

BACHELOR OF SCIENCE EXAMINATION, 2019

(1st Year, 1st Semester)

GEOLOGICAL SCIENCES

Mineral Science

Paper - CORE/TH/02

Time : Two hours

Full Marks : 50

1. Answer any *five* questions :
 - (a) (i) “Diamond is hard, where as graphite is soft”.
Explain the statement with the help of their internal atomic structures and chemical bonding.
 - (ii) Why does any mineral section remain dark when their vibration directions coincide with the vibration directions of polarizer and analyzer of the microscope? $2^{1/2} + 2^{1/2} = 5$
 - (b) (i) “Calcite crystal show double images in hand specimen whereas the optically anisotropic quartz crystal does not produce the same.”
Explain the phenomenon.

(Turn over)

(2)

- (ii) Draw a neat sketch of X-Z section of a biaxial indicatrix to show all optic features. How are biaxial minerals classified further as (+) and (-) crystals. $2+3=5$
- (c) (i) How an isotropic mineral section and an optic axis perpendicular section of any anisotropic mineral can be distinguished ?
- (ii) “[SiO₄] tetrahedrons do not prefer to share edges or faces in silicate structures”– Why ? Justify with the help of Pauling’s Rule. $2\frac{1}{2}+2\frac{1}{2}=5$
- (d) (i) Which section of a biaxial mineral would express the true birefringence value ? How will you select that section of mineral ?
- (ii) Why the observations regarding the change in interference colour before and after insertion of accessory plate would be opposite in NE and NW quadrants of a uniaxial optix axis figure ? $2\frac{1}{2}+2\frac{1}{2}=5$
- (e) (i) “Mg and Fe²⁺ are in diadochic relation in ferromagnesian minerals”. Accept or reject the statement with proper reasons.
- (ii) A quartz grain (uniaxial positive) shows 1st order gray interference colour under transmitted light microscope. How can be the orientation of ϵ and ω assigned in the quartz grain using an accessory plate ? $2\frac{1}{2}+2\frac{1}{2}=5$

(5)

- (vii) Write short notes on (any *two*) : $2.5 \times 2 = 5$
- (a) Symmetry Elements
- (b) Spherical Projection
- (c) Crystallographic Axes
- (viii)(a) Define “Crystal Form” and “Zone Axis”.
- (b) What is Pinacoid ? How many pedions should be required to completely enclose the space ?
- (c) What is the difference between “Dome” and “Sphenoid” ? $2+1+2=5$

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(Turn over)

(4)

- (c) Is (001) face always perpendicular to z-axis of any crystal ? Justify your answer. $1.5+2+1.5=5$
- (iii)(a) What point group is developed through the interaction of 2-mirror planes at 60° to each other ?
- (b) How will you get the “Face Symbol” of any crystal face ?
- (c) What is the difference between two point groups “ $2/m\bar{3}2$ ” and “ $2/m\bar{3}2/m$ ” ?
 $1+1.5+2.5=5$
- (iv) What is lustre ? Differentiate “Cleavage” and “Fracture” of a mineral. 5
- (v) Briefly discuss the different processes by which we examine the hardness of mineral in laboratory. What is Moh’s Scale of Hardness ? 5
- (vi)(a) What point group is developed due to removal of “i” from the point group $4/m\bar{2}2/m$?
- (b) Plot the stereographic projection of face (001) with respect to monoclinic system on the equatorial plane.
- (c) Which face of a crystal provides the same result in Gnomonic Projection and Spherical Projection ? Explain with diagram. $2+1+2=5$

(3)

- (f) (i) What are the coordination number and the radius ratio ? Calculate the lower limit of the radius ratio for octahedral coordination.
- (ii) How do the thickness and orientation of mineral section influence the interference colour ? $3+2=5$
- (g) (i) Demonstrate the inosilicate structures with reference to the pyroxene group of minerals.
- (ii) How can be the fast and slow ray vibration directions of a mineral section, which shows 1st order grey interference colour, estimated with the help of a gypsum accessory plate ? $2\frac{1}{2}+2\frac{1}{2}=5$
2. Answer any **five** questions : $5 \times 5 = 25$
- (i) (a) Define “Crystal” and “Unit Cell”.
- (b) Calculate the face symbol, if a crystal face intersects the a-axis with one third unit length of a-axis and b-axis at twice of a-axis, and c-axis with two third of b-axis.
- (c) Calculate the Zone Symbol for the non-parallel faces (123) and (231). $2+2+1=5$
- (ii) (a) What is “Roto-inversion” ?
- (b) State the point group that results if a Plane of symmetry is added perpendicular to the z-axis of a Hexagonal Scalenohedron.