

GEOLOGY (Paper II)

Time Allowed : Three Hours

Maximum Marks : 300

QUESTION PAPER SPECIFIC INSTRUCTIONS

(Please read each of the following instructions carefully before attempting questions)

There are EIGHT questions divided in two Sections.

Candidate has to attempt FIVE questions in all.

Question Nos. 1 and 5 are compulsory and out of the remaining, any THREE are to be attempted choosing at least ONE question from each Section.

The number of marks carried by a question/part is indicated against it.

Wherever any assumptions are made for answering a question, they must be clearly indicated.

Word limit in questions, wherever specified, should be adhered to.

SECTION 'A'

1. Attempt any three of the following in 200 words each:

3×20=60

- (a) Explain how radius ratio (of cation to anion) influences coordination in silicate minerals. Write how an element can have more than one coordination number?
- (b) Define the Gibbs phase rule and calculate the variance of the assemblage containing enstatite + forsterite + Mg-spinel + corundum.
- (c) Compare the optical properties of the following mineral pairs, with at least two diagnostic optical properties: (i) quartz and plagioclase (ii) hornblende and diopside (iii) chlorite and muscovite, and (iv) kyanite and sillimanite
- (d) Explain how depending on magma composition, some lavas flow a great distance, while others barely move.

2. (a) With theoretical details, discuss the (i) optical indicatrix (ii) interference figure and (iii) optic sign determination of uniaxial minerals **30**

(b) With suitable examples, discuss the causes behind and effects of (i) pleochroism (ii) extinction angles and (iii) birefringence in minerals **30**

3. (a) What are the major minerals that constitute carbonate sediments and what physico-chemical factors control their precipitation? What are the basic components of Folk's classification of carbonate rocks? **30**

(b) By suitable reactions, discuss various mineralogical and mineral chemical changes, that take place during metamorphism of a gabbroic rock at the greenschist-amphibolite facies transition. **30**

4. (a) What are turbidites? With a neat sketch, show different units of a Bouma cycle and flow regimes under which they are formed. **30**

(b) Discuss the role of PH_2O in the albite-orthoclase-silica- H_2O system. Explain the rarity of rhyolites and preponderance of granites in the rock record. **30**

SECTION 'B'

5. Attempt any three of the following in 200 words each:

3×20=60

(a) Explain why ore deposits of Fe and Al are far more common in the rocks compared to those of Ag, Hg and Sb. Add brief notes on tonnage, grade and cut-off grade of an ore.

- (b) Enumerate the various corrections that are necessary for reduction of gravity field data in any exploration programme.
- (c) Explain how on the basis of ionic radius and charge, atomic substitution take place in silicate minerals. What is the effect of electronegativity on the above substitution mechanisms?
- (d) Discuss the precursor events that might signal the occurrence of an earthquake.
- 6. (a) Compare the processes that lead to formation of chromite and Ni-Cu sulfide ores in basic-ultra basic layered rocks. **30**
- (b) With suitable chemical reactions, explain the mineralogical changes that take place, when a Cu sulfide ore body, containing pyrite, undergoes oxidation and supergene enrichment. **30**
- 7. (a) Enumerate the various natural sources of hydrothermal ore forming fluids and explain how most hydrothermal ore deposits owe their origin to multiple fluid sources. **30**
- (b) With suitable examples, define indicator and pathfinder elements in geochemical prospecting. Discuss element mobility, as a result of various processes of dispersion. **30**
- 8. (a) Discuss the mineralogical (and chemical) compositions of various meteorites, with a note on how carbonaceous chondrites furnish evidence for planet's composition. **30**
- (b) Discuss the various causative factors behind different types of mass wasting. **30**