

Serial No.

C-HFP-L-HMB

GEOLOGY

Paper—II

Time Allowed : Three Hours

Maximum Marks : 200

INSTRUCTIONS

Candidates should attempt SIX questions in all including Question No. 1, which is compulsory, from Part—I and attempt ONE question each from Sections A, B, C, D and E from Part—II.

The number of marks carried by each question is indicated at the end of the question.

Answers must be written only in ENGLISH.

Symbols and abbreviations are as usual.

Neat sketches may be drawn to illustrate answers, wherever required.

PART—I

1. Write brief explanatory notes on any TEN of the following :— 5×10=50

- (a) Birefringence
- (b) Laccolith
- (c) Tonalite
- (d) Boninite

- (e) Skarns
- (f) Blueschist facies
- (g) Silt and sand
- (h) Turbulent flow
- (i) Terrestrial planets
- (j) Transitional elements
- (k) Porphyroclasts
- (l) Tsunamis.

PART—II
SECTION—A

- 2. Displacive and reconstructive phase transformations explain the stability relations of crystalline SiO_2 group of minerals — Write a critique. 30
- 3. Write at least two characteristic optical properties to distinguish the following minerals :— 6×5=30
 - (a) Quartz and plagioclase
 - (b) Kyanite and sillimanite
 - (c) Chlorite and chloritoid
 - (d) Hornblende and epidote
 - (e) Muscovite and biotite.

SECTION—B

- 4. With suitable balanced chemical reactions, describe the mineralogical changes that take place during prograde metamorphism of a basaltic rock from greenschist to granulite facies. 30

5. Attempt the following with terse and precise answers :— 6×5=30

- (a) What are the differences between aphanitic and porphyritic textures ?
- (b) On simple thermodynamic rationale, explain why some mineralogical reactions are suitable for thermometry, while others are good barometers.
- (c) With a suitable sketch, describe the IUGS classification of igneous rocks.
- (d) Comment on the age, mineralogy, chemistry and origin of anorthosites.
- (e) Enumerate the nature of magmatism that takes place in the island arcs.

SECTION—C

6. With neat sketches, describe the primary depositional sedimentary structures. 30

7. Attempt the following with terse and precise answers :— 6×5=30

- (a) With schematic sketches and using at least two indicators explain how you can perform paleocurrent analysis in a sedimentary terrain.
- (b) Explain how grain sorting in sedimentary rocks affects their porosity.
- (c) Explain the relationship between kurtosis and sedimentary particle size.
- (d) Describe the utilitarian aspects of sedimentary basin analysis.

- (e) Define Stokes law and enumerate its significance in Sedimentology.

SECTION—D

8. With a schematic sketch, describe the geochemical cycle for the whole Earth system. Briefly illustrate and explain the oxygen and carbon cycles. 10+20=30
9. Attempt the following with terse and precise answers :— 6×5=30
- (a) A granite contains 25% quartz and 75% alkali feldspar. If the feldspar contains 66 weight % SiO_2 , calculate the amount of SiO_2 in the granite.
- (b) Consider a rock containing 2 weight % K_2O metamorphosed to form a granulite and a quarter of it melt to give a granite containing 4 weight % K_2O . How much of K_2O will the residual granulite contain ?
- (c) Differentiate between the Nernst distribution coefficient and bulk distribution coefficients. Calculate the bulk distribution coefficient for the element Er in a garnet lherzolite containing 60 weight % olivine (Ol), 25 weight % orthopyroxene (Opx), 10 weight % clinopyroxene (Cpx), and 5 weight % (Grt), from the following mineral-melt distribution Nernst distribution coefficients :

	Ol	Opx	Cpx	Grt
Er	0.026	0.023	0.583	4.7

- (d) Which nucleosynthetic processes are responsible for the synthesis of elements heavier than Fe and Ni ? Also list the likely astrophysical settings of these processes.
- (e) What are rare earth elements (REE) ? How would the REE pattern of a melt formed from plagioclase-lherzolite source be different from that of a garnet-lherzolite source, for the same degree of partial melting ?

SECTION—E

10. Attempt the following with terse and precise answers :— 6×5=30

- (a) What are the causes behind formation of acid water associated with mining and how can we overcome the problem of acid drainage by suitable chemical treatment ?
- (b) Explain how groundwater is-contaminated.
- (c) With schematic sketches, briefly describe various slope failures..
- (d) Briefly discuss the factors that affect river flooding.
- (e) With schematic sketch, describe the various types of soil horizons. Add a brief note on the effect of parent rock on the soil composition.

11. Describe the various parameters that constitute earthquake *risks* and enumerate the subsequent *hazards*.

15+15=30