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UPSC
Comb. Geo-Scientist
(Mains)

Previous Year Paper
(Geology) Paper-II
24 June, 2023



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. Write short notes on the following with neat, labelled diagrams, wherever necessary : 5×10=50

- (a) Pauling's rule and coordination principle 5
- (b) Isochromes, melatopes (or melatope eyes) and isogyres 5
- (c) Partition coefficient or distribution coefficient and application of trace elements in petrogenesis 5
- (d) Petrogenetic implication of Samarium-Neodymium isotopic compositions 5
- (e) Myrmekite 5
- (f) IUGS classification of ultramafic rocks 5
- (g) Anatexis 5
- (h) P-T-t path for Granulite facies 5
- (i) Mantle plumes and their source 5
- (j) Magnetic field reversals 5

SECTION B

Attempt any **one** question.

- Q2.** (a) Explain symmetry elements and orientation of crystallographic axes of $2/m$ crystal class with the help of suitable diagrams. 10
- (b) Arrange various lattice types (with their symbols) that are compatible with the 32 point groups. Draw a diagram of a face-centered orthorhombic lattice and compare it to body-centered isometric lattice. 10
- (c) How would you determine indices of a crystal face with the help of stereographic projection? 10
- Q3.** (a) How is enantiotropy distinct from monotropy? Comment upon application of atomic substitution in geological thermometry. 10
- (b) What do you understand by twin? How many types of twins are found in Feldspar? Add a note on symmetry law. (Give suitable diagrams) 10
- (c) Discuss the structure and chemical composition of clinopyroxenes. How would you distinguish augite from hypersthene under the microscope? 10

SECTION C

Attempt any **one** question.

- Q4.** (a) What are the textural, mineralogical and chemical compositional attributes of chondrites ? Add a note on the significance of chondrites. 10
- (b) Discuss stability of Uraninite and aqueous uranium complexes with the help of Eh-pH diagram. 10
- (c) Discuss evolution of atmosphere. Add a note on atmospheric gains and losses during geological time. 10
- Q5.** (a) Discuss Rb – Sr isotopic evolution of continental crustal rocks. 10
- (b) Explain concordia and discordia using U-Th-Pb systems. 10
- (c) Explain K-electron capture in case of K-Ar system. 10

SECTION D

Attempt any **one** question.

- Q6.** (a) Discuss various forms and structures of Igneous rocks. Comment upon role of viscosity in their formation. 15
- (b) Discuss partial melting of the mantle and generation of basaltic melt. 15
- Q7.** (a) Discuss Ternary system with solid solution citing an example of Ab-An-Or system. Comment upon cotectic curves. 10
- (b) Explain magma generation associated with various plate tectonic settings. 10
- (c) Discuss unmixing and exsolution with an example of perthite and antiperthite. 10

SECTION E

Attempt any **one** question.

- Q8.** (a) Discuss various facies associated with Dynamothermal metamorphism of pelitic sediments. 15
- (b) What is the influence of Tectonics on metamorphic P-T-t paths ? Describe such paths for the rocks in subduction related environment. 15
- Q9.** (a) What is Charnockite ? Give its mineralogy, chemical composition and origin. Comment upon spatial distribution of Charnockites in India. 10
- (b) Define Metamorphic facies. Discuss Metamorphic facies on the basis of increasing rock pressure. 10
- (c) Give an account of Metamorphic mineral assemblages associated with Delhi – Aravalli belt. 10

SECTION F

Attempt any **one** question.

- Q10.** (a) With a suitable sketch, explain the seismic discontinuities and corresponding compositional changes in the Earth. 15
- (b) What is Wilson Cycle ? Bring out its relation to the formation of supercontinents. 15
- Q11.** (a) Explain the Himalayan orogeny. 10
- (b) What do you understand by heat flow in the Earth's crust ? Discuss the production of heat in the Earth's crust. 10
- (c) Explain the dynamics of sea-floor spreading. Discuss the topographic features formed at spreading sites. 10

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