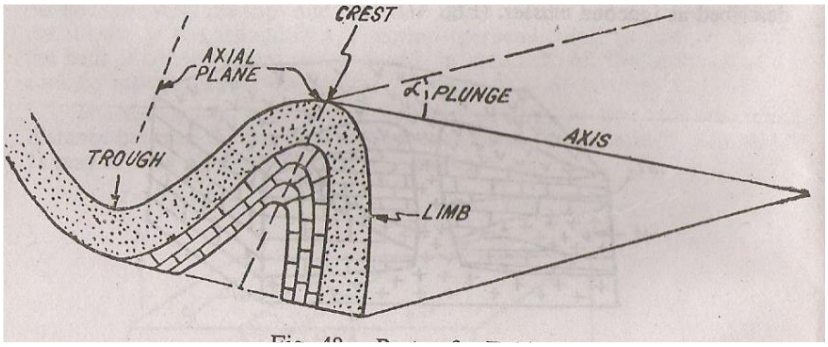
Internal Assessment Test 1 Solution– Sept. 2018

Sub:	Engineering Geology					Sub Code:	17CV35	Branch:	Civil		
Date:	07-09-2018	Duration:	90 min's	Max Marks:	50	Sem / Sec:	3A & B			OBE	
									MARKS	CO	RBT
1 (a)	Define Fold. Explain different types of fold with neat diagram.								[10]	CO4	L4

FOLD:

An Undulation in rock strata.



Axial line or Axis:- The median line about which folding has taken place. The axis may be horizontal, inclined or vertical

Axial plane:-An imaginary plane that divides a fold into two more or less symmetrical halves. The axial plane may be vertical inclined or horizontal

Limbs: -The two sides of folds the left limb and right limb

Crest:-Highest position of fold, it is always curving or angular

Types of Folds: Folds are classified on the basis of (i) Symmetrical character (ii) Upward or down ward bend (iii) occurrence of plunge (iv) Uniformity of bed thickness (v) Behavior of the fold pattern with depth etc

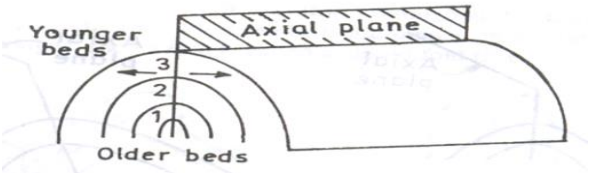
- **ANTICLINE & SYNCLINAL FOLDS**
- **SYMMETRICAL & ASYMMETRICAL FOLDS**
- **PLUNGING & NON-PLUNGING FOLDS**
- **OVERTURNED FOLD**
- **OPEN AND CLOSED FOLDS**
- **CHEVRON FOLD**
- **ISOCLINAL & RECUMBENT FOLDS**
- **BOX FOLD**
- **FAN FOLD**

Anticline: It may be defined as a fold that is convex upward; and the two limbs dip away from each other. In such a fold, the older rocks occur in the centre.

Syncline: It may be defined as a fold that is convex downwards and the two limbs dip toward each other. In this fold, the younger rocks are in the centre.

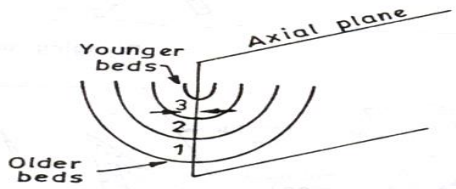
ANTICLINE

A fold that is convex upward and the two limbs dip away from each other.
In such a fold, the older rocks occur in the centre.



SYNCLINE

A fold that is convex downwards and the two limbs dip toward each other
In this fold, the younger rocks are in the centre

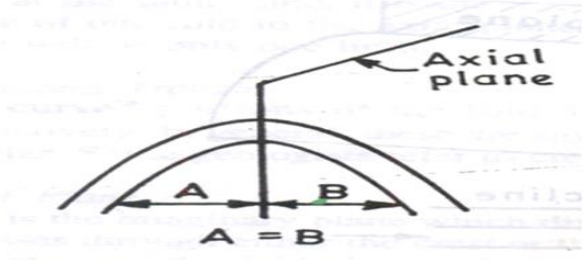


Symmetrical fold– The two limbs dip at the same angle but in opposite direction. Axial plane is vertical and its passes through the crest or troudh.

Asymmetrical- The limbs dip at unequal angles in opposite direction, in this axial plane inclined and it not passes through the crest line.

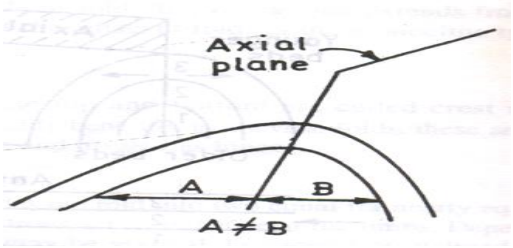
SYMMETRICAL FOLD

the axial plane is essentially vertical or upright.
The axial plane divides a fold into two equal halves



ASYMMETRICAL FOLD

the axial plane is inclined. If the two halves are not mirror images,
then the fold is called as asymmetrical fold.



Overturned fold – It is asymmetrical fold,In a simple fold, the limbs show the order of superposition of beds. But when one of the limbs is overturned, the order of superposition of beds in that particular limb will be in reverse order, such a fold is called an overturned fold. In this axial plane is inclined and both

the limbs dip in the same direction.

Recumbent fold– In this fold both limbs becomes almost horizontal, even axial plane becomes nearly horizontal and lower limbs gets overturned.

Normal Type of Fold Isoclinal Fold Recumbent Fold

Isoclinal fold – Folds that have parallel limbs, in this limbs dip at same angle and in same direction. There are 3 types

- **Inclined isoclinal fold** – Where the axial plane is inclined.
- **Vertical isoclinal fold** – Where the axial plane is vertical.
- **Recumbent isoclinals fold** – Where the axial plane is horizontal.

Plunging fold– Anticline and syncline whose axes are inclined.

Non plunging fold – The fold axes of anticline and synclines whose axes are horizontal.

The angle of inclination of the axis measured from the horizontal is called Angle of plunge.

The direction in which this axis is inclined is called the Direction of plunge.

Anticlinorium and Synclinorium – It is a large anticline and syncline with number of secondary fold of smaller size developed on it.

Open fold– The folding is mild and limbs meet at bends at an obtuse angle. Thickness of bed unchanged everywhere.

Close fold – The folding is so tight that the incompetent strata flow plastically towards the crest and troughs.

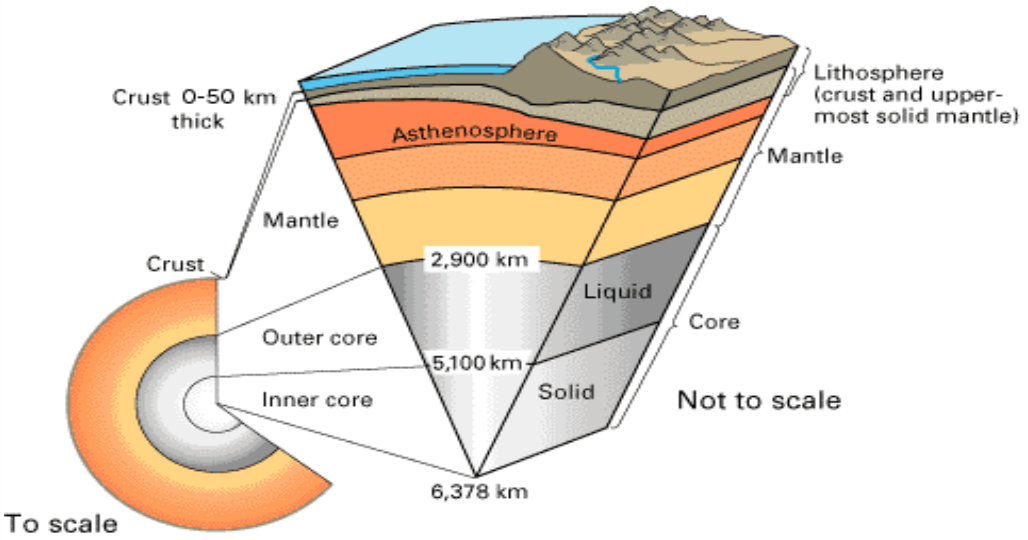
Chevron fold – The folds which have straight or nearly straight limbs, their crest and troughs become sharp and angular. Such zigzag folds are called "Chevron fold".

Fan fold – It is upright fold in which both limbs are overturned. In anticline limbs dip towards the axial plane and in syncline they dip away from it.

2 (a) Give a general view on internal structure of the Earth as revealed by the seismological evidence. [10]

CO1	L2

INTERNAL STRUCTURE OF THE EARTH



On the basis of seismic investigation, the earth can be divided in to 3 groups

- Crust
- Mantle
- Core (Outer core and Inner Core)

The Crust:-

The top most shell of the earth, which has a thickness of 30-40 km in the continents and 5-6km in the oceans. There is a striking variation in the materials or rocks, as they are called, composing the crust over the continents and ocean floors. The oceanic crust is made up of heavier and darker rocks called basalts compared to light- colored and light density, granitic rocks of the continental crust. When considered as a part of the total structure of the earth, crust makes only an insignificant part represented by a thin layer similar to the skin of an apple. As regards the chemical composition of the crust, analyses made by Clarke and Gold Schmith, using rocks from different geographic regions of the crust have all shown that when expressed in terms of oxides, volume in the oceanic crust and above62% in the continental crust. Alumina is the next important oxide, varying between13-16% followed by Iron Oxides (8%), Lime (6%), Sodium (4%), Magnesium (4%), Potassium (2.5%) &Titanium (2%). The crust itself shows a complicated structure both in make-up and compositional variations.

The Mantle:-

At the base of the crust materials of the earth become greatly different in many properties from those overlying the mine the crust. These materials appear to form a

nearly homogeneous zone till a depth of 2900km is reached. This zone of materials lying between crust and a depth of 2900km is known a MANTLE. It is made up of extremely basic materials, called ultra basic rocks, which are believed to be very rich in iron and magnesium but quite poor in silica. Such rock names as Periodotites, Dunite. This One is characterized with a high density, increasing steadily with depth further; the mantle material is believed to be highly plastic in nature. Many of the most important geological process such as earthquakes and formation of mountains are believed to have their origin in this zone.

The Core:-

It is the third and the innermost structures hell of the earth, which is clearly marked by the seismic evidence. It starts at adepthof2900 km below the surface and extends right up to the center of the earth at 6370km. The material in the core is found to be from seismic studies only strikingly different from that making the other two shells in one major aspect, in elastic properties. The material has no shear resistance, which makes it nearer to liquid than to a solid body. It has a very high density, above 10gms/cubic centimetre, at the mantle–core boundary nothing can be said about the composition of the core. According to one, widely favoured view, the core is made up of Iron and Nickel alloy material.

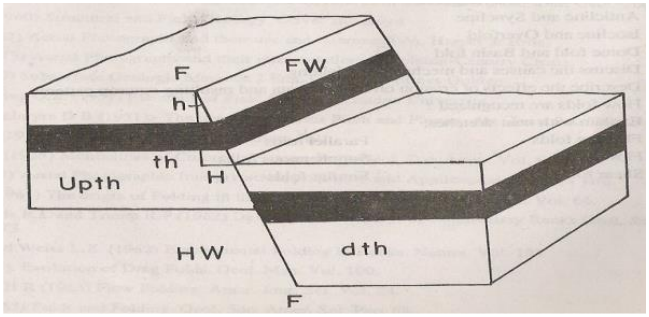
3 (a) Define Fault. Explain different types of fault with neat diagram. [5]

CO4	L4

FAULT:

A fault is a fracture or fracture zone in rocks along which there has been displacement of the two sides relative to one another parallel to the fracture.

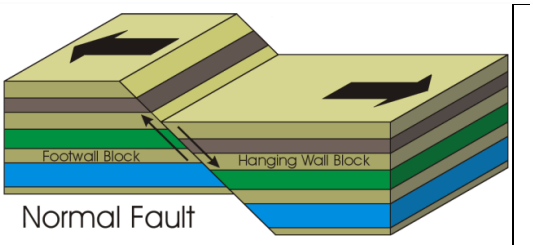
PARTSOF FAULT: -



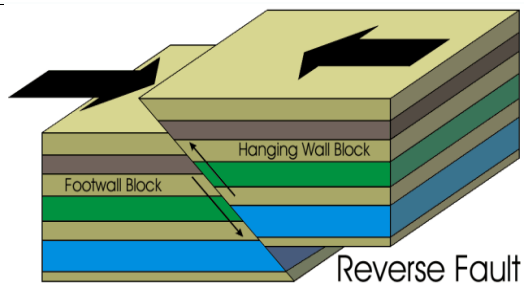
Types of Faults:

Normal fault – In normal fault the hanging wall appears to have moved downward relative to the foot wall. Normal fault produced by tensional forces and it is also called “Gravity fault”.

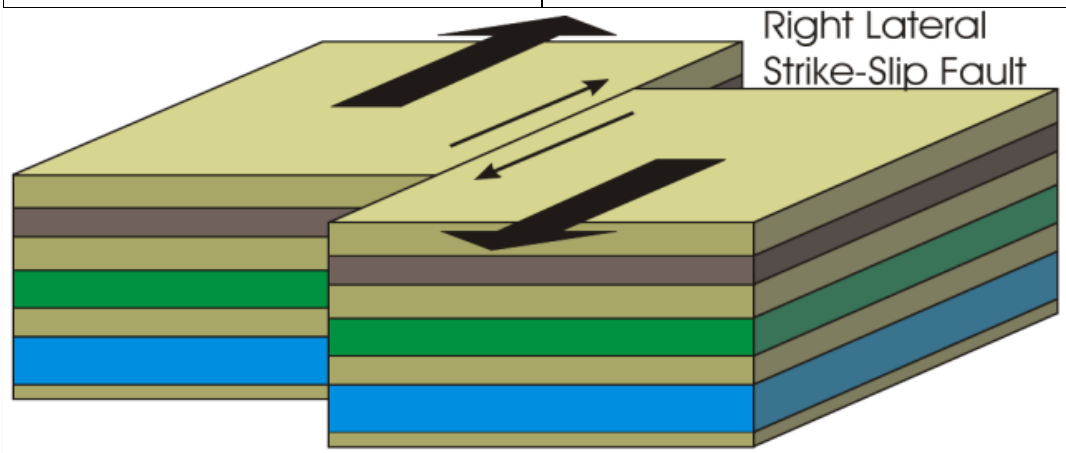
Reverse Fault: If the HW goes up with respect to the FW , it is called as Reverse Fault. This is also called as **Thrust Fault**



Normal Fault / Gravity Fold



Reverse Fault / Thrust Fault



Based on Slips: The displacement that occurs during faulting is called the slip. The total displacement is known as the **Net slip.** The net slip may be along the strike direction (**strike slip)** or the dip direction (**Dip slip**) or along both

Strike slip fault / Wrench Fault: The displacement is only along the strike direction of the fault plane, such a fault is described as strike slip fault.

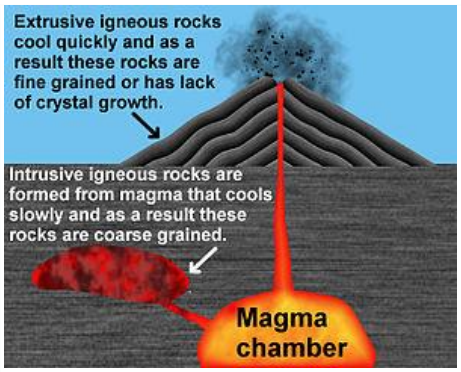
(b) Explain various types of Igneous rocks. Illustrate your answer with neat sketches. [5]

CO2	L3

Igneous rock – Igneous rock are formed by cooling and solidification of magma.
Ex – Granite and Basalt.

Classify Igneous rock based upon Depth of formation

Extrusive rocks – When magma reaches earth surface cause volcanic eruption to generate extensive lava flow. The rock solidified of lava upon the earth surface are called Extrusive rock or volcanic rock. The volcanic rocks are formed 1) Solidification under low pressure 2)Underlying surface rocks are relatively cold 3)Overlying atmospheric gasses. Due to rapid crystallization or cooling and escape of volatiles results in high flowing of lava and low pressure resulting in the formation of fine grained or glassytexture. Ex – Basalt.



Intrusive rock – The magma crystallize below the earth surface are called Intrusive, depend upon depth of formation its classified into

1>**Plutonic rocks** – Rocks which are formed in the deeper zones or greater depth of the earth are called Plutonic rock .The plutonic rocks are formed 1)Under great pressure 2) At high Temp

3) Presence of huge quantity of Volatiles At depth rocks were subjected to the slowest cooling, which result mineral constituent crystallizes to gives a coarse grained texture. Ex- Granite

2>**Hypabysal rock** – Rocks which are solidifies at shallow depths or close to the earth surface. These rock occur as injection within the country rock. Hypabysal rocks are formed under moderate temp and pressure, surrounded by neither cold nor very hot rocks, resulting in medium rate of cooling, gives medium grained texture. This texture coarser than volcanic rock and finer compare to plutonic rocks. Ex – Pegmatite.

4 (a) Explain different physical properties that are commonly studied for their identification. [10]

CO2	L4

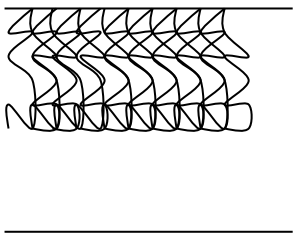
Mineral

Mineral is naturally occurring inorganic homogeneous substance, having set of chemical composition and definite atomic structure and posses set of physical properties.

Physical properties of Minerals:

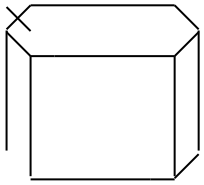
Habit or Form – Shape of the mineral, it's mainly depend upon the internal structure of the minerals.

1. Fibrous- when the mineral has a thread- like structure. Example: Asbestos.

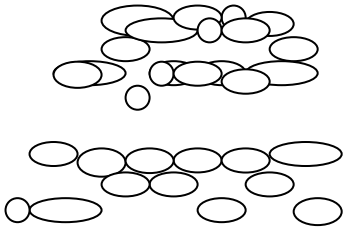


2. Columnar: - When the mineral has a thick or thin columnar structure. Example-

Hornblende



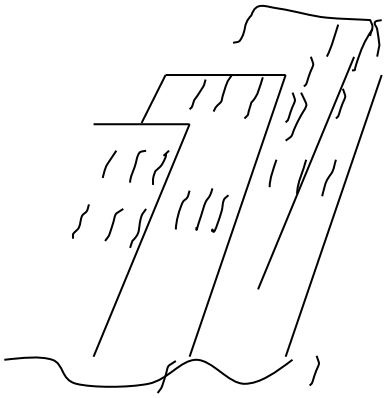
3. Granular-When the mineral has numerous grains, coarse or fine Example: Calcite, Chromite.



4. Crystalline- when the mineral has fine crystals packed together. Example: Galena, Pyrite.

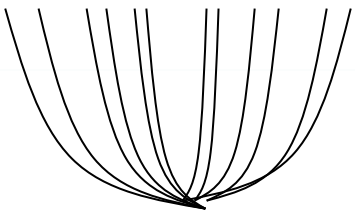
5. Massive- when the mineral has an irregular structure. Example- Feldspar.

6. Bladed-

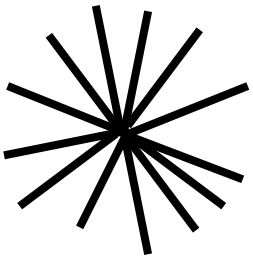


When a mineral appears to be composed of a blade- like structure. Example: Kyanite.

7. Acicular- When the mineral consists of thin, sharp and slender needles as shown in the figure. Example: Natrolite.

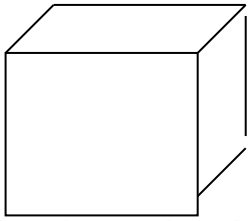


10. Radiating-



When the fibers or needles are arranged around a central point. Example: Iron Pyrite.

11) Tabular-



The mineral is flat rather than elongated as shown in the figure. Example: Calcite, Orthoclase.

B) Colour: Colour is an important physical property of minerals, which depends upon light. The colour of any mineral depends up on the absorption of some and reflection of others of the colour of white light. If the mineral absorbs all the colour of white light, it appears Black. If the mineral reflects all the Colours of white light it appears, White.

C) Streak: Colour of the mineral in its powdery form. Rubbing the mineral against the streak plates can get streak.

For example, Natural gold is Yellow in both in its colour and powder form. Pyrite yellow in colour but it gives black streak.

D) Diaphaneity: Diaphaneity means ability to transmit light. The terms used are:

i**) Transparent**: when the mineral allows the light to pass through it. In the case of transparent minerals the objects can be clearly seen through such minerals.Example: Quartz and Calcite (Coloured varieties).

ii) Translucent: When the minerals allow only a part of the light to pass through. The outlines of any object cannot be seen clearly through such lines of translucent mineral.Example: Quartz and Calcite (Milky white varieties)

iii) Opaque: When a mineral does not allow any light to pass through. The Objects are not seen through opaque mineral.Example: Bauxite, Hematite, and Magnetite.

E) Lustre

The Lustre of a mineral is its appearance in a reflected light, which is independent of its colour.
The terms used are:
(i) **Adamantine**- when a mineral has lustre like Diamond. Example: Zircon, Diamond, Sulphur etc.,
(ii) **Resinous**- when a mineral has lustre like Grease. Example: Opal amber and a variety of Zincblende.

(iii) **Vitreous**-When a mineral has lustre like Glass. Example: Quartz, Calcite, and in many other Silicate Minerals

(Iv**) Pearly**- when a mineral has lustre like Pearls. Example: Talc. Brucite, Micas etc.,

(V) **Metallic**-When a mineral has lustre like metals. Example: Galena, Pyrite, and Chalcopyrite.

(vi) **Silky lustre**- Mineral with a Silky shine Example- Asbestos

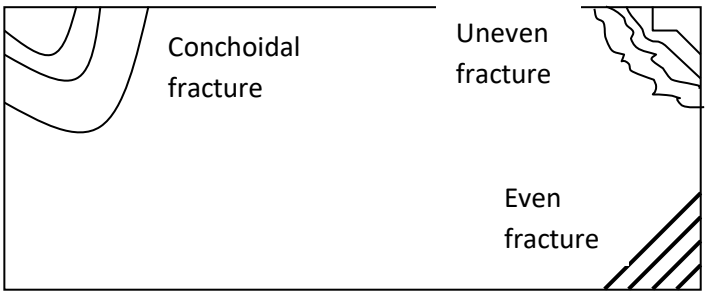
(Vii) **Dull**- when a mineral has no lustre. Example- Bauxite.

Cleavage: cleavage of the mineral is its tendency to Split along certain parallel planes producing more or less Smooth surface. Cleavage lines are the weak lines or Divisional planes in a mineral.

i)Perfect, Good or Distinct- When a mineral can split up with great ease and give a Smooth surface. Example: Mica, Feldspar

(ii) Imperfect, Poor, Imperfect or None- When a mineral does not split up with an average force. Example: Quartz.

Fracture: fracture of the mineral may be defined as the appearance of its broken surface, when the mineral is hammered and broken.



(i**) Even fracture**-Appearance of a mineral in its broken surface is Smooth.

Mineral examples: Chert, Mica.

(ii) **Uneven fracture**- when the mineral breaks with very rough and coarse surfaces.Mineral examples: Chromite and various other minerals.

iii) **Conchoidal fracture**- when a mineral breaks with curved Surfaces or concentric

Rings or half moon shape. Mineral example: Quartz

(Iv) **Hackly fracture**- when a mineral breaks with irregular Surfaces having sharp edges. Mineral example: Native copper.

(v) **Earthy fracture**- when the broken surface is soft and almost smooth.

Mineral example- Chalk.

Specific gravity - The Specific gravity of a mineral is the ratio of its weight to the Weight of equal volume of water.

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Low - Light minerals (less weight)

Medium - Intermediate minerals (medium weight)

High - Heavy minerals (much weight)

5 (a) Explain Mohs' scale of hardness. [05] | CO2 | L1 |

Hardness: The hardness of a mineral is the resistance it offers to abrasion.

Moh's Scale of Hardness

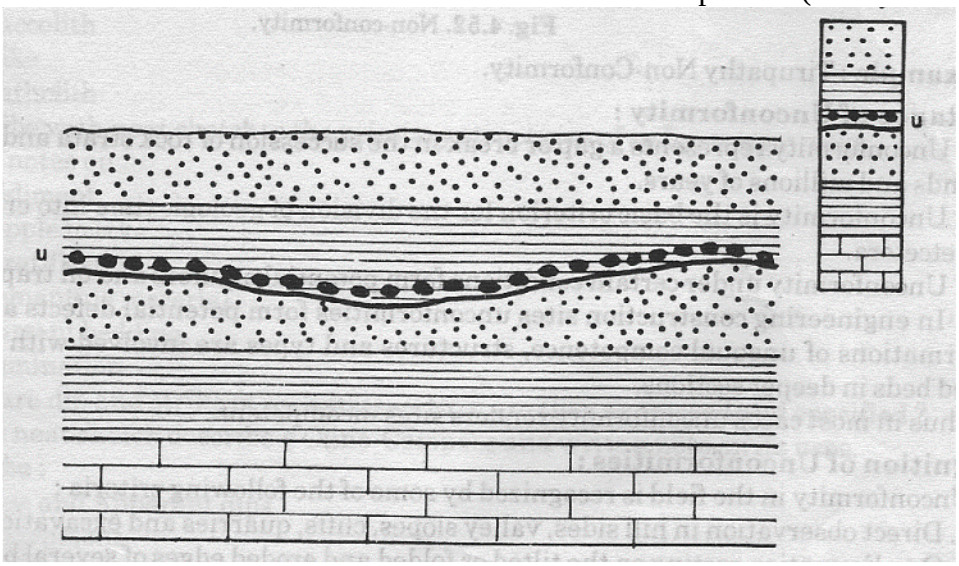
Standard Mineral and its composition	Hardness scale	Remarks
Talc $Mg_3 (Si_4O_{10}) (OH)_2$	1	Can be scratched by a finger nail
Gypsum $CaSO_4$	2	Can be scratched by a finger nail
Calcite $CaCO_3$	3	Can be scratched by a copper coin
Fluorite CaF_2	4	Can be scratched by an iron nail
Apatite Ca_3 (F, CL, OH) (PO_4)	5	Can be scratched by window glass
Orthoclase $KALSI_3O_8$	6	Steel pocket knife
Quartz SiO_2	7	Pen knife
Topaz $Al_2 (SiO_4) (SOH)_2$	8	Can not be scratched by a Pen knife
Corundum Al_2O_3	9	Cannot be scratched by a Pen knife
Diamond C	10	Cannot be scratched by a Pen knife

A mineral with lowest hardness is talc and the mineral with the maximum hardness is Diamond

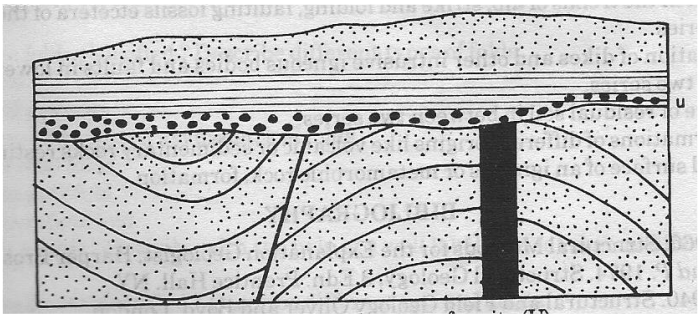
(b) Explain different types of Unconformity with neat diagram. [05] | CO4 | L2 |

UNCONFORMITY:
Unconformity is of three kinds.

PARALLELUNCONFORMITY OR DISCONFORMITY
An erosion surface with an uneven relief between two parallel (conformable) series.



ANGULAR UNCONFORMITY
An unconformity in which a younger parallel series deposited on an erosion surface of a lower deformed (tilted, folded and or faulted) older series with an angular discordance.



NON-CONFORMITY
An unconformity between two series of rock of different origins like an upper younger stratified formation and an older non-stratified or massive igneous or metamorphic rock.

IMPORTANCE OF UNCONFORMITY
- Unconformity represents a gap or break in the succession of rock strata and a time gap of thousands of millions of years.
- Unconformity is the basic criterion for the division of geologic time into era, periods and epoch etc.

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