

## 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 are to be drawn to illustrate answers, wherever required.*

*All parts/sub-parts of a question being attempted must be completed before moving on to the next question.*

## PART I

1. Write brief explanatory notes on the following :  $5 \times 10 = 50$
- (a) Extinction angle
  - (b) Diagenesis
  - (c) Pigeonite
  - (d) Stony meteorites
  - (e) Ripple marks
  - (f) AFM triangular projection from muscovite
  - (g) Carbonatites
  - (h) Silica saturation in igneous rocks
  - (i) Paired metamorphic belts
  - (j) Interference colours

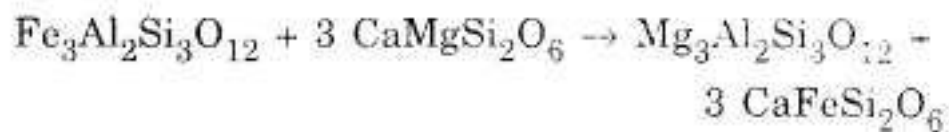
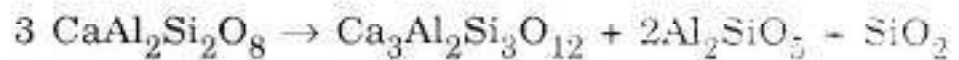
**PART II**  
**SECTION A**

2. Describe Twinning in minerals. Explain the following twin laws with neat sketches.  $6+6\times 4=30$
- (i) Carlsbad twins
  - (ii) Baveno twins
  - (iii) Polysynthetic twins
  - (iv) Manebach twins
3. Attempt the following with precise answers :  $5\times 6=30$
- (a) How does a pyroxenoid differ from a pyroxene ?
  - (b) What are the major end member components of garnet ?
  - (c) Explain why sections cut perpendicular to c-crystallographic axis in tetragonal system show isotropism.
  - (d) Compare the optical properties of the mineral pair of Biotite and Tourmaline (giving at least two diagnostic optical properties).
  - (e) Explain isomorphism and polymorphism with two examples each.
  - (f) Compare the optical properties of the mineral pair of Staurolite and Olivine (giving at least two diagnostic optical properties).

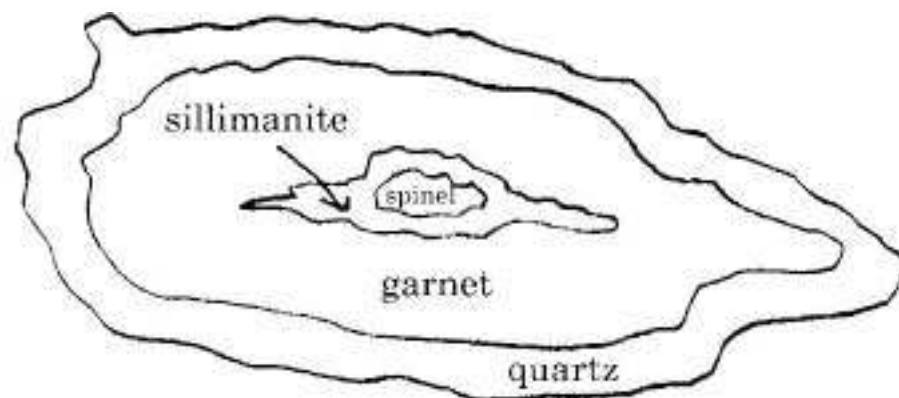
## SECTION B

4. Attempt the following with precise answers : 6×5=30

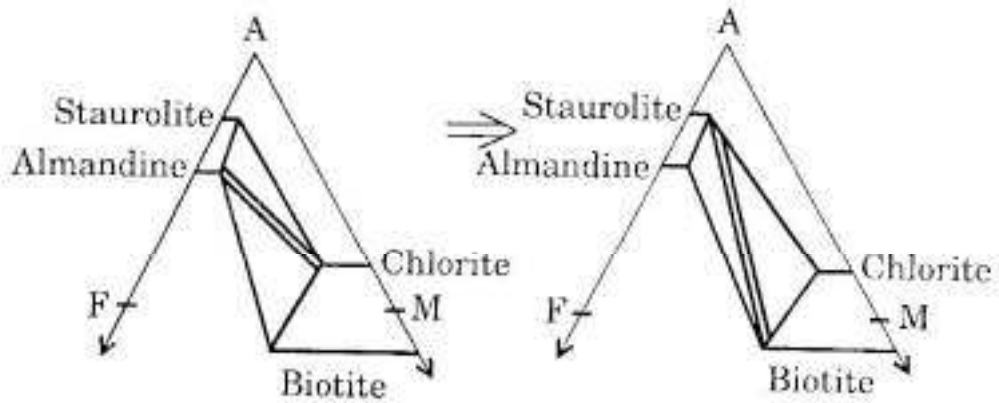
- (a) Identify the nature of metamorphic reactions using end-member names. Explain with reason which of them are best suited as geobarometer and as geothermometer.



- (b) Differentiate between symplectitic and myrmekitic intergrowth.
- (c) What are the mineralogical differences between an alkaline basalt and a tholeiitic basalt ?
- (d) Identify the texture and infer the possible metamorphic reaction :



- (e) Deduce the possible metamorphic reaction and mention the facies/zone to which it belongs :



5. (a) Describe the textural features, mode of occurrence and petrogenetic aspects of kimberlites with suitable examples. 24
- (b) Diagrammatically show the various forms of intrusive igneous bodies. 6

### SECTION C

6. (a) Enumerate the role of grain size parameters in terrigenous clastic sediments. 20
- (b) Describe the various sedimentary processes that produce clastic rocks. 10
7. Write explanatory notes on the following : 5×6=30
- (a) Tillites and their significance
- (b) Cementing material in sedimentary rocks
- (c) Heavy mineral application in provenance
- (d) Paleocurrent analysis
- (e) Turbidites and their significance
- (f) Micrite and Sparite

## SECTION D

8. (a) Describe the fundamental law governing the decay of radioactive elements. 20
- (b) What are Rare Earth Elements (REE) and High Field Strength Elements (HFSE) and what is their importance in geochemistry? 10
9. Write explanatory notes on the following : 5×6=30
- (a) Eh-pH diagram
- (b) Pathfinder elements in geochemical exploration
- (c) Lithosphere and lithospheric plates
- (d) Goldschmidt rules of trace elements distribution
- (e) Carbonaceous chondrites
- (f) Chemical composition and mineralogy of the Earth's mantle

## SECTION E

10. (a) Explain the groundwater problems encountered in mining work. Comment on the over-exploitation of groundwater in India. 20
- (b) Bring out the various causes of natural hazards of floods in Indian plains. 10
11. Attempt the following with precise answers : 5×6=30
- (a) Discuss the precursor events that might signal the occurrence of an earthquake.
- (b) Explain causes of natural hazards of landslides. Mention measures to mitigate their impacts.
- (c) Risks of coastal erosion.
- (d) Deforestation and sustainable development.
- (e) Soil degradation with application to fertilizers.
- (f) Discuss the open cast coal mining hazards.