

Sl. No. of Ques. Paper : 8572 C
Unique Paper Code : 219102
Name of Paper : GEHT-102 : Mineralogy Crystallography
Name of Course : B.Sc. (Hons) Geology Part I
Semester : I
Duration : 3 hours

Maximum Marks : 75

Attempt five questions. All questions carry equal marks.
Question No. 1 is compulsory.

1. Answer the following: 3 + 1 + 4 + 2 + 2 + 3
- (a) What are the polyhedral shapes of anions surrounding cations with the following coordination numbers:
- (A) CN = 4
(B) CN = 6
(C) CN = 8
- (b) If Na substitutes for Ca in plagioclase, what other substitution must occur?
- (c) Match the element pairs that are likely to substitute for each other in solid solution sites:
- | | |
|--------|----------------------|
| (A) Na | (i) Fe ³⁺ |
| (B) Al | (ii) Mn |
| (C) Ca | (iii) K |
| (D) Fe | (iv) Sr |
- (d) How does a feldspathoid differ chemically from a feldspar?
- (e) We find diamonds at the Earth's surface. Are they stable? Why or why not?
- (f) Given two wooden blocks that represent crystals from the most symmetric crystal class in the tetragonal and isometric systems, what would you look for to determine which of the blocks is tetragonal and which is isometric?
2. Write notes on the following (any two): 7.5 × 2 = 15
- (i) Graphical representation of mineral compositions
(ii) Crystal habits

- (iii) Cleavage, parting and fractures in minerals
- (iv) Physical properties of minerals based on interaction with light.
3. (a) Write a note on solid solution and exsolution.
- (b) Discuss the phenomenon of double refraction and describe the construction of nicol prism. 7.5 × 2 = 15
4. (a) Sketch and label all relevant parts of the biaxial (–) and (+) principal sections (X-Z, Y-Z, and X-Y planes). Include optic directions, optic axes, B_{xa}, B_{xo}, optic normal, 2V angle, etc.
- (b) Distinguish between screw axis and glide planes. Illustrate your answer. 9 + 6
5. Discuss how following physical properties of minerals may be controlled by crystal structure and/or chemical composition. Give one example for each.
- (i) Hardness (ii) Cleavage
- (iii) Specific gravity (iv) Tenacity. 9 + 6
6. (a) Explain why Becke lines form (using sketches) and show how they are used to determine relative refractive indices.
- (b) Explain isotropism and anisotropism in minerals. What is the relation between these properties and crystal structure? Give at least two examples of minerals with each property. 7_{1/2} + 7_{1/2}
7. (a) Define optic sign in terms of both light velocity and refractive index.
- (b) Draw examples of indicatrices for uniaxial positive and negative minerals. Give two mineral examples for each.
- (c) Diamond and graphite have the same chemical formula yet exhibit very different properties like cleavage and hardness. Explain why this is so.
- (d) What are circular sections in uniaxial and biaxial minerals? 2 + 7 + 4 + 2
8. Discuss compositional variations (between end members) and describe substitutions of the major cations in the following mineral groups:
- (i) Feldspars (ii) Pyroxenes (ii) Amphiboles
- (iv) Olivines (v) Garnets. 15