

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 (QCA) 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 (QCA) Booklet must be clearly struck off.

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

(Compulsory Section)

- Q1. Describe the following in brief with diagrams and suitable examples, wherever necessary : 5×10=50**
- (a) Draw stereogram for crystal class 2 (Sphenoidal class). 5
 - (b) Name the members of plagioclase feldspar series and their composition ranges. 5
 - (c) Rubidium-Strontium geochronology. 5
 - (d) Compatible and incompatible trace elements. 5
 - (e) Crystal settling in magma chamber. 5
 - (f) Distinguish between S-type and I-type granites. 5
 - (g) Pressure solution. 5
 - (h) Two-feldspar thermometer. 5
 - (i) Give mineralogical and phase transformation changes at upper mantle transition zone – 410 km discontinuity. 5
 - (j) Draw a neat diagram showing forces acting at mid-oceanic ridges. 5

SECTION B

Attempt any **one** question.

- Q2.** (a) Explain the coordination principle and discuss various possible coordination numbers describing their geometry. 15
- (b) Discuss the structure and composition for mica group of minerals. 15
- Q3.** (a) Explain the procedure for determining optic sign for uniaxial minerals. 10
- (b) Discuss mineral group with the general formula XY_2O_4 . Explain series of members due to substitution of associated cations. 10
- (c) Explain the terms 'Primitive' and 'Non-primitive' space lattice. Depict the relationship of Bravais lattice with crystal system, using appropriate figures. 10

SECTION C

Attempt any **one** question.

- Q4.** (a) Describe Goldschmidt's rules for trace elements distribution. Discuss interpretation of Eu and Ba anomalies. 15
- (b) Discuss applications of oxygen isotopes in paleoclimatic studies. 15
- Q5.** (a) Describe the different varieties of meteorites and their possible sources. 10
- (b) Write the rules pertaining to the principles that govern the entry of trace elements into minerals. 10
- (c) Write down the equation for Rayleigh's fractionation law. A basaltic magma (originally containing 940 ppm Ni) suffers fractional crystallization of clinopyroxene crystal only. Find out the Ni concentration in the derived magma if the parent magma suffers 20% fractional crystallization. [Given : $K_{dNi}^{Cpx} = 4$] 10

SECTION D

Attempt any **one** question.

- Q6.** (a) Draw a neat labelled diagram of the Diopside-Anorthite system (1 atm. dry) and describe the course of crystallization from two initial melts [$P_1 : \text{Di}_{80}\text{An}_{20}$ and $P_2 : \text{Di}_{30}\text{An}_{70}$]. Deduce the degree(s) of freedom at the eutectic point of this system. Give the system's petrogenetic significance. 15
- (b) (i) Explain batch melting and dynamic melting of the mantle.
(ii) Describe the assimilation phenomenon when a basaltic magma assimilates a shale country rock. 15
- Q7.** (a) Describe perthitic and myrmekitic textures. Explain their origin with the help of relevant phase diagrams. 10
- (b) Give the ideal sequence for an ophiolite suite. Give the petrogenetic account of the ophiolite suite of rocks. 10
- (c) Discuss the types of igneous rock textures. Comment on the significance of poikilitic, porphyritic and flow textures. 10

SECTION E

Attempt any **one** question.

- Q8.** (a) What are paired metamorphic belts and metamorphic facies series ? Discuss the P-T conditions, tectonic setting, processes and mineral assemblages involved in such metamorphic belts. 15
- (b) On a simple P-T- X_{CO_2} diagram, show the mineral phases and reactions that develop during regional metamorphism of an impure limestone. 15
- Q9.** (a) Discuss with the help of neat sketches how porphyroblast-inclusion relations can help in interpreting the temporal relationship between tectonics and metamorphism. 10
- (b) Why is a system containing corundum, quartz, sillimanite and andalusite termed 'degenerate' ? Draw the phase boundaries to show the degenerate reactions among these minerals. 10
- (c) Describe the characteristics of ultra-high pressure metamorphism and its tectonic conditions. 10

SECTION F

Attempt any **one** question.

- Q10.** (a) Draw a neat labelled sketch, label it and describe the generalized morphology of an island arc system. 15
- (b) Compare and contrast between Apparent Polar Wander and True Polar Wander curves. 15
- Q11.** (a) Discuss causes for the magnetic reversals in the Earth's Magnetic Field. 10
- (b) Discuss the sequence of events for the generation of plumes in the Earth's D'' layer. 10
- (c) Discuss paleontological evidence for Continental Drift. 10