

MASTER OF SCIENCE EXAMINATION, 2019

(1st Year, 1st Semester)

APPLIED GEOLOGY

Metamorphic Petrology

Paper : - IV

Time : Two hours

Full Marks : 50

All questions carry equal marks.

Answer *Q.no. 1 or Q2, Q3, Q4 or Q5 and Q6.*

1. State Fick's law of heat conduction. Derive an equation that relates temperature (T), time (t) and distance(x) of heat conduction. What is Rault's law ? Is Rault's law be applicable for non-ideal gas mixture ? Justify your answer.

OR

2. Write short notes on :
 - (a) Carbonic metamorphism and formation of patchy charnockite
 - (b) The relation among Gibbs Free Energy(G), Chemical potential (μ) and Entropy(S).

(Turn over)

(2)

3. Derive mineralogical phase rule in open system. Can a system have negative degrees of freedom ? Justify. In a six component system there are 15 phases. Calculate the number of phases associated with a non-degenerate invariant point.
Can magma (at 1000°C) heat up the country rock (at 0°C) to 600°C ? Justify your answer.
4. (a) What is 'peak' condition of metamorphism ? Discuss the tectonic significance of prograde P-T-t path with reference to peak condition of metamorphism.
(b) How the sense of an ACW path of metamorphism can be conceived albeit difficulty from metapelitic and Mg-Al granulites ?
(c) What do you mean by 'Cold Eclogites' ? Explain why these mineral assemblages are so rarely preserved ? $4\frac{1}{2}+3\frac{1}{2}+4\frac{1}{2}=12\frac{1}{2}$

OR

5. (a) What is 'Mobile hydro fracturing' ? In which crustal condition this phenomenon is likely to occur and why ?
(b) Discuss the importance of polymorphic transformation and density change of the characteristic minerals of UHP metamorphism ? 'Exhumed UHP rocks are mostly metamorphosed continental crust'—Why ?

(3)

- (c) 'Presence of high density CO₂ fluid inclusion in an ACW-granulite facies mineral assemblage doesn't always indicative of its formation through CO₂ flushing'—Why ? $4\frac{1}{2}+5+3=12\frac{1}{2}$
6. (a) Discuss the petrological significance of
(i) Osumilite and its break down product in appropriate bulk composition.
(ii) Phengite + glaucophane + jadeite assemblage in appropriate bulk composition.
(b) What is 'Fluid-present' partial melting of crustal rocks ? Do you expect formation of large granite batholith emplaced at mid crustal depth through such melting reaction at lower crust ?
(c) Discuss the significance of a syn-tectonic crack-seal quartz vein passing through a calcitic marble. What could be the nature of the vein — 'syntaxial' or 'antitaxial' ? Answer with reasons and suitable sketches.
(d) Identify one reaction from rutile-bearing khondalite which can be used as a good geobarometer. $4+3+4\frac{1}{2}+1=12\frac{1}{2}$

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