INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH KOLKATA
Mid-semester Examination, Autumn 2018

Course: ES4101 – Igneous and metamorphic petrology

Full marks: 20 **Time: 1 hour** **Date: 17/09/2018**

Name: **Roll No.:**

Question 1. Marks: 8

a) Write two points why using the 'metamorphic-facies' concept is more advantageous than the 'metamorphic-zones' concept. (1)

b) What would be the name of the rock that is composed of biotite 40%, quartz 30%, porphyroblastic garnet 20% and muscovite 10% and exhibiting a prominent foliation, defined by the schistose minerals and quartz? Is this rock igneous or metamorphic and why? State very briefly the logic behind your nomenclature. (2)

c) Consider a rock that is composed of very coarse-grained plagioclase laths (25%) along with fine-grained clinopyroxene (40%) and haphazardly oriented plagioclase laths (35%). What would be the name of the rock? What is the special textural term used to describe the very coarse-grained plagioclase? Describe briefly the evolution of the magma in terms of crystallization and magma ascent (in equilibrium conditions) whereby such a texture and rock can develop. Can you comment on the composition of the initial magma based on a suitable 2 component phase diagram? (0.5+0.5+2+1=4)

d) Explain briefly how additions of fluid in magma facilitate magma ascent. (1)

Question 2. Marks: 7

a) Starting with a melt of composition 80wt.% forsterite at 1900°C (figure below), briefly describe what happens with cooling till the entire melt crystallizes (Consider complete equilibrium conditions). Write the reactions taking place at each step. What would be the name of the final rock formed? (4)

b) Will there be any change in the evolution path of the above melt if there is ideal fractional crystallization? Explain briefly with the help of the diagram below. Draw the solid evolution path as well. (2)

c) If a rock composed of quartz and enstatite starts melting, at which point will the first melt be produced? Write the melting reaction taking place at this point. (1)

Question 3. Marks: 5

a) What will be the likely facies of metamorphism at the base of a continental crust of normal thickness? State briefly the reasons for your answer. (2)

b) If a basalt is buried to a pressure of 1.0 GPa along a geotherm of 30°C/km, what would be the facies of metamorphism? (1)

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c) What would be the sequence of facies a rock should cross, if it is metamorphosed along high P/T series? Mark the respective facies and show the series on the figure. (1)

d) Which tectonic setting can be associated with a high P/T metamorphic series? (1)

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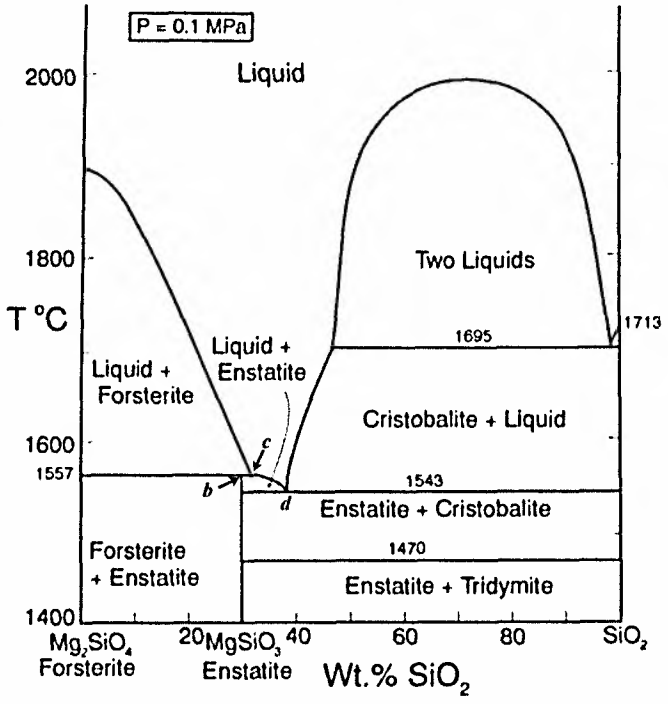
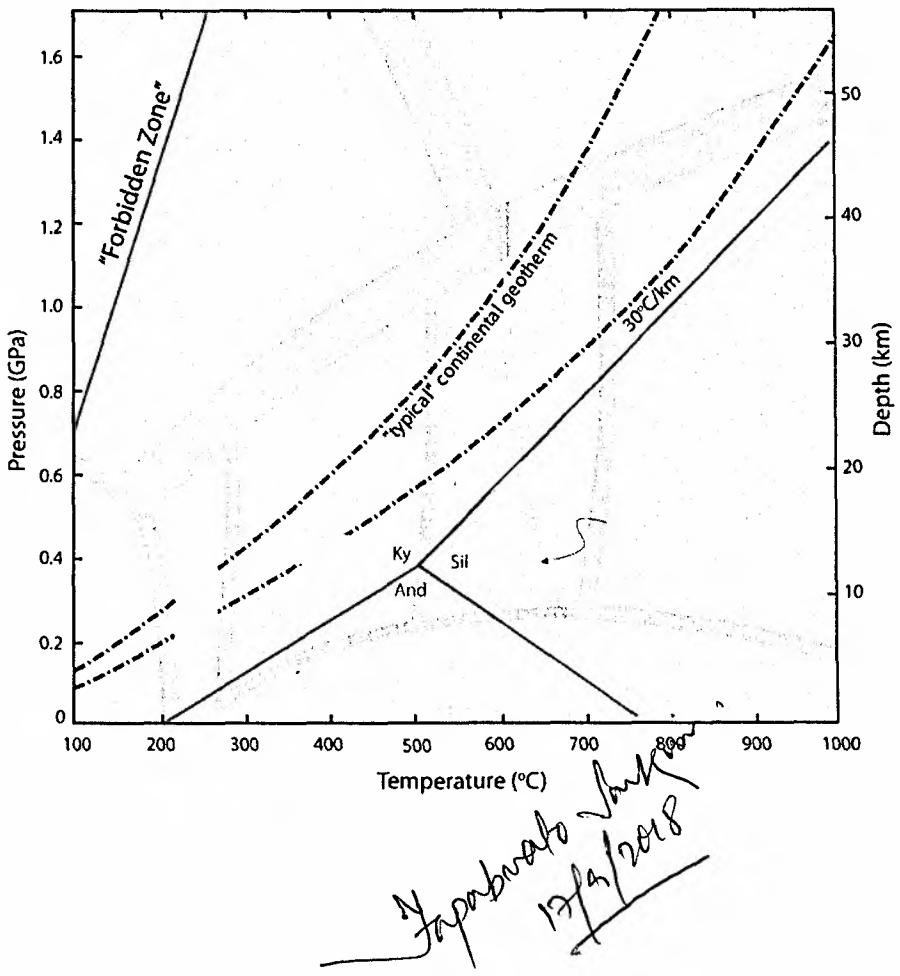
Question 2 (Figure)



Question 3 (Figure)



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17/9/2018