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UPSC CGS

Previous Year Paper
Mains 2022 Paper
(Geology Paper - II)



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.*

SECTION A

(Compulsory Section)

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

- | | | |
|-----|-------------------------------------|---|
| (a) | Optical Indicatrix | 5 |
| (b) | Bravais Lattices | 5 |
| (c) | Chondrites and Achondrites | 5 |
| (d) | Potassium-Argon Isotopic System | 5 |
| (e) | MORBs and Continental Flood Basalts | 5 |
| (f) | Cumulate Textures | 5 |
| (g) | Ultra High Temperature Metamorphism | 5 |
| (h) | Geothermobarometry | 5 |
| (i) | Triple Junctions | 5 |
| (j) | Continent-Continent Collisions | 5 |

SECTION B

Attempt any **one** question.

- Q2.** (a) Describe the symmetry elements, various forms and stereogram of the normal class of orthorhombic crystal system. Give any four mineral examples which crystallise in this system. 15
- (b) Describe Pauling's rules and discuss their role in understanding the stability of silicate structures. 15
- Q3.** (a) What is sign of elongation in minerals ? Explain how the sign of elongation is determined. 10
- (b) Describe the crystal structure, general formula and paragenesis of olivine group of minerals. 10
- (c) Distinguish between the aluminosilicates (sillimanite, andalusite and kyanite) in terms of their physical and optical properties. 10

SECTION C

Attempt any **one** question.

- Q4.** (a) Describe the geochemistry of hydrosphere, with emphasis on the processes influencing the seawater composition. 15
- (b) Write an account on the utility of trace elements in igneous petrogenesis. 15
- Q5.** (a) What is “closure temperature” of minerals ?
Discuss its importance in geochronology. 10
- (b) Explain the principle of monazite chemical dating technique and its applications. 10
- (c) Give a brief account on the utility of conventional stable isotopes (O, C and S) in understanding Earth system processes. 10

SECTION D

Attempt any **one** question.

- Q6.** (a) What is the texture of a lamprophyre ? Discuss the classification of lamprophyres and their petrogenetic significance. 15
- (b) Draw a neat labelled diagram of forsterite-silica system and explain its petrological significance. 15
- Q7.** (a) Explain as to why the felsic magmas have higher viscosity than that of the basic magmas. 10
- (b) Discuss various types of Komatiites. Comment on the restriction of Komatiites to the Archaean shields. 10
- (c) Explain assimilation, mixing and mingling in the evolution of magmatic systems. 10

SECTION E

Attempt any **one** question.

- Q8.** (a) What are metapelitic rocks ? Describe the various mineral assemblages formed during the progressive regional metamorphism of pelitic rocks. 15
- (b) Discuss enthalpy, entropy and Gibbs' free energy. Derive the expression of Gibbs' free energy as a function of temperature and pressure. 15
- Q9.** (a) Describe the blueschist facies metamorphism and its tectonic significance. 10
- (b) Discuss P-T-t path and its significance in metamorphic petrogenesis. 10
- (c) Discuss with neat sketches various textures formed in the regional orogenic metamorphism. 10

SECTION F

Attempt any **one** question.

- Q10.** (a) Discuss with a neat sketch the various phase transitions in the Earth's mantle. 15
- (b) What are hotspots ? Describe the role of hotspots in continental break-ups in the Earth's history. 15
- Q11.** (a) What is paleomagnetism ? Discuss its significance in understanding the continental drift. 10
- (b) Distinguish between passive and active continental margins, with suitable examples. 10
- (c) Discuss various intra-plate earthquakes in the Indian shield and their geotectonic significance. 10

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