

**B. SC. GEOLOGICAL SCIENCES EXAMINATION, 2023**

( 2nd Year, 2nd Semester )

**METAMORPHIC PETROLOGY**

**PAPER – CORE/TH/08**

Time : Two hours

Full Marks : 40

(Use a separate Answer script for each Part)

**PART – I (Marks: 20)**

Answer **Q1** and *one* from **Q2** and **Q3**

1. Define a ‘System’? What are the different types of systems and how are these distinguished? What is the difference between metamorphism and metasomatism? What are the likely tectonic settings for ultra high temperature (UHT) and ultrahigh pressure (UHP) metamorphism? Justify your answer. “Metamorphism of basalt can lead to prehnite-pumpeylite facies under appropriate physico-chemical condition.” Accept or reject the statement. 12
2. “Presence of talc in metadolomite always suggests the presence of aqueous fluid” Accept or reject the statement. What are oxygen buffers? Give three common oxygen buffers. Derive a relation between  $fO_2$  and the change in Gibbs Free Energy of an oxygen buffer. 8

[ 2 ]

3. How does Al enter the structure of amphibole during metamorphism along the following geothermal gradients?
- High pressure - low Temperature
  - Low pressure - high Temperature.

In which metamorphic facies are two amphiboles and two plagioclases formed under equilibrium condition? Justify your answer. 8

**PART – II (Marks: 20)**

Answer **All** questions.

1. a) What is the devolatilization reaction? Give one example of a devolatilization reaction that occurs during the progressive metamorphism of pelites. Draw the reaction in P-T and T-H<sub>H<sub>2</sub>O</sub> diagrams. How would the reaction be influenced by the internal buffering of metamorphic fluid or by an influx of CO<sub>2</sub> (external buffer) in the metapelites? 5
- b) Write short notes on **any two** : 2×2·5=5
- Ion exchange reaction
  - Prograde hydration reaction
  - Buchan type metamorphism

[ 3 ]

2. Answer **any two** questions from the following: 5×2=10
- Comment on the development of quartz-rich domains in metamorphic schistose rocks with the progress of crenulation cleavage. What is inter-kinematic porphyroblast? Discuss the development of inter-kinematic crystal with suitable sketches.
  - “At lower greenschist facies chlorite-muscovite assemblage is stable for common pelites whereas biotite appears in low-Al pelites.” Justify the validity of this statement.
  - The staurolite isograd is sensitive to the aluminium content of the bulk rock in pelites. Accept or reject the statement with reason.