Eg →

Fibrous → Asbestos

Platy → Gypsum

is
an object
shine, due

Magnetic properties

Ferromagnetic → Magnetite, Pyrrhotite, Maghemite.
Strongly attracted

Paramagnetic → weakly attracted in an applied magnetic field.

Eg → Ilmenite, Actinolite

1 → Bauxite

Diamagnetic → Quartz, Feldspar.

mineral
in piece
lustrous.

mineral
of metal
lustre.

substance

line of diamond

*) Mohs Scale of hardness gives the rough measure of the resistance of a smooth surface to scratching or abrasion, expressed in terms of a scale devised by German mineralogist Friedrich Mohs. The Mohs hardness of a mineral is determined by observing whether its surface is scratched by a substance of defined hardness.

*) The phenomenon of development of cleavage in crystalline minerals is ascribed to their particular internal atomic structures. Within the structure if the bonds, along a particular direction happen to be weaker than those in other direction, a suitable blow in the appropriate direction would lead to formation of cleavage.

7/18

Pyralite, Graphite → Soils our hand, it reflects softness of the minerals.

Galena marks on the paper.

Talc gives soapy feeling due to its softness.

Psilomelane shows a particular structure called Botryoidal structure. It is a very good diagnostic.

Bauxite shows oolitic or fibrolitic structure.



oolites are marine organisms that are circular in shape.

We study the optical properties of minerals under Petrological / Polarising microscope.

Some minerals shows the property called double refraction.

Polymorphism → Same composition, different form.

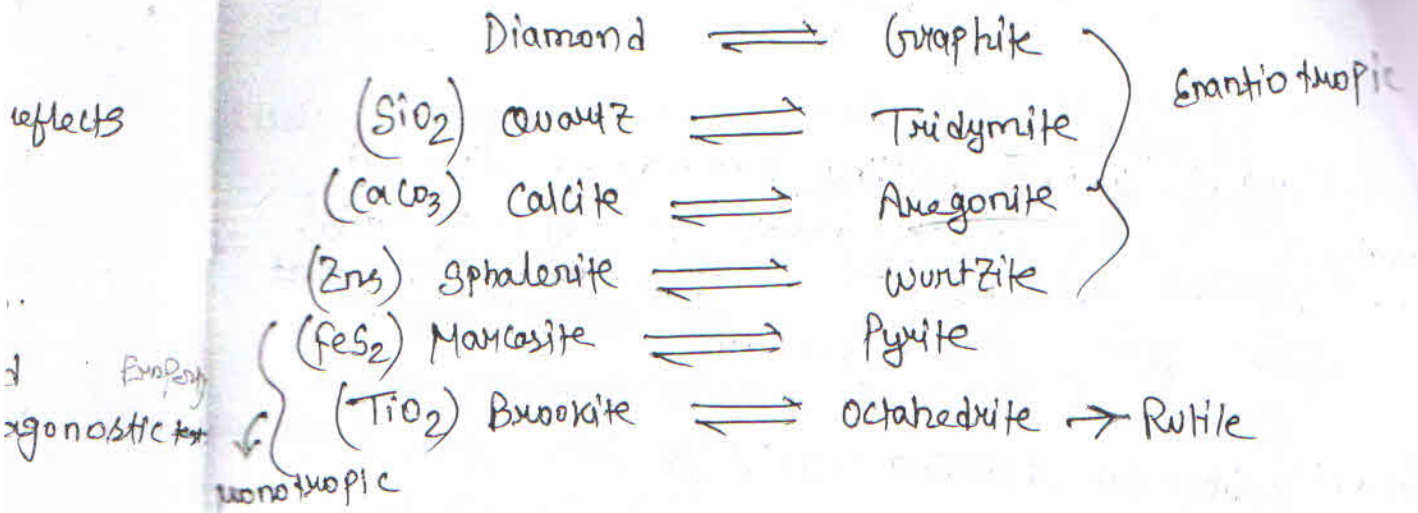
E.g → Graphite, Diamond.

An element or a compound that can exist in more than one crystal form are said to be polymorphous and this phenomenon is known as polymorphism. The atomic structure are different in different polymorphs of the same substance. Number of polymorphs may be two or three and accordingly they are called di-morphic, tri-morphic etc.

Sometimes the change from one polymorph to another is reversible. When it is called enantiomorphism. And in some cases change from one form to another form is irreversible and is called monotropy.

Suppose $A \xrightarrow{\text{changes}} B$, B is stable and more abundant in nature than A.

Different polymorphs of the same substance differ in physical characteristics.



Isomorphism

It is the property by virtue of which substances of different but at the same time analogous or allied chemical composition are capable of crystallizing in same or closely related crystal forms. The members of an isomorphous group show very close physical properties and also belong to same crystal structure.

Calcite Group

CaCO_3 - Calcite
 MnCO_3 - Rhodochrosite
 FeCO_3 - Siderite
 ZnCO_3 - Smithsonite
 MgCO_3 - Magnesite

Aragonite Group

CaCO_3 - Aragonite
 BaCO_3 - Witherite
 PbCO_3 - Cerussite
 SrCO_3 - Strontianite

more than
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 isomorphic,

to
 isomorphism
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 isomorphism.

ind

are