Combined Geo-Scientist (Main) Examination, 2024

SGSE–M–GLG

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)

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

(a) Flash figure

(b) Perthite

(c) Global Meteoric Water Line

(d) Carbonate compensation depth and lysocline

(e) Soret effect

(f) Rapakivi texture

(g) Geothermal gradient

(h) Diffusion and mass transfer

(i) Heat flow in the crust

(j) Seamounts

SECTION—B

Attempt *any* **one** question

2. *(a)* Describe the different types of defects in crystals. 15

(b) Zircon and rutile crystallize in the 4/m 2/m 2/m class. Describe the five forms that develop in crystals of this class. 15

3. *(a)* Give the classification of rock-forming minerals on the basis of degree of polymerization of $[SiO_4]$ tetrahedra and name the important mineral groups in each. 10

(b) With examples, explain isotypous and polymorphism in minerals. 10

(c) Describe the physical characters and give the chemical composition of the nesosilicate group minerals which crystallize in isometric system. 10

SECTION—C

Attempt *any* **one** question

4. *(a)* Explain, with Eh-pH diagrams, the difference in geochemical behaviour of iron and manganese that leads to their spatial and stratigraphic separation. 15

(b) Describe the processes that are involved in the carbon fluxes between atmosphere, ocean, biosphere and lithosphere, and explain the working of the carbon cycle. 15

5. *(a)* Describe the Sm-Nd dating method. Add a note on its application in petrology. 10

(b) Describe the applications of K-Ar and ^{40}Ar - ^{39}Ar dating methods in igneous, metamorphic and sedimentary rocks. 10

(c) Describe briefly the isochron method, and explain how it overcomes the limitations of radiometric age calculations. 10

SECTION—D

Attempt *any* **one** question

6. *(a)* What are the major components which influence the flow of magma? How does compositional variation develop in primary magma? 15

(b) Write about the principles of IUGS classification of igneous rocks. 15

7. *(a)* How are fabrics used as tool to decipher the genesis of igneous rocks? Discuss the various textures with suitable diagrams. 10

(b) Describe the potash-rich basic volcanic rocks. How are these rocks different from the spilitic-keratophyre rocks? 10

(c) Discuss, with the help of a phase diagram, how the chromite layers developed in the Bushveld Layered Mafic Complex. 10

SECTION—E

Attempt *any* **one** question

8. *(a)* Explain the concept of facies. Describe, with a neat *P-T* diagram, the general facies formed during regional dynamothermal metamorphism. Mention their approximate equivalent facies in contact metamorphic aureoles. 15

(b) With neat sketches, describe the structures and textures observed in metamorphic rocks. Add a note on their significance in understanding metamorphic conditions. 15

9. *(a)* Explain enthalpy, entropy and Gibbs' free energy, and their relation to metamorphic process. 10

(b) With examples and neat sketches, discuss the application of ACF and AKF diagrams to represent metamorphic assemblages. 10

(c) Discuss the process involved in the formation of skarns. 10

SECTION—F

Attempt *any* **one** question

10. *(a)* What do you understand by phase transitions? Explain them in relation to seismic discontinuities in the earth. 15

(b) Which are the different plate boundaries? Bring out the interrelationship among them with neat diagram. 15

11. *(a)* What is rock magnetism? Discuss its importance in understanding polarity reversals. 10

(b) How are hot spots formed? How are they related to breaking up of continents? 10

(c) What do you understand by intraplate earthquakes? Discuss on the intraplate earthquakes of India. 10

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