

M. Sc. APPLIED GEOLOGY EXAMINATION, 2023

(1st Year, 1st Semester)

METAMORPHIC PETROLOGY

PAPER – CORE/TH/04

Time : Two hours

Full Marks : 40

(Use a separate Answer script for each Part)

PART – I (20 Marks)

Answer any **two** questions.

All questions carry equal marks.

1. Derive Gibbs-Duhem relation. “Under all conditions a reaction of the type $A=B+H_2O$ (A, B are solid phases) is spontaneous” accept or reject the statement with reason.
2. What is the minimum initial temperature required for a rock to experience ultra high temperature metamorphism at the contact of a magma body ($\sim 1200^\circ\text{C}$)? Assume that contribution of the latent heat of the magma is negligible. Why does a pelitic rock release H_2O when heated?
3. What is “patchy Charnockite”? “Brine is a better candidate than the CO_2 rich fluid to dehydrate an amphibolite facies rock under isothermal-isobaric condition”. Accept or reject the statement with reason. Can “patchy Charnockite” form in a closed system? Justify your answer.

[Turn over

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PART – II (20 Marks)

Answer all the questions.

All questions carry equal marks.

1. a) Discuss the petrological significance of 'Glaucophane + Jadeite + Phengite' as peak metamorphic mineral assemblage in appropriate bulk. In what type of tectonic set up this assemblage is commonly observed and why? 'Preservation of this mineral assemblage in ancient rock record is rather difficult' – why?
 - b) Do you conceive an event of extensive CO₂ flux during formation of a khondalite with prominent stromatic leucosomal banding? Answer with reasons.
 - c) Discuss the significance of:
 - i) Isobaric cooling (IBC) type of P-T-t path from high temperature peak condition of metamorphism.
 - ii) Presence of leucosomal segregates with idioblastic amphibole and dark selvage in a migmatitic genesis. 4+2+4
2. Answer any **two (2)** from the following : 2×5
- a) What is UHP metamorphism? Mention the tectonic set up for such extreme metamorphism? How can

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- you petrologically differentiate a 'High-pressure mafic granulite', a 'High-pressure-high temperature Eclogite' and an 'UHP Eclogite'? All the rocks belong to similar mafic bulk composition.
- b) What is geothermometry? What type of metamorphic reactions are suitable for this and why? Mention two such reactions from a metamorphic rock having assemblage of Orthopyroxene + Garnet + Plagioclase + Kfeldspar + Ilmenite + Quartz.
 - c) What is symplectic intergrowth texture in metamorphic rock? Give one such example with suitable sketch. Why this type of texture is more commonly observed in retrogressed granulites rather than greenschist or amphibolite facies rocks? Answer with reasons.