UNIT III LAND FORMS

CHAPTER-5 MINERALS AND ROCKS

This unit deals with

Minerals, elem ents, characteristics of minerals such as crystal form cleavage, fracture,lustre, colour,streak, transparency ,structure, hardness specific grvity, important minerals such as feldspar,quartz,pyroxene,amphibole,mica,olivine and their characteristics classificationof minerals, rocks,igneous,sedimentary ,metamorphic rocks rock cycle

Minerals found in the crust are in solid form where as in intrior they are in liquid form98% of the crust consist of eight elements

1.oxygen 2. Silicon 3. Aluminium 4. Iron. 5. Calcium 6. Sodium 7. Potassium 8. Magnes

the rest is constituted by titanium, hydrogen, phosphorous, manganese, sulphur carbon, nickel & other elements

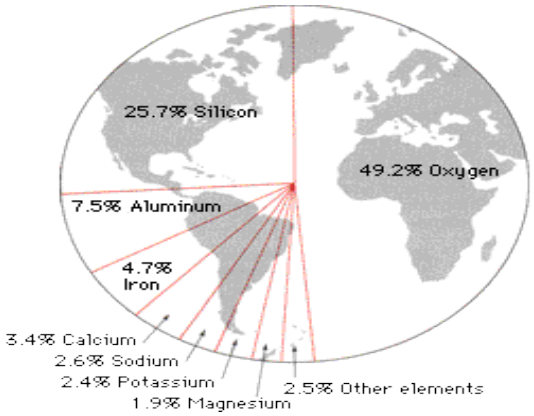


Table 5.1 : The Major Elements of the Earth's Crust

Sl. No.	Elements	By Weight(%)
1.	Oxygen	46.60
2.	Silicon	27.72
3.	Aluminium	8.13
4.	Iron	5.00
5.	Calcium	3.63
6.	Sodium	2.83
7.	Potassium	2.59
8.	Magnesium	2.09
9.	Others	1.41

Many elements found in combination with other elements. These substances are called minerals

Mineral: naturally occuring inorganic substance having an orderly atomic structure and a definite chemical composition and physical properties.

It is composed of two or three minerals /single element ex. S,Cu, Ag,Au, Graphite.

There are at least 2000 minerals in the crust. There are at least six mineral groups which form rocks in the crust.

The basic source of all minerals is the hot magma in the interior of the earth. Coal, petroleum and natural gas are organic minerals

PHYSICAL CHARACTERISTICS OF MINERALS

(I) EXTERNAL CRYSTAL FORM:Internal arrangement of molecules-cube, octahedrons,hexagonal, prisms.

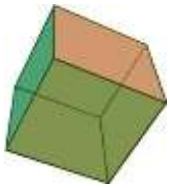


Figure 8 CUBE

Figure 9 HEXAGONAL

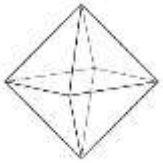


Figure OCTAHEDRONS

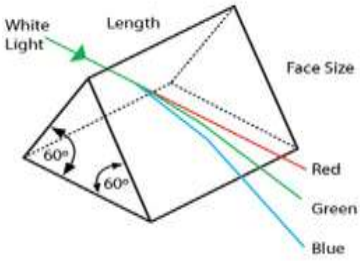


Figure 7 PRISM

(II) CLEAVAGE:

Tendency to break in given direcations producing relatively plane surfaces, it may any direction

FRACTURE: Conchoidal fracture

Obsidian

Conchoidal fracture is a curved breakage that resembles the concentric ripples of a mussel shell. It often occurs in amorphous or fine-grained minerals such as flint, opal or obsidian, but may also occur in crystalline minerals such as quartz. **Sub conchoidal fracture** is similar to conchoidal fracture, but not as curved. (Note that obsidian is an igneous rock, not a mineral, but it does illustrate conchoidal fracture well.)

Earthy fracture

Limonite

Earthy fracture is reminiscent of freshly broken soil. It is frequently seen in relatively soft, loosely bound minerals, such as limonite, kaolinite and aluminite.

Hackly fracture

Native copper

Hackly fracture (also known as **jagged fracture**) is jagged, sharp and uneven. It occurs when metals are torn, and so is often encountered in native metals such as copper and silver.

Splintery fracture

Chrysotile

Splintery fracture comprises sharp elongated points. It is particularly seen in fibrous minerals such as chrysotile, but may also occur in non-fibrous minerals such as kyanite.

Uneven fracture

Magnetite

Uneven fracture is self descriptive. It occurs in a wide range of minerals including arsenopyrite, pyrite and magnetite.The crystal breaks inan irregular manner not along the planes

LUSTURE : Adamantine lustre

Cut diamonds

Adamantine minerals possess a superlative lustre, which is most notably seen in diamond.[1] Such minerals are transparent or translucent, and have a high refractive index (of 1.9 or more).[2] Minerals with a true adamantine lustre are uncommon, with examples being cerussite and zircon.[2]

Minerals with a lesser (but still relatively high) degree of luster are referred to as **subadamantine**, with some examples being garnet and corundum

Dull lustre

Kaolinite

Dull (or **earthy**) minerals exhibit little to no luster, due to coarse granulations which scatter light in all directions, approximating a Lambertian reflector. An example is kaolinite.[3] A distinction is sometimes drawn between dull minerals and earthy minerals,[4] with the latter being coarser, and having even less lustre.

Greasy lustre

Moss opal

Greasy minerals resemble fat or grease. A greasy lustre often occurs in minerals containing a great abundance of microscopic inclusions, with examples including opal and cordierite.[2] Many minerals with a greasy lustre also feel greasy to the touch.[5]

Metallic lustre

Pyrite

Metallic (or **splendant**) minerals have the lustre of polished metal, and with ideal surfaces will work as a reflective surface. Examples include galena,[6]pyrite[7] and magnetite.[8]

Pearly lustre

Muscovite

Pearly minerals consist of thin transparent co-planar sheets. Light reflecting from these layers give them a lustre reminiscent of pearls.[9] Such minerals possess perfect cleavage, with examples including muscovite and stilbite.[2]

Resinous lustre

Amber

Resinous minerals have the appearance of resin, chewing gum or (smooth surfaced) plastic. A principal example is amber, which is a form of fossilized resin.[10]

Silky lustre

Satin spar variety of gypsum

Silky minerals have a parallel arrangement of extremely fine fibres,[2] giving them a lustre reminiscent of silk. Examples include asbestos, ulexite and the satin spar variety of gypsum. A **fibrous** lustre is similar, but has a coarser texture.

Submetallic lustre

Sphalerite**Submetallic** minerals have similar lustre to metal, but are duller and less reflective. A submetallic lustre often occurs in near-opaque minerals with very high refractive indices,[2] such as sphalerite, cinnabar and cuprite.

Vitreous lustre

Quartz

Vitreous minerals have the lustre of glass. (The term is derived from the Latin for glass, *vitrum*.) This type of lustre is one of the most commonly seen,[9] and occurs in transparent or translucent minerals with relatively low refractive indices.[2] Common examples include calcite, quartz, topaz, beryl, tourmaline and fluorite, among others.

Waxy lustre

Jade

Waxy minerals have a lustre resembling wax. Examples include jade[11] and chalcedony.[12]

Optical phenomena

Asterism

Sapphire cabochon

Asterism is the display of a star-shaped luminous area. It is seen in some sapphires and rubies, where it is caused by impurities of rutile.[12][13] It can also occur in garnet, diopside and spinel.

Aventurescence

Aventurine **Aventurescence** (or **aventurization**) is a reflectance effect like that of glitter. It arises from minute, preferentially oriented mineral platelets within the material. These platelets are so numerous that they also influence the material's body colour. In aventurine quartz, chrome-bearing fuchsite makes for a green stone and various iron oxides make for a red stone.[12]

Chatoyancy

Tiger's eye

Chatoyant minerals display luminous bands, which appear to move as the specimen is rotated. Such minerals are composed of parallel fibers (or contain fibrous voids or inclusions), which reflect light into a direction perpendicular to their orientation, thus forming narrow bands of light. The most famous examples are tiger's eye and cymophane, but the effect may also occur in other minerals such as aquamarine, moonstone and tourmaline.

Colour change

Alexandrite

Color change is most commonly found in Alexandrite, a variety of chrysoberyl gemstones. Other gems also occur in color-change varieties, including (but not limited to) sapphire, garnet, spinel. Alexandrite displays a color change dependent upon light, along with strong pleochroism. The gem results from small scale replacement of aluminum by chromium oxide, which is responsible for alexandrite's characteristic green to red color change. Alexandrite from the Ural Mountains in Russia is green by daylight and red by incandescent light. Other varieties of alexandrite may be yellowish or pink in daylight and a columbine or raspberry red by incandescent light. The optimum or "ideal" color change would be fine emerald green to fine purplish red, but this is exceedingly rare.

SchillerLabradorite

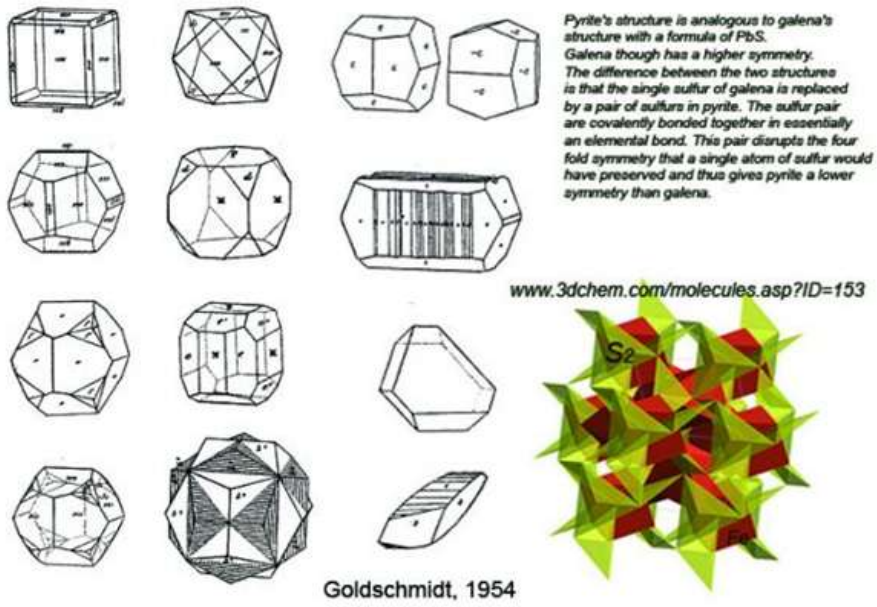
Schiller, from German for "twinkle", is a term used to describe the metallic iridescence originating from below the surface of a stone, that occurs when light is reflected between layers of minerals. It is seen in moonstone and labradorite and is very similar to adularescence and aventurescence.[14]

appearance of material without regard to clolour-metallic silky glossy

COLOUR :some colours determined by molecular structure ex.malachite, azurite, chalcopyrite some because of impurities found the crystal.
STREAK : colour of the ground powder of any mineral Ex. Malachit –green, fluorite – purple/white

TRANSPARENCY: Transparency **Definition:** Transparency refers to the degree to which light can pass through a mineral.
Terminology: *Opaque* - no light can pass through the mineral;
Translucent - light can pass through the mineral but is diffused so that images cannot be seen clearly;
Transparent- light can pass through the mineral and images can be seen clearly.

1. Transparency –light rays pass through 2.translucent-light pass through but diffused 3.opaque-light doesnot pass through.



Magnetite

(III) STRUCTURE :particular arrangement of the individual crystals – fine medium,or coarse, coarse grained fibrous, separable divergent rdiating

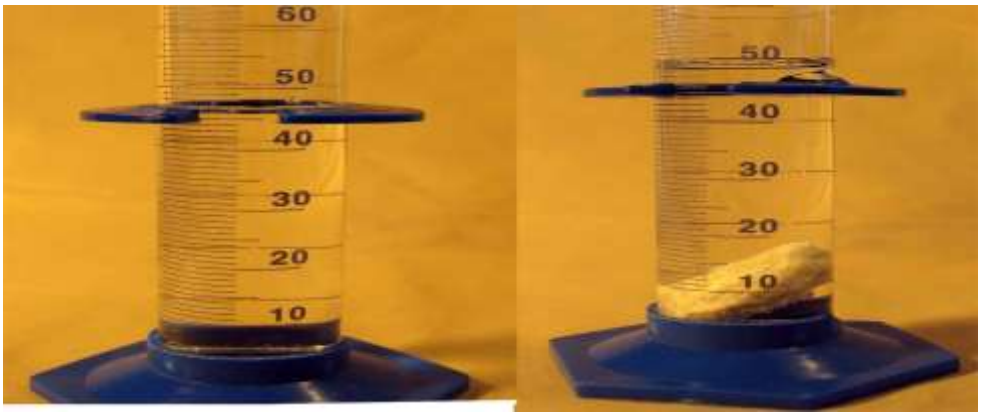
HARDNESS: as corundum. The table below shows comparison with absolute hardness measured by a sclerometer, with pictorial examples.[7][8]

Mohs hardness	Mineral	Chemical formula	Absolute hardness	Image
1	Talc	$Mg_3Si_4O_{10}(OH)_2$	1	
2	Gypsum	$CaSO_4 \cdot 2H_2O$	3	
3	Calcite	$CaCO_3$	9	
4	Fluorite	CaF_2	21	
5	Apatite	$Ca_5(PO_4)_3(OH^-,Cl^-,F^-)$	48	

Mohs hardness	Mineral	Chemical formula	Absolute hardness	Image
6	Orthoclase Feldspar	$KAlSi_3O_8$	72	
7	Quartz	SiO_2	100	
8	Topaz	$Al_2SiO_4(OH^-,F^-)_2$	200	
9	Corundum	Al_2O_3	400	
10	Diamond	C	1600	

(IV) Relative resistence being scratched ten minerals are selected to measure the degree of hardness from 1to 10

1. Talc 2.gypsum 3.calcite 4.fluorite 5.apatite 6.feldspar 7.quartz 8.topaz 9.corundum 10.diamond. ex.fingre nail has 2.5 hardness knife has 5.5 hardness



(V) SPECIFIC GRAVITY :The ratio between the weight of a given object and the weight of an equal volume of water ; object weighed in air and then weighed in water and divide weight in an airby the difference of th etwo weights.

IMPORTANT MINERALS OF THE EARTH CRUST

FELDSPAR: Silicon & Oxygen Are Common Elements ,Sodium, Potassium Calcium Aluminium Are Found In Specific Variety. ½ The Earth Crust Consists Of Feldspar.Light Cream To Salmon Pink Colour Used In Ceramics And Glass Making.

QUARTZ:important component of sand granite.consists of silica, hard mineral, insoluble in water it is white ore coloruless used INRADO OR RADOR

YROXENE :consists of calcium aluminum magnesium iron silica, it forms 10% of earth crust, found in meteorites,green or black in colour

OLIVINE:Magnesium,Iron, Silica are major elements,used in jewellary, greenish crystal, found inbasaltic rocdk

AMPHIBOLE:
major elements.
, used in asbestos

aluminium, calcium silica, iron magnesium are They form 7% of earth crust, green or black colour industry, hornblende is a;nother formof amphibole

MICA:consists of potassium, aluminium, magnesium iron silica . Form 4%

Of the earth crust. Found in basaltic rock

IGNEOUS ROCKS; 1. They are primary rocks 2.formed due to cooling of lava 3. They are two types intrusive & extrusive rocks

Extrusive rocks have small grains because of sudden cooling intrusive rocks have bigger grains due to slow cooling4.they are hard 5. Do not contain fossils 6. Do not allow water to percolate through them 7. No layers

SEDIMENTARY ROCKS:1. Formed Due To Sedimentation 2. Consists Of Layers 3. Contain Fossils 4.The Process Of Sedimentary Rock Formation Is Called Lithification 5. They Are Three Types . A. Mechanically Formed B.Chemically Formed 3. Organically Formed.

METAMORPHIC ROCKS: 1.Formed Due To Recrystalization 2.Formed Due To Pressure And Temperature 3. Very Smooth

4. Consists of layers sime times very preceious stones

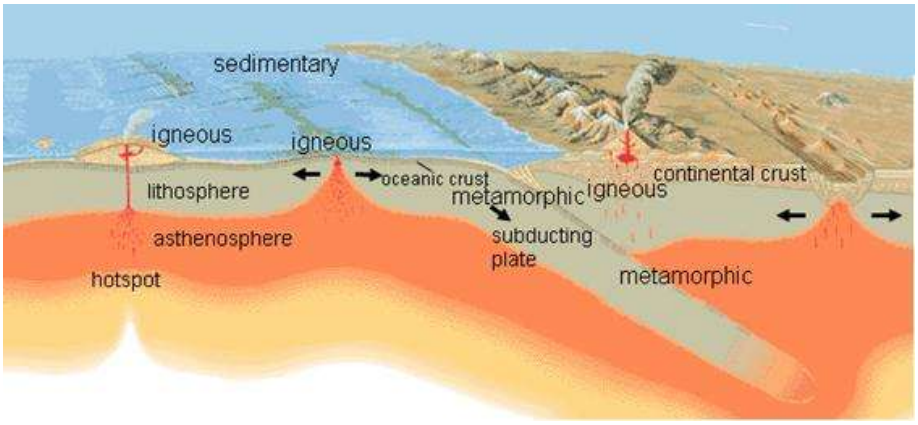
Type of rock

Igneous rock Sedimentary rockMetamorphic rock

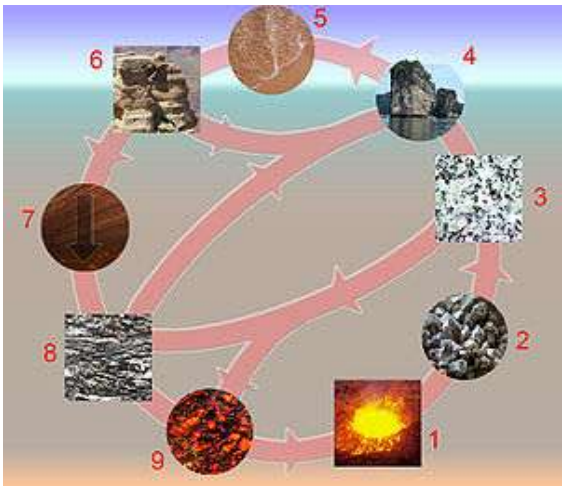
Granite Sandstone Slate

Rocks are aggregate of one or more minerals,they may be hard or soft in varied colours, they do not have definite chemical composition.

Petrology is the science of rocks. Petrologist who studies the scientific methods of rocks.



ROCK CYCLE



A diagram of the rock cycle. Legend: 1 = magma; 2 = crystallization (freezing of rock); 3 = igneous rocks; 4 = erosion; 5 = sedimentation; 6 = sediments&sedimentary rocks; 7 = tectonic burial and metamorphism; 8 = metamorphic rocks; 9 = melting.

Rock cycle is a continuous process through which old rocks are converted into new rocks. Igneous rocks are changed into metamorphicor sedimentary rocks. Metamorphic rocks afurther change into magma