(b) Temperature always represents the thermal state of a matter–Accept or reject the statement with reason.

(c) Using G-T diagrams explain why a solid changes to liquid to gas with increasing temperature.

(d) How does the chemical potential of a fluid depend upon pressure? $12^1/_2$

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Ex./M.Sc.-I/G-I/IV/3/2017

MASTER OF SCIENCE EXAMINATION, 2017

(1st Year, 1st Semester)

APPLIED GEOLOGY

Paper : IV

Metamorphic Petrology

Time : Two hours Full Marks : 50

Answer ***all*** questions.

All questions carry equal marks.

1. (a) Discuss with suitable sketch the tectonic significance of decompressional melting of a fertile protolith that holds rare inclusion of kyanite within garnet.

(b) Comment on the nature of the prograde path of metamorphism, where in a sapphirine+garnet–bearing quartzofeldspathic rock cordierite is found to occur as inclusion within sapphire grains. What could be the possible retrograde path from such peak assemblage? Try to identify the probable retrograde reactions encountered with suitable textural sketches.

(c) 'Large scale CO_2 ingress in mid-to lower crustal condition may inhibit anatectic migmatite formation'–accept or reject the statement with proper reasoning. $4+5+3^1/_2=12^1/_2$

2. (a) 'Spinel + quartz' association in metapelitic bulk does not always indicative of 'Ultra high temperature (UHT)' condition of metamorphism'–discuss why ?

(b) Discuss with reasons the mineralogical associations of 'Low T-High P' and 'High T-High P' metamorphisms from basic bulk compositions.

(c) What is 'Ultra high pressure (UHP)' metamorphism ? Why is this type of metamorphic rocks more common in 'Himalayan' type orogens instead of others ? $4+5+3^1/_2=12^1/_2$

OR

3. (a) What is ITD path of metamorphism ? Mention two (2) mineral reactions with suitable textural sketches from pelitic and mafic bulk compositions that are indicative of such retrograde path.

(b) What is 'Ultra high temperature (UHT)' metamorphism ? Discuss the possible ways by which such extreme temperature conditions can be estimated.

(c) What is 'Metamorphic Field Gradient (MFG)' ? How is this different from 'P-T-t' path of metamorphism ?

$4^1/_2+4^1/_2+3^1/_2=12^1/_2$

4. Using the Fourier's Laws of heat conduction deduce a relation among time (t), distance (x) and Temperature (T). How is conductivity related to diffusivity of a conducting body ? $12^1/_2$

5. (a) 'Ion exchange reactions are usually good geothermometer whereas net-transfer reactions are not'–accept or reject the statement with reason.

(b) Derive the phase rule in an open system with P no of phases, C no. of system components and K-number of mobile components. F being the degrees of Freedom of that system. What is the variance of perthite (K-feldspar and albite intergrowth) at variable pressure but at constant temperature ? Justify your answer.

(c) In nature 'almandine is less stable than garnet –why ? $12^1/_2$

OR

6. (a) Derive Classeus-Cleypeyron equation ? Gibbs Free Energy does not satisfy all the requirements of Energy – Accept or reject the statement with reason.