Question paper no 63767

Duration 3 Hrs **Max. Marks 100**

1 a Fill in the blanks **10**

i)Common salt (NaCl) is an example of ionic bonding.
ii)Hypersthene is a orthopyroxene, while augite is a clinopyroxene.
iii)Water (H_2O) is an example of covalent bond.
iv)Asbestos mineral shows fibrous fractures.
v)The mineral with hardness 5 on Moh's hardness scale is apetite.
vi)Olivine is an example of nesosilicate type of silicate structure.
vii)Inosilicates are divided into single chain and double chain based on their structure.
viii)Cube is a form bounded by six similar faces, each of which is parallel to the three crystallographic axes and intersects the third axis at unit distance.
ix)_____ (1000) is form present in hexagonal system, which intersects only one of the horizontal axis.
x)In Monoclinic system the 'a' axis is called as the orthoaxis.

b Define the following **10**

i)Metallic bond and Ionic bond

A metallic bond occurs whenpositive metal ions like Cu^{+2} or Fe^{+3} are surrounded by a "sea of electrons" or Cloud of electrons which are freely-moving valence electrons**.**
The valence electrons are not bound to any particular cation, but are free to move throughout the metallic crystal.
Crystals with this type of bonding are called metallic crystals.
Many properties which are characteristics of metatals, are due to the presence of free electrons.
Ionic bond: Bonding between ions of opposite electrical charge. Atoms are held together by this type of bond are in the ionized state, each atom having gained or lost one or more electron, so that they have acquired a positive or negative charge. The ions are held together by the electrical attraction between oppositely charged bodies. Example-Common halite mineral NaCl and Fluorite CaF

ii)Prism and Pyramid

Prism: These are the forms with vertical faces and therefore parallel to the c axis and intersecting both the horizontal axes. Depending upon their orientation and lengths of intersection with horizontal axis, prisms can be classified into three types- Prism of first order, prism of second order, Ditetragonal prism etc.
Pyramid:A pyramid is a 3, 4, 6, 8 or 12 faced open form where all faces in the form meet, or could meet if extended, at a point.

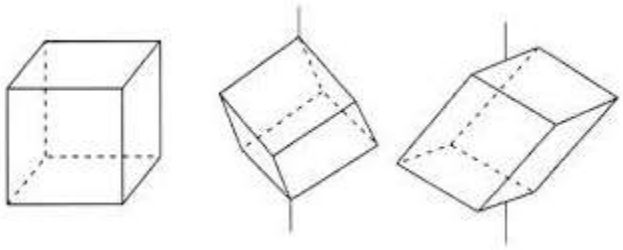
iii)Acicular and reniform habit of mineral

Acicular: Occurs as needle-like crystals.Example: Natrolite
Reniform:Kidney shaped aggregates of crystals. The rounded outer surface of massive mineral aggregates resembling those of kidneys. Example- Haematite

iv)Axes of symmetry and centre of symmetry

Axis of symmetry: It is an imaginary line in the crystal, about which when a crystal is rotated, certain faces, edges and corners come to occupy same position in space, more

than once, during complete rotation of 360°.



Centre of symmetry:It is an imaginary point in thecrystal that any line drawn through it intersects the surface of the crystal at equal distance on either side.

v)Dome and Pinacoid

A pyramid is a 3, 4, 6, 8 or 12 faced open form where all faces in the form meet, or could meet if extended, at a point.
Domes are 2- faced open forms where the 2 faces are related to one another by a mirror plane.

2 Answer any two of the following

a Describe the ionic bonding, and give examples of minerals that show ionic bond. Why ionically bonded compounds are easily dissolved in water? **10**

Bonding between ions of opposite electrical charge. Atoms are held together by this type of bond are in the ionized state, each atom having gained or lost one or more electron, so that they have acquired a positive or negative charge. The ions are held together by the electrical attraction between oppositely charged bodies. Example-Common halite mineral NaCl and Fluorite CaF. The electrical charge of ions in water and ions in ionically bonded compound is chaged and hence these compounds dissolve in water.

b Graphite and diamond have same chemical composition but different forms. Explain this phenomenon. Also explain the phenomenon of two minerals with different chemistry show the same form. **10**

The bond in diamond is strong covalent bond whereas in the Graphite it is weak Van der waals bond. Because of the change in bond the the forms are different. The phenomenon where two minerals have different chemistry but same form is called as pseudomprphism. If a mineral is replaced by another mineral without any change in the external form then they are termed as pseudomorphs. Pseudomorphs are formed in several ways such as by incrustation, infiltration, replacement and by alteration.

c List various physical properties observed in minerals. Explain the forms of minerals with **10** examples.

Colour
Streak
Lusture
Test, odour and feel
Form
Habit

Clevage and partings
Fracture
Hardness
Specific gravity
Crystallized- The mineral occur as well developed crystals.
Crystalline- No definite crystals are developed
Cryptocrystalline- The mineral possesses traces of crystalline structure.
Amorphous- Complete absence of crystalline structure. Examples of all of them is expected.

d How many of the following can be classified as 'mineral'? Justify your answer. **10**
(i)Petrol (ii) Natural gas (iii) Corundum (iv) Ice
Only corundum can be classified as mineral as it follows the defienation of mineral.
Students are expected tp write about the rest why they are not mineral.

3 Answer any two of the following

a Define and describe any four external characteristics of crystal.
Colour
Streak
Lusture
Test, odour and feel
Form
Habit
Clevage and partings
Fracture
Hardness
Specific gravity
Form above mentioned properties description for any four is expected.
10

b Describe the principle and working of contact goniometer.
A contact goniometer consists of two metal rules pivoted together at the centre of a graduated semicircle. The instrument is placed with its plane perpendicular to an edge between two faces of the crystal to be measured, and the rules are brought into contact with the faces. The angle between the rules, as read on the graduated semicircle, then gives the angle between the two faces. The rules are slotted, so that they may be shortened and their tips applied to a crystal partly embedded in its matrix. The instrument illustrated is employed for the approximate measurement of large crystals.
10

Write the characteristics of Cubic system. Give examples of minerals belonging to cubic system
Planes of symmetry: 9 (3 axial, 2 vertical, 1 horizontal, 2 diagonal vertical, 4 digonal inclined planes

c Axes of symmetry: 13 (3^4,4^3,6^2) **10**
Centre of symmetry: present
Forms present:Cube, Octahedron, Rhom-do-decahedron, Triasoctahedron, Trapedohedron, tetrahexahedron, hexaoctahedron.

Examples: Galena, Pyrite, Fluorite, Galena, Garnet

d Differentiate between Monoclinic and Triclinic Systems using elements of symmetry and **10** mineral examples.

System	Type	Planes	Axes	Centre	Examples
Monoclinic	Gypsum	1	1 (1^2)	Present	Gypsum, Kaolinite Albite Augite
Triclinic	Axinite	Absent	Absent	Present	Axinite Microcline Plagioclase Wollastonite etc.

4 Answer any two of the following

a Explain the chemical composition, paragenesis and occurrence of Mica Group of minerals. **10**

Mica, any of a collection of hydrous potassium, aluminum silicate minerals. It is a kind of phyllosilicate, showing a -dimensional sheet or layer structure. Among the most important rock-forming minerals, micas are located in all 3 foremost rock types—igneous, sedimentary, and metamorphic.

Chemically, micas can be given the general formula

X2Y4–6Z8O20(OH, F)4, in which

X is K, Na, or Ca or less commonly Ba, Rb, or Cs;
Y is Al, Mg, or Fe or less commonly Mn, Cr, Ti, Li, etc.;
Z is chiefly Si or Al, but also may include Fe3+ or Ti.

Structurally, micas can be classed as dioctahedral (Y = 4) and trioctahedral (Y = 6). If the X ion is K or Na, the mica is a common mica, whereas if the X ion is Ca, the mica is classed as a brittle mica.

Common micas:Biotite, Lepidolite, Phlogopite, Zinnwaldite

Brittle micas: Clintonite

Occurrence of Mica Group Minerals

Micas may additionally originate as the result of diverse procedures under several specific situations. Their occurrences, listed underneath, encompass crystallization from consolidating magmas, deposition by fluids derived from or immediately related to magmatic sports, deposition by means of fluids circulating at some point of both contact and nearby metamorphism, and formation because the result of alteration techniques—possibly even those caused by weathering—that involve minerals which include feldspars. The balance ranges of micas were investigated within the laboratory, and in a few institutions their presence (instead of absence) or some issue of their chemical composition may additionally function

geothermometers or geobaromet.

b What are Cyclosilicates? Explain the structure, chemical formula and minerals of this group.
Cyclosilicate, called polysilicate, compound with a structure in which silicate tetrahedrons (each of which consists of a central silicon atom surrounded by four oxygen atoms at the corners of the tetrahedron) are arranged in rings. Each tetrahedron shares two of its oxygen atoms with other tetrahedrons; the rings formed may have three (e.g., benitoite), four (e.g., axinite), or six members (e.g., beryl). The cyclosilicates have chemical formulas that contain multiples of SiO3.Minerals of cyclosilicate group: Silicate minerals **10**

c Explain the chemical composition, paragenesis and occurrence of Olivine Group of minerals.
This group of mineral belongs to nesosilicate. The olivine group consists of an isomorphous series with the general formula R_2SiO_4 in which R is Mg^{2+} or $Fe^{2+.}$ The magnesium end member is fosterite (Fo), and the iron end member is fayalite. **10**
Occurence: Ultrabasic igneous, basic igneous rocks, some intermediate rocks.

d With examples, explain inosilicate structures. Write a note on minerals belonging to single Chain inosilicate structure. **10**
Inos means fibre. The fibrous nature of these minerals is because of the chain structure of the tetrahedrs. Two types of chain structure are seen. Single chain and double chain.
Single chain: the tetrahedral linkage is in one direction only. The pyroxene minerals like augite, hypesthene crystallises in this group.
Double chain: The tetradedral linkage is in the form of double chain innwhich single chains are linked side by side. This creates voids between the chains that are filled with hydroxyl molecules. The ambhibole minerals minerals occur in this group.

5 Write notes on any four of the following **20**

i) Elements of symmetry of orthorhombic system
Planes of symmetry : 3 (two vertical axial palnes and one horizontal axial plane)
Axes of symmetry:3^2(one vertical and two horizontal axes)
Centre of symmetry: Present.

ii) Lustre of minerals
A mineral's luster is the overall sheen of its surface – it may have the sheen of polished metal, or that of an unpolished metal that is pitted by weathering – or it may have the sheen of glass, or look dull or earthy, etc. Luster should not be confused with color: A brass-yellow pyrite crystal has a metallic luster, but so does a shiny grey galena crystal . Quartz is said to have a glassy (or vitreous) luster, but its color may be purple, rose, yellow, or any of a wide range of hues.
The different types of luster referred to are: Metallic, sub metallic, non metallic (Adamantine, Resinous, Glassy/Vitreous, Pearly, Silky, Dull, Earthy

iii) Colour and streak of Minerals (give examples)
The minerals absorb certain wavelengths of the natural light and reflects others, this is how to a human eye the mineral appears coloured. The colour is related to major atomic constitution of that mineral. Colour of mineral can also be due to presence of certain anions or anionic groups like CO3-2, Cl-1etc.

The color of a mineral's powder is often a very important property for identifying the mineral. The streak test is done by scraping a specimen of the mineral across a piece of unglazed porcelain known as a "streak plate."

iv Scale of relative hardness of minerals

Hardness is a measure of a mineral's resistant to abrasion. This property is easily de-termined and is used widely for field identification of minerals. More than a century ago. Friedrich Mohs (1773-1839), a German mineralogist, assigned arbitrary relative numbers to ten common minerals in order of their hardness.

1	Talc	Fingernail (2.5)
2	Gypsum	
3	Calcite	Cooper coin (3)
4	Flourite	Knife blade (5.5)
5	Apatite	Glass plate (5.5+)
6	K-feldspar	
7	Quartz	Streak plate (7)
8	Topaz	
9	Corundum	
10	Diamond	

A simpler version of the Moho's scale can be established using three types of hardness:

Soft - Minerals that can be scratched with a fingernail

Intermediate - Minerals that cannot be scratched with a fingernail but can be scratched with a steel nail.

v) Forms of Tetragonal system.

Basal Pinacoid (001), Prisms (prisms of first order, prisms of second order, ditertragonal prism), Pyramids (pyramids of first order, pyramids of second order, ditertragonal pyramids

Amphibole group of minerals.

The amphiboles are a group of hydroxylated chain structure with some substitution of F and Cl for (OH). They include both orthorhombic and monoclinic members. The double chian silicate structure allows large number of elemental subsitutuion. Tha chains are stacked parallel to the c crystallographic axis and joined together by

vi) ions occupying particular lattice sites. Three groups are Ca poor amphiboles, carich amphiboles and the alkali amphiboles. All amphiboles are prismatic with two ggod prismatic cleavages meeting at 124°in tha basal section.

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