

RANCHI UNIVERSITY
GEOLOGY HONS./RESEARCH – SEMESTER IV
MAJOR COURSE – M3.6
ELEMENTS OF GEOCHEMISTRY AND IGNEOUS PETROLOGY

Full Marks: 75	Time: 3 Hours
SET – III	Theory Paper

Instructions:

- Group A is compulsory.
- Question No. 1 contains five objective/MCQ questions of 1 mark each.
- Question No. 2 and Question No. 3 are single questions of 5 marks each.
- In Group B, answer any **four** questions out of six. Each question carries 15 marks.
- All questions are based on the prescribed syllabus of Major Course M3.6.

GROUP – A

Q.1. Choose the correct answer. (5 × 1 = 5)

1. The pH of a solution is a measure related to the activity of:
A) Na⁺ B) H⁺ C) Ca²⁺ D) O₂
2. An isotope tracer is particularly useful for studying:
A) Rock colour only B) Source, age and material pathways C) Grain size only D) Hardness only
3. The continuous branch of Bowen's Reaction Series mainly represents the evolution of:
A) Olivine to pyroxene B) Plagioclase composition C) Quartz to feldspar D) Garnet to mica
4. OIB commonly stands for:
A) Oceanic Island Basalt B) Oceanic Intrusive Batholith C) Old Island Basin D) Oceanic Igneous Belt
5. Lamproites are generally classified as:
A) Ultrapotassic volcanic rocks B) Pure quartzites C) Carbonate sediments D) Oceanic cherts

Q.2. (5 Marks) What is geochemical fractionation? Explain any two mechanisms responsible for elemental fractionation.

Q.3. (5 Marks) Explain the origin and nature of magma and discuss the major factors controlling magma composition.

GROUP – B

Answer any four questions. (4 × 15 = 60)

Q.4. (15 Marks) Explain the concept of geochemistry and its scope. Discuss chemical bonding, atomic structure, geochemical classification and the distribution of elements among different Earth reservoirs.

Q.5. (15 Marks) Discuss conservation of mass, elemental and isotopic fractionation, and mass balance in geochemical systems. Illustrate their importance with suitable geological examples.

Q.6. (15 Marks) Describe the composition of the solar system and the bulk silicate Earth. Explain the cosmic abundance of elements and the geochemical evidence for chemical differentiation of the Earth.

Q.7. (15 Marks) Explain Bowen's Reaction Series and magmatic differentiation. Discuss the roles of fractional crystallization, magma mixing and assimilation in producing diverse igneous rocks.

Q.8. (15 Marks) Discuss binary phase diagrams and their application to petrogenesis. Explain crystal–melt equilibrium using suitable examples such as Ab–An, Or–Ab and Di–An systems.

Q.9. (15 Marks) Give a detailed account of igneous rock classification, textures and structures. Discuss the petrogenesis and tectonic significance of mafic, felsic and alkaline igneous rocks, including basalt, gabbro, granitoids, kimberlite and lamproite.