

## GEOLOGY

### Paper - II

Time Allowed : **Three Hours**

Maximum Marks : **200**

#### Question Paper Specific Instructions

*Please read each of the following instructions carefully before attempting questions :*

*There are **ELEVEN** questions divided under **SIX** sections.*

*Candidate has to attempt **SIX** questions in all.*

*The **ONLY** question in Section A is **compulsory**.*

*Out of the remaining **TEN** questions, the candidate has to attempt **FIVE**, choosing **ONE** from each of the other Sections **B, C, D, E** and **F**.*

*The number of marks carried by a question / part is indicated against it.*

*Unless otherwise mentioned, symbols, abbreviations and notations have their usual standard meanings.*

*Neat sketches are to be drawn to illustrate answers, wherever required. They shall be drawn in the space provided for answering the question itself.*

*Wherever required, graphs/tables are to be drawn on the Question-cum-Answer Booklet itself.*

*Attempts of questions shall be counted in sequential order. Unless struck off, attempt of a question shall be counted even if attempted partly.*

*Any page or portion of the page left blank in the Question-cum-Answer Booklet must be clearly struck off.*

*Answers must be written in **ENGLISH** only.*

**SECTION A**

**(Compulsory Section)**

**Q1. Describe the following in brief with diagrams, wherever necessary :** **5×10=50**

- |  |   |
|--|---|
| (a) Crystal defects                                    | 5 |
| (b) Interference phenomenon in Petrological microscope | 5 |
| (c) Siderophile and Chalcophile elements               | 5 |
| (d) Eu-anomaly and its significance                    | 5 |
| (e) Rapakivi texture                                   | 5 |
| (f) Congruent and Incongruent melting                  | 5 |
| (g) Paired metamorphic belt                            | 5 |
| (h) Hornfelsic texture and its implications            | 5 |
| (i) Difference between Seismic and Petrological Moho   | 5 |
| (j) Kerguelen hotspot                                  | 5 |

Attempt any **one** question.

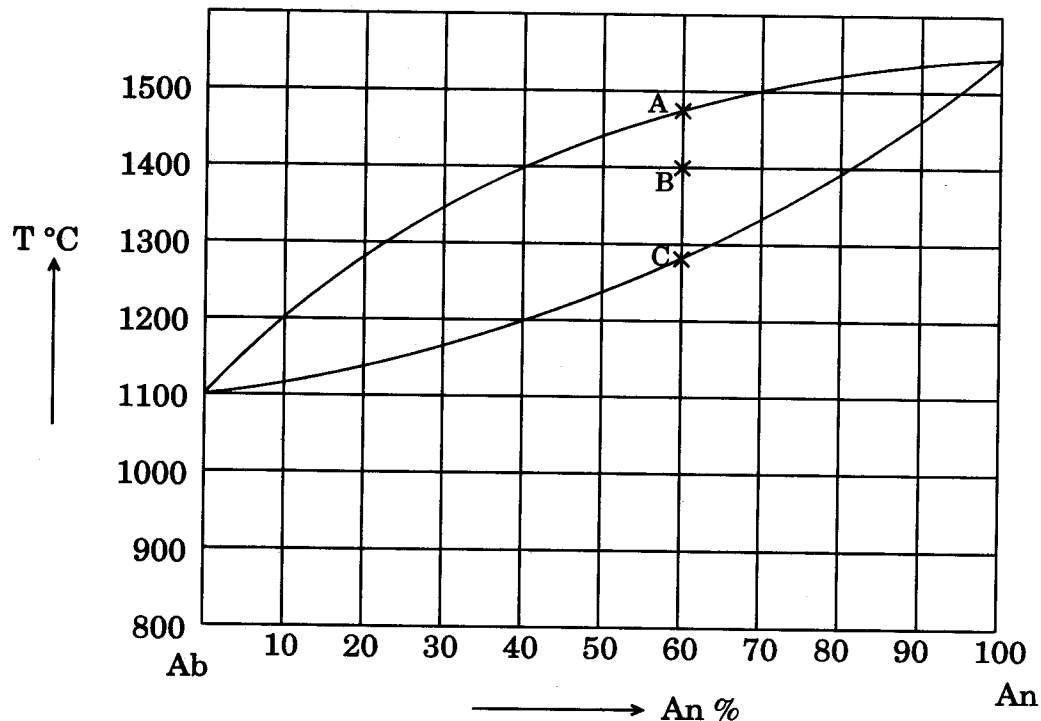
- Q2.** (a) Write the projection for  $C_{2h}$  and  $D_{2h}$  class and give its symmetry and Hermann-Mauguin symbols. 10
- (b) Give an account on structure, chemistry and classification of Garnet group of minerals. 20
- Q3.** (a) Write the procedure to obtain conoscopic vision in a Petrological microscope. How would you determine optic sign of a uniaxial mineral? 10
- (b) Give an account on structural classification of silicate minerals with examples and neat sketches. 10
- (c) Explain Twin and Twin laws. Describe different types of twinning in Feldspars. 10

Attempt any one question.

- Q4.** (a) Give an account on classification, mineralogy and composition of meteorites. 10
- (b) Define partition coefficient ( $K_D$  or  $D$ ). Discuss Goldschmidt's Rules that govern chemical fractionation of elements in silicate melts. 10
- (c) Using partition coefficients of compatible and incompatible elements, explain batch melting in magma evolution. 10
- Q5.** (a) What do you understand by isotopic fractionation ? Discuss isotopic evolution of the ocean. How is PDB (Pee Dee Belemnite) useful in the study of carbon isotopes ? 10
- (b) Discuss mass fractionation and bond strength with suitable examples. 10
- (c) Write the application of Radio-nuclei in geochronology and discuss the Sm - Nd system. 10

Attempt any **one** question.

- Q6.** (a) What are petrographic characteristics of Kimberlites ? Add a note on their tectonic setting. 10
- (b) Explain the factors responsible for magma generation. 10
- (c) What is an ophiolite suite ? Draw a neat sketch of an ophiolite section. Label and add a comment on each unit. 10
- Q7.** (a) What are the conditions to form Layered Igneous Complexes ? Give a brief account on Bushveld Layered Igneous Complex. 10
- (b) Describe eutectic and peritectic crystallisation with reference to Forsterite – Silica T – X phase diagram. Add a note on corona formation. 10
- (c) Explain Lever's rule. Find the composition and relative proportions of liquid and solid at points A, B and C in a given Albite – Anorthite phase diagram. 10



*Attempt any one question.*

- Q8.** (a) What are metamorphic facies and metamorphic facies series ? Give suitable examples. 10
- (b) Describe Clausius-Clapeyron equation. Add a note on its applications to metamorphic reactions. Discuss in brief, the prograde regional metamorphism of pelitic rocks. 20
- Q9.** (a) Discuss in brief, the role of fluids in metamorphism. 10
- (b) Give ideas with suitable examples on (i) Retrograde metamorphism, and (ii) ACF diagram.
- Describe with neat sketches the following textures :  
Helicitic and Cataclastic. 20

**SECTION F**

*Attempt any one question.*

- Q10.** (a) Explain seismic discontinuities within the Earth with suitable diagram. Mention the role of Olivine – Spinel phase transition in geodynamic setting. 10
- (b) What are mantle plumes ? Discuss their origin and significance. 20
- Q11.** (a) Give evidences in support of Continental Drift theory. 10
- (b) Briefly mention the Gravity and Magnetic anomalies of the ocean floor. 10
- (c) Illustrate different types of plate boundaries and add a note on their inter-relationship. 10

