

Ex/SC/GEOL/UG/CORE/TH/08/2022

B. SC. (GEOLOGICAL SCIENCES) EXAMINATION, 2022

(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

Answer **all** the questions. 5×4=20

All the questions carry equal marks.

1. A magma (at 1400°C) upon cooling heated the country rock to 900°C. If the contact heating occurs at the depth of 20 km, what was the geothermal gradient of the country rock prior to the emplacement of the magma?
2. How does pressure affect the stability of talc in dolomitic marble? What is 'fluid dominated' metamorphism?
3. A garnet-zone metapelite has **P** number of phases and **C** number of system components. The rock has three mobile components.

What is the relation among the **P**, **C** and the variance of the rock (**F**)? Does addition of heat to rock always increases its temperature? Justify your answers.

4. In a five component system, there are eight phases. What is the number of non-degenerate invariant point in the

[Turn over

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system under the conditions (a) one component is mobile and the pressure remains constant and (b) load pressure is different from the fluid pressure? Justify your answer.

Can degrees of freedom in a system be negative? Justify.

PART – II

Answer **all** the questions. 4×5=20

All the questions carry equal marks.

1. What causes persistence of actinolitic amphibole with calcic plagioclase (An ~20) and chlorite in mafic bulk within greenschist facies condition of metamorphism?
2. Identify the mineral from the formula given below:
$$\text{Na } 0.3 \text{ Ca } 1.8 \text{ Na } 0.2 \text{ (Fe, Mg) } 3.4 \text{ Al } 1.6 \text{ Si } 6.3 \text{ Al } 1.7 \text{ O}_{22}(\text{OH})_2$$

In which metamorphic facies and bulk composition it is stable? Answer with reasons.
3. ‘Garnet appears early in a manganese-rich metapelitic bulk compared to normal pelite’ – why?
4. Discuss the petrological significance and the probable mineral reaction that stabilizes ‘Garnet + Biotite + Staurolite + Muscovite + Quartz’ mineral assemblage in a pelitic bulk. Why is this mineral assemblage not common in granitic bulk?

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5. Discuss the textural features by which a ‘Pre-tectonic’ garnet porphyroblast in a mica schist can be differentiated from a syn-tectonic garnet porphyroblast with prominent inclusion trails of quartz. Draw neat sketches in support of your explanation