GROUP-A

(Short Answer Type questions).
Answer all the following questions.

1. Answer the following questions in brief (1X5=5)

(a) What is a crystal ?

Ans. Crystals are solid, geometric substance bounded by several smooth surface, called faces and have well arranged internal atomic structure.

(b) What is a mineral ?

Ans Mineral is a solid, natural, made from inorganic processes, having a well arranged atomic structure as well as fixed chemical composition.

(c) What is a metamorphic rock ?

Ans. Metamorphic rocks are rocks that have formed from intense heat or pressure.
eg:- Slate, marble, etc.

(d) What is a permeability ?

Ans. Permeability is the capacity of a rock to transmit fluid through it.

(e) What is gangue minerals ?

Ans. Gangue is an unwanted substance or impurity that surrounds the mineral in an ore deposit such as sand, rock or some other materials.

2. What is stratigraphy ? Describe the principles of stratigraphy. (5)

Ans: Stratigraphy is the science of correlation, classification and description of strata in a sedimentary beds. Stratigraphy is the science which deals with the historical development of the earth.

There are three major principles which are used to determine the relative ages of strata. These principles are—

① Law of Superposition → In a series of undisturbed beds, a bed that overlies another bed is always the younger. The younger bed will be at the top of the sequence and the oldest beds are present at the bed.

② Doctorine of uniformitarianism → It is important that all the geological occurrences and changes are recorded in the rock strata. According to late Pandit Jawaharlal Nehru, 'Nature had a way of writing her own history in her rocks and stones.'

This theory states that 'the study of present is a key to the study of the past.' This statement was given by James Hutton.

③ Fossils content → William Smith in 1799 noticed that each of the sedimentary

beds contain a particular sets of fossils by which it can be identified. Because the lower forms of life existed long before the higher organisms appeared.

3. What is wind? Describe its erosional landforms. (5)

Ans. Moving air is called wind. Wind as an agent of geomorphic changes is much less ~~less~~ important than water. Wind does many types of geological work but noticable in arid and semi-arid regions where moisture and vegetation is absent.

Geological work of wind is completed in following stages-

① Erosion ② Transportation ③ Deposition.

① Erosion → Blowing wind breaks rock particles. Wind uses sand as the agent of erosion. ~~The~~ Erosional work completed into three ways-

ⓐ Deflation → 'To deflate' means to blow away with wind. Removal of loose materials by wind is called deflation. By this process, the land surface is lowered.

ⓑ Abrasion → Sometimes blowing particles/ sediments collide with rocks standing en-route and rub them. As a result Yardang is formed.

① Attrition → Sand particles blowing with wind collide among themselves. They become smaller.

If they become smaller and polished then such type of rounded sand particles are called 'millet-seed sand'.

LANDFORMS.

① Hamada → Due to deflation, when the loose particles are swept away and only the hard mantle is left which is known as Hamada.

② Yardang → Softer rocks are abraded earlier than harder rocks. As a result alternate ridge and grooves are developed known as Yardang.

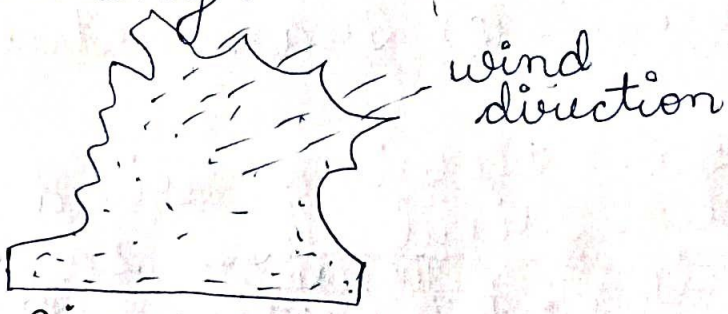
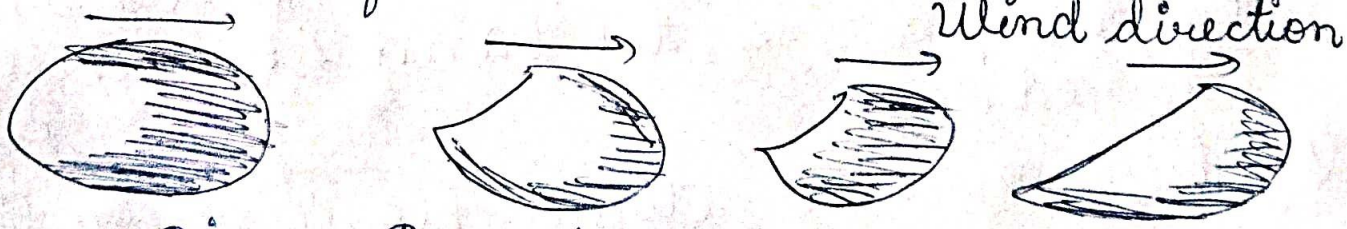


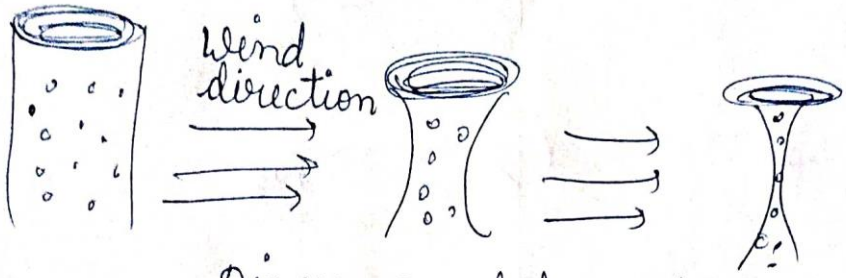
Fig:- Yardang.

③ Ventifacts → One or more faces are developed on the boulder due to abrasion. Such faceted boulders, cobbles etc are called ventifacts.



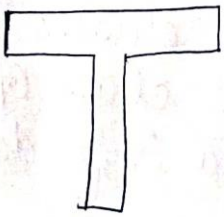
Diag: Development of a ventifacts.

④ Pedestal rock → The lower portion of the rocks standing in desert are more abraded than the upper portion, As a result, lower portion becomes thinner than upper. This structure is called pedestal rock.



Diag: Development of a pedestal rock.

⑤ Zeugen → It is also known as mushroom table. Zeugen are infact a kind of pedestal rock with a flat surface.



Diag: Zeugen.

GROUP-B.

(Long / Descriptive Answer Type Questions)

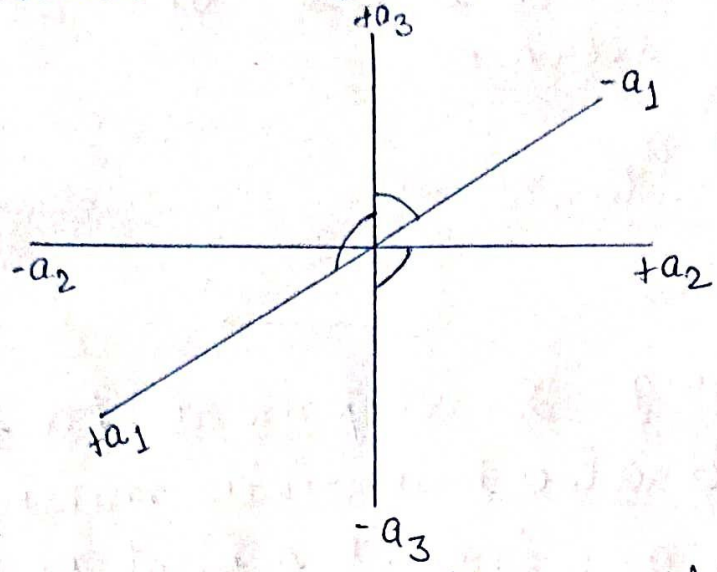
Answer any four of the following questions.

4. Describe Isometric system.. ⑮

Ans. In this system there are three three crystallographic axes which are equal, interchangeable ~~axes~~ and perpendicular to each other. They are named as a_1, a_2 and a_3. Two of them (a_1,a_2) are horizontal and a_3 is vertical. Of the two horizontal axes, a_1 is perpendicular to the

observer and a_2 is parallel to the observer.

The front end of a_1, R.H.S of a_2 and top end of a_3 are taken as ⊕ve ends and their perpendicular are ⊖ve ends.



Diag :- Crystallographic axes of Isometric system.

Class - There are five classes in this system, of which the normal class Galena-type is the most common and important.

Normal Class Galena-Type.

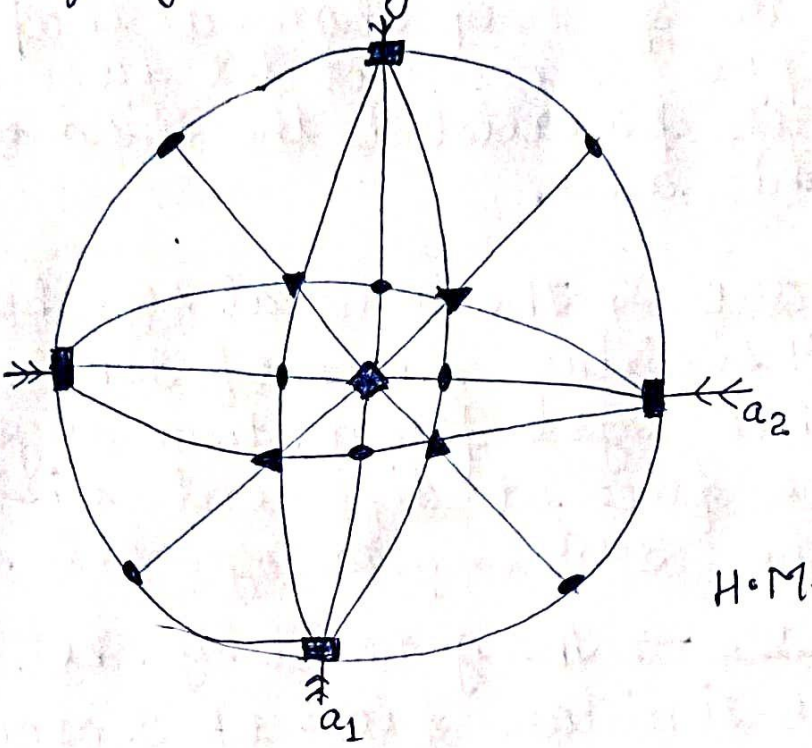
① Symmetry elements:-

3 x L. Ax - 4; 4 diag. Ax - 3; 6 diag. Ax - 2; 3 x L-P; 6 diag. P.; C. (3 Axial axis of 4-fold symmetry; 4 diagonal axis of 3-fold symmetry; 6 diagonal axis of 2-fold symmetry; 3-axial plane of symmetry; 6 diagonal plane of symmetry and centre of symmetry is present).

(a) Axis of symmetry → There are 13 axes of symmetry of which 3 axes are of 4-fold symmetry coincide with 3-crystallographic axes. Other four axes are diagonal and are of 3-fold symmetry. There are also 6-diagonal axes of 2-fold symmetry.

(b) Plane of symmetry → There are 9 planes of symmetry of which 3 are axial planes and other 6 are diagonal planes.

(c) Centre of symmetry → Present.



H.M. Symbol = $\left(\frac{4}{m}\ \bar{3}\ \frac{2}{m}\right)$

Stereographic projection : Normal class Isometric System.

Forms	Indices	No. of faces
(1) Cube	(100)	06
(2) octahedron	(111)	08
(3) Dodecahedron	(110)	12
(4) Tetrahexahedron	(hk0)	24
(5) Trisoctahedron	(hhl)	24
(6) Trapezohedron	(hhl)	24
(7) Hexoctahedron	(hkl)	48.

(1) Cube → The general symbol is (100). There are 6 similar faces of square shape. Each of them is parallel to two crystallographic axes and cut third axis at unit distance.

(2) Octahedron → The general symbol is (111). There

are 8 similar faces of equilateral Δ. Each face cuts all the crystallographic axes at equal distances.

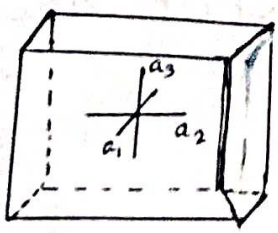
③ Dodecahedron → The general symbol is 110. There are 12 similar faces of Rhombus shape. Two crystallographic axes cut the face at equal distances while parallel to the third ~~crystogra~~ crystallographic axis.

④ Tetrahexahedron → The general symbol is hk0 There are 24 similar faces of Isosceles Δ shape. In this ~~syst~~ form, two crystallographic axes cut the face at different distances while ∥ to the 3rd crystallographic axis.

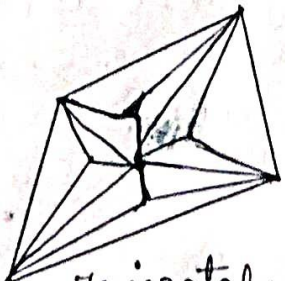
⑤ Trisoctahedron → The general symbol is hhl. There are 24 similar faces of Isosceles Δ shape. In this form, two crystallographic axes cut the face at equal distances and 3rd axis at unequal distances.

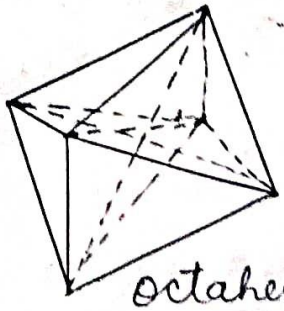
⑥ Trapezohedron → The general symbol is (hll) There are 24-faces similar of trapezium shape. In this form, two crystallographic axes cut at same point and one crystallographic axis cut at another point.

⑦ Hexoctahedron → The general symbol is hkl. There are 48-similar faces of scalene Δ shape. Each of crystallographic axes at different points.



Cube.


Trisoctahedron


octahedron.

Minerals crystallising in the cubic system / Isometric system are -

① Galena ② Garnet ③ Diamond ④ Magnetite ⑤ Pyrite ⑥ Fluorite ⑦ Chlorite, etc.

Classes of Isometric System.

① Normal class / Hexoctahedral class.
② Gyroidal class.
③ Hextetrahedral class.
④ Deploidal class.
⑤ Tetratoidal class.

5. Describe hardness, lustre, streak ~~and~~ cleavage and fracture of minerals citing suitable examples. (15)

① Hardness → Hardness may be defined as the resistance against scratch. Hardness depends upon the atomic structure of mineral. It increases with the density and packing in the structure, valency of the ions and with decrease in ionic size. The hardness of a mineral may vary in different direction depending upon the internal structure. These ~~are~~ difference are generally very small but, in the kyanite mineral hardness varies between 5 & 7.

The hardness of a mineral is determined with a reference to a scale of standard mineral proposed by Moh and is given below -

Name of minerals	Hardness
Talc	1
Gypsum	2
Calcite	3
Fluorite	4
Apatite	5

(6)	Orthoclase	6
(7)	Quartz	7
(8)	Topaz	8
(9)	Corundum	9
(10)	Diamond	10.

Lustre → Lustre is defined as the amount of light reflected from the surface of a mineral (i.e; shining of a mineral). The lustre of single crystal may differ from crystals in aggregates. The following are the common lustre —

(i) Metallic lustre – Ordinary lustre of metals.
Eg: Gold, Silver, etc.

(ii) Sub-metallic lustre – Poor display of light in metallic lustre.
Eg: Chromite ($FeO.Cr_2O_3$), Cuprite (Cu_2O) etc.

(iii) Vitreous lustre – The lustre of broken glass
Eg: Quartz.

(iv) Sub-vitreous lustre – When poor display.
Eg: Pyroxene, Amphibole.

(v) Pearly lustre – The lustre of a pearl.
Eg: Talc, Brucite, etc.

(vi) Resinous lustre – The lustre of resin.
eg: Opal, sphalerite.

(vii) Adamantine lustre – Such minerals are transparent or translucent and having a high refractive index. eg: Diamond, Zircon etc.

Streak → Streak of a mineral is the colour

of its powder, may be different from the mineral mass.

eg: Hematite appears to be black but it gives a cherry red streak.

Streak is studied by scratching or rubbing the minerals. In the laboratory a streak plate is used for this purpose. The mineral which are harder than the streak plate are said to be colourless streak.

Cleavage → The cleavage of a mineral is the direction along which mineral breaks easily producing smooth surface.

The smooth surface along which mineral splits is known as cleavage plane. In all mineral the direction of the cleavage plane are parallel to the certain crystal faces.

Eg: (i) Quartz has no cleavage.
(ii) Amphiboles, pyroxenes, felspars, have 2-sets of cleavage.
(iii) Calcite has 3-sets of cleavage.
(iv) Hoorblende has 1-set of cleavage.

Fracture → Fracture is the nature of surface produced by breaking a mineral in any directions, other than cleavage directions. The fracture surface is not the smooth surface of a cleavage plane.

eg: Quartz, chalk, chert, etc.

The following terms are used to described fracture —

(i) Conchoidal fracture - The mineral breaks with concave or convex.
eg: Quartz, Glass.

(ii) Even fracture - The fracture surface is flat. Eg: Chert.

(iii) Uneven fracture - The fracture surface is rough. Most minerals have uneven fracture.
Eg: Bauxite.

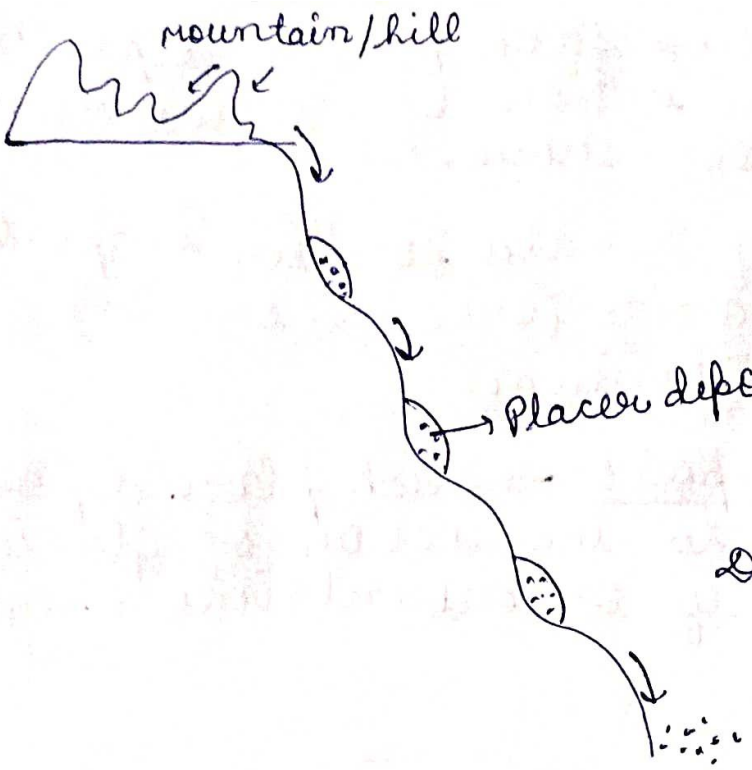
(iv) Hackly fracture - The f surface has pointed elevations. (as in cast iron)

(v) Earthy fracture - The dull fracture surface
eg: Chalk.

Q6. Write short notes on the following. (5+5+5)
(a) Types of placer deposits.
(b) Succession and economic Importance of Gondwana supergroup.
(c) Magmatic Concentration process.

Ans(a) Types of placer deposits are -

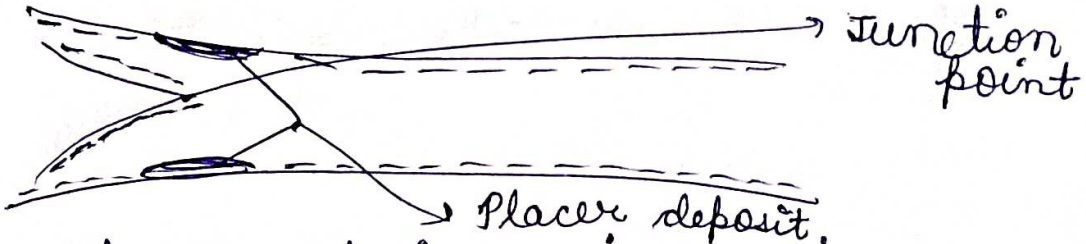
(i) Eluvial placer deposit → These deposits are formed due to the action of rain water, generally at the mountainous or hilly regions. Some particles take their place at the foot hill side and some are at the top of the hill.



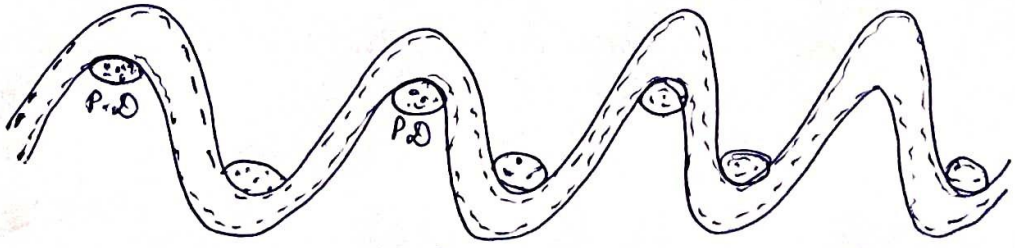
Diag:- Shows Eluvial placer deposit.

(ii) Alluvial placer deposit → Such placer deposit are formed due to the action of river water, generally at the bank of the river. The places where alluvial placer deposits are formed are as follows.

(a) Just downward streams to the junction of a tributaries to the main river.



(b) In case of meandering river.



Diag: Meandering river.

(iii) Aeolian placer deposit → Such placer deposit are formed due to action of wind, generally in the desert area or arid region. Eg: Aeolian placer deposits are found in Australia.

Ans (b) GONDWANA SUPERGROUP

After the deposition of the Vindhyan rocks, there was a great hiatus or break in the stratigraphic history of the peninsula. The sedimentation ~~period~~ begins during the close of Palaeozoic era that is at the end of Carboniferous Period or in the beginning of Permian period.

The term Gondwana was given by H.B. Medlicott in 1872 for a thick succession of sediments of fluviatile and lacustrine deposits with a glacial deposit at the bast. The name has been derived from the 'Gond Kingdom' in Madhya Pradesh where, these formation were studied by Medlicott first.

Succession.

System	Group	Formation	Age
Upper Gondwana System.	Jabalpur	Umia Jabalpur Chaugon	——
	Rajmahal	Kota Rajmahal	Lower Jurassic Lower Cretaceous
	Mahadeva (Supra Panchet)	Maleri Pachmari	Upper Triassic
	Unconformity		
Lower Gondwana System.	Panchet	Panchet	Lower Triassic
	Damuda	Raniganj	Upper Permian
		Barren measure	Middle "
		Barakar	Lower "
		Karharbari	

Talchir	Rikba	Upper carboniferous
	Talchir	
	Boulder bed	Lower carboniferous

Unconformity

Archaean basement.

Economic Importance.

(i) Gondwana supergroup especially the lower Gondwana is known for ~~eic~~ deposits of coal. Most of the coal in the Gondwana is found in the Damuda Group i.e; Barakar and Raniganj formation.

(ii) Barren measure formations is devoid of any coal seams but iron-ores are found in this formation.

(iii) Different types of fire clay deposits are also associated with Gondwana rocks which are used for the manufacture of refractory ~~rocks~~ bricks.

(iv) The Gondwana sandstone such as Barakar, Raniganj, Pachmari sandstones are locally used as building materials.

(v) The other and stones are used as road materials

Ans (c) Magmatic Concentration processes.

It is that process of formation of deposits of mineral in which minerals ~~are~~ are came out from the magma; according to their descending order of melting point. During cooling the magma

either within the earth or upon the surface of the earth. The magmatic deposits are formed during different stages of crystallisation of magma. Magmatic ore deposits are characterised by their close relationship with the intermediate deep seated intrusive igneous rocks. They constitute either the whole igneous or a part of a fluid. The process of magmatic concentration can be divided into two types —

(a) Early Magmatic Concentration → In early magmatic concentration, those minerals are leached out of the magma having their high melting point. Certain metallic oxides, sulphides and native minerals such as chromite, magnetite, diamond, platinum, nickel, etc are found at early magmatic deposit.

Types of early magmatic concentration

(a) Magmatic segregation.
(b) Magmatic Dissemination.
(c) Magmatic Injection.

(b) Late Magmatic Concentration →

In late magmatic concentration, those minerals are leached out of the magma having their low melting point. Late magmatic deposits consists of igneous ore minerals, that have crystallised from a residual magma towards the end of magmatic period. The late magmatic deposits are always associated

with mafic igneous rock.

The essential difference between early magmatic and late magmatic deposits is that the early deposit must lie within the igneous body at the ~~body~~ place of settling but, in case of late magmatic deposits, it may lie enclosed within its host rock or cut across its internal structure.

The late magmatic deposits may be of following types —

(a) Residual liquid segregation.
(b) Residual liquid Injection.
(c) Immiscible liquid segregation.
(d) Immiscible liquid Injection.
(e) Residual liquid pegmatitic Injection.

Q7. Write down the physical properties, chemical composition and uses of any three of the following: 3×5=15

(a) Kyanite
(b) Muscovite
(c) Talc
(d) ~~Corundum~~ Gypsum.

(a) Kyanite

Chemical composition. → $Al_2O_3 \cdot SiO_2$ [Al_2SiO_5]
Colour → Usually blue, white, grey or green.
Streak → Colourless
Lustre → Vitreous to Pearly
Hardness → 5 along parallel length and 7 at 90°

Specific Gravity → 3.55 to 3.66 (medium)
Cleavage → Two - sets perfect
Fracture → Uneven, brittle

Form and structure → Long, tabular, crystal, bladed aggregates.
Crystal system → Triclinic System.

Uses.

① It is used in refractory and ceramics product and also used in electrical insulators and abrasives.

② It has been used as a semi-precious gemstones which may display cat's eye (Chatoyancy).

⑥ Muscovite.

Chemical composition - $KAl_2(AlSi_3O_{10})(F,OH)_2$
Colour → Colourless or White
Streak → Colourless
Lustre → Vitreous to Pearly
Hardness → 2.0 to 2.5
Specific Gravity → 2.76 to 3.00
Cleavage → 1 - sets perfect.
Fracture → Even.
Form and structure → Tabular, foliated.
Crystal system → Monoclinic System.

Uses.

① The ability of muscovite to split into thin transparent sheets, which is used as window panes.

② Sheet mica is an excellent insulator and that is makes it suitable for manufacturing specialised for electrical equipments.

© Talc.

Chemical composition → $[Mg_3Si_4O_{10}(OH)_2]$

Colour → Apple green to white

Streak → White

Lustre → Pearly to silky

Cleavage → 1-set perfect.

Fracture → Uneven to sub conchoidal.

Hardness → 1.

Specific Gravity → 2.7 to 2.8.

Form and structure → Massive, foliated and granular.

Crystal system → Monoclinic system.

Uses.

① It is used in the manufacture of talcum powder.

② It is used as a filler in the paints, paper and rubber.

(d) Gypsum.

Chemical composition → $CuSO_4 - 2H_2O$
Colour → Commonly white or colourless.
Streak → White.
Lustre → Vitreous (sub) to Pearly.
Specific Gravity → 2.32
Hardness → 1.5 to 2.6 (low)
Fracture → Conchoidal
Cleavage → 1-set perfect.
Form and structure → Crystalline, massive and granular.
Crystal system → Monoclinic system.

Uses.

(1) For making Plaster of Paris ($CuSO_4 \cdot \frac{1}{2}H_2O$)
(2) In foot creams, shampoos and many other hair products.

Q8. Write short notes on the following: (5+5+5)

(a) Dip, True dip and Apparent dip
(b) Fold
(c) Fault.

Ans (a) Dip is the angle which any plane makes with the horizontal plane. It always measured in vertical plane.

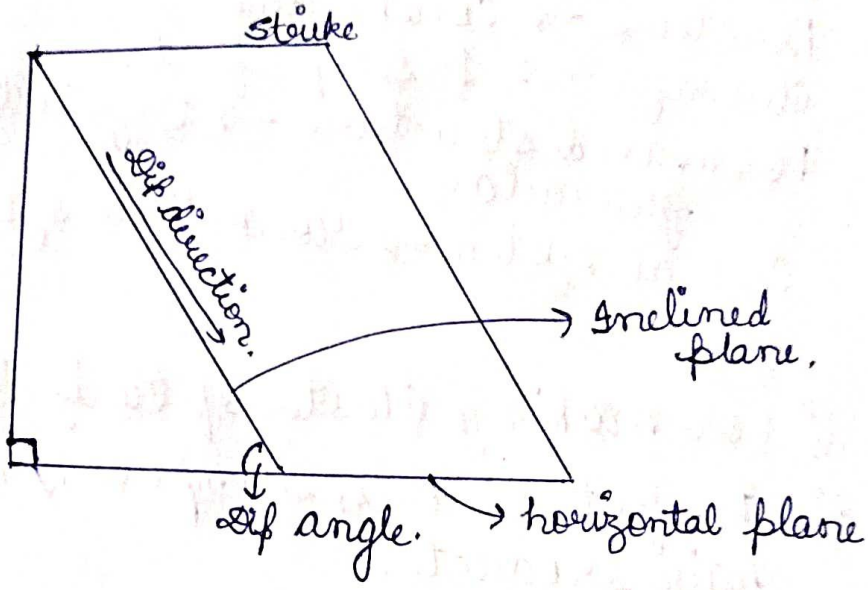
Dip is a vector quantity because it has both directions and magnitude.

Dip has two components.

(i) Amount of Dip → The amount of dip is the angle which varies from 0 to 90°. It may be press expressed either in

terms of degree (20°, 30°, 40°, 90°, etc) or in terms of gradient (20 in 1, 5 in 1).

(vi) Direction of Dip → The direction of dip is the direction along which a bed has maximum slope. It may be expressed either in whole circle bearing or in quadrant bearing.



True Dip → True dip is the maximum slope of an inclined plane. It's direction is perpendicular to its strike direction. i.e;

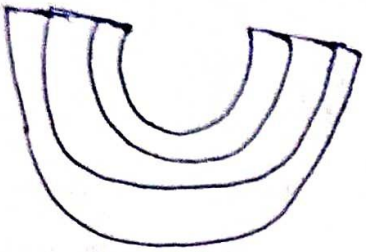
True dip = 90°.

Apparent Dip → Dip measured in the directions other than the direction of true dip is called apparent dip.

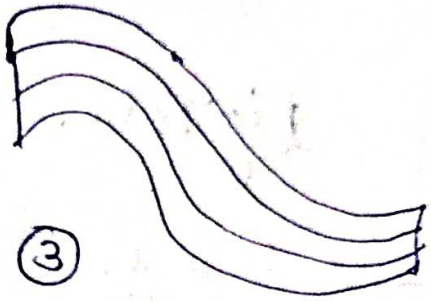
It varies from 0° to little less than the value of true dip i.e; 90°.

Ans (b) Fold → Folds may be defined as undulations or warps or bends or curvatures developed in the rocks of the earth's crust, as a result of stresses (tectonic or non-tectonic forces).

① Anticline



② Sycline



③

Although all the three types of rocks such as igneous, sedimentary and metamorphic show folding but it is well seen in sedimentary rock. Some folds are measured in feet and inches or even fraction of an inch while other folds which is measured in km or miles.

Terominology of fold.

① Limb - The sides of a fold are called limb.

② Axial plane → It is an imaginary plane which divides a fold into two equal halves. It may be vertical, inclined or horizontal.

③ Anticline or sycline → An anticline is up-fold whereas syncline are down fold where the limbs dip towards the axis of fold on either side in syncline.

④ Inflection point → A point which separates a convex and concave segment of the wavy line is called an inflection point.

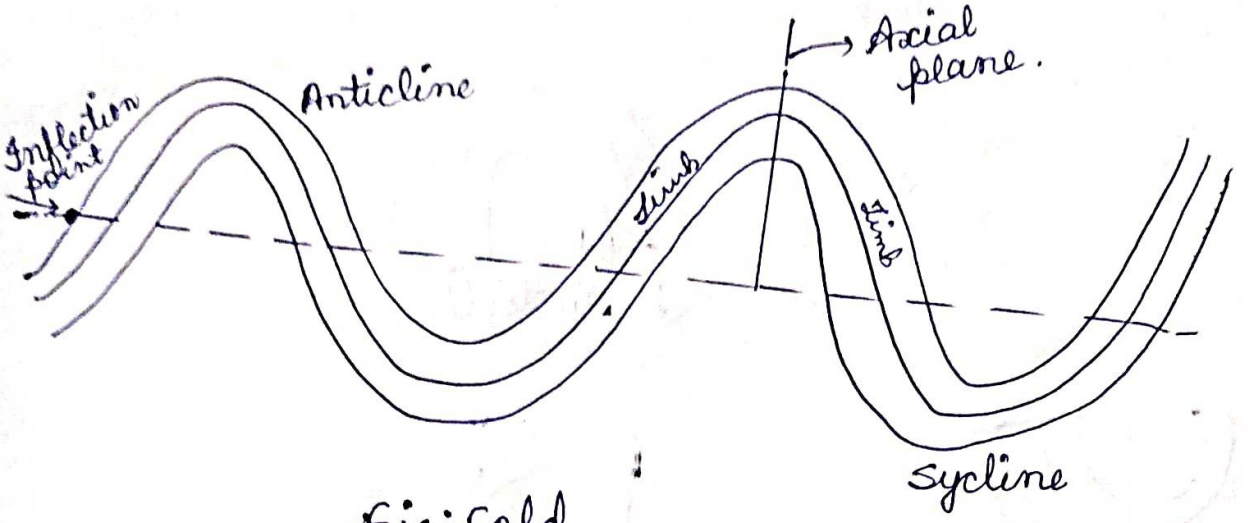
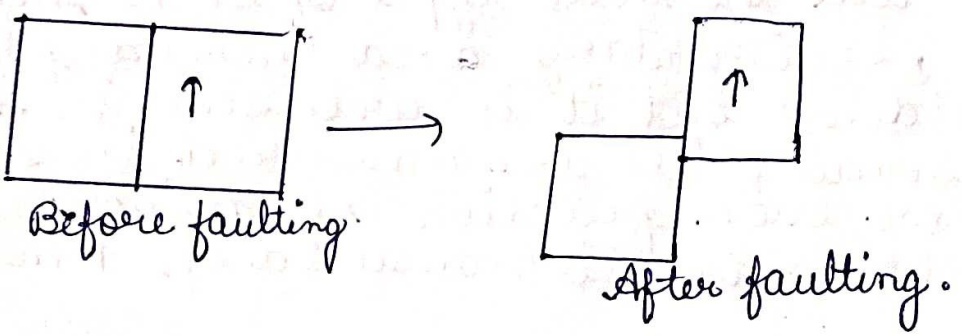


Fig: Fold.

Ans © Fault is a smooth rupture or fracture along which there is a relative displacement of the rock bed.



Some fault are only a few inches long and the total displacement is measured in fraction of an inch while some faults are 100 of miles of long with a displacement measured in miles and even tens of miles.

Terms related to the fault :-

① Fault plane → The plane along which displacement takes place is known as fault plane.

② Foot wall → The block below the fault plane is called foot wall.

③ Hanging wall → The block which lies above the fault plane or which appears hanging over the fault plane is called hanging wall.

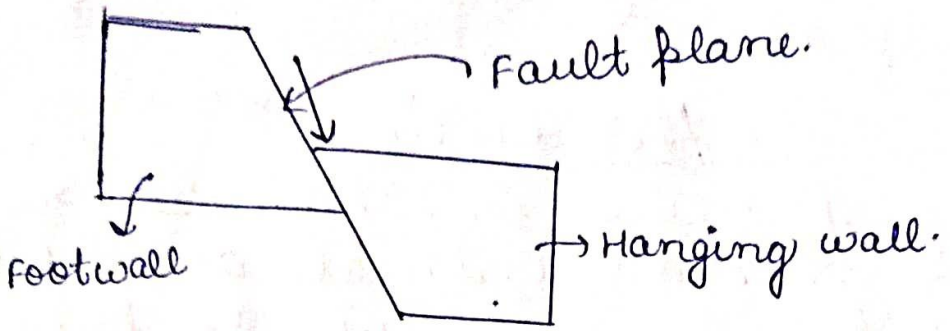


Fig: Showing fault.

Q9. Define fossils. Describe its mode of preservation. (15)

Ans. Fossils are the remains of organic substances either plants or animals which are preserved in the rock of sedimentary beds. They must be geologically ancient.

Mode of preservation of fossils.

(1) Whole body of the organism (both soft and hard parts) are preserved. Such type of preservation are very rare. These types of preservation takes place when the dead organism is covered quickly under thick layer of ice or glacier, where no decay of the fleshy materials.
Eg: Woolly mammoth and Rhinoceras found in Norther Siberia.

(2) Only the hard parts (skeleton, bones, teeth, nails, shells, etc) are preserved. Fossils of such type preservation are most common. The whole skeleton are rarely preserved because they are fragmented during transportation and deposition. The hard parts may survive for a longer

time because they are not easily destroyed or decayed.

③ **Petrification / Petrifaction.**

It is the process in which the remains of the plants and animals are converted into rocks. In such type of preservation, the internal organism's structure as well as the external form at the body are totally preserved but the chemical components is replaced by silica, carbonates (calcium), oxides etc. This type of preservation of fossils are found maximum in number.

④ **Carbonisation (both hard and soft parts).**

Carbonisation is that process in which the hard parts as well as soft parts of the organism are decomposed and it loses nitrogen, oxygen and other volatile constituents. As a result, the percentage of carbon is enriched.

Eg: Conservation of plants into coal.

⑤ **Traces of organism.**

Sometimes organisms leave its impressions as traces which is well preserved in the rock beds. These traces are also important to paleontologists. Some of the important traces fossils are —

(i) In the form of mould and casts.
(ii) In the form of tracks and ~~traces~~ trails.
(iii) Imprints.