

MASTER OF SCIENCE EXAMINATION, 2017

(1st Year, 1st Semester)

APPLIED GEOLOGY

Paper : I

Mineralogy

Time : Two hours

Full Marks : 50

Use a separate Answer-Script for each group.

GROUP - A (25 marks)

Answer **Q.no. 1(a)** and any **two** from the rest.

1. (a) What are the elements that commonly substitute Mg in olivine in crust and mantle rocks? Name the species of olivine that are formed during this substitution. Why is olivine with Fo_{60-20} uncommon in nature? What is the significance of olivine-spinel transition in the mantle? Do you expect Fayalite to coexist with quartz in crustal rocks? Justify your answer. 13
- (b) What is inverted pigeonite? In which crystal system does pigeonite crystallize? What is intra crystalline Fe-Mg exchange pyroxene thermometer? 'Al content of pyroxene is a recorder of ambient geothermal gradient' accept or reject the statement with reason. 6

(Turn Over)

(2)

- (c) Both amphibole and pyroxene have two sets of prismatic cleavages, but the angle subtended by two sets of cleavage varies widely in two minerals. – Why? 6
- (d) State the different chemical substitutions in calcic amphibole group. How do pressure and temperature control these substitutions? 6
- (e) Write short notes on : 6
- (i) Pauling's rule of chemical bonding
- (ii) Chemical potential

GROUP - B (25 marks)

2. Answer any **five** questions.

- (a) What are the controlling factors for the formation of sulfide and oxide minerals? What are the types of solid solutions present in the $\text{FeO}-\text{Fe}_2\text{O}_3-\text{TiO}_2$ system? Why is mineral wustite rare on the surface of the earth? 2+2+1=5
- (b) What is 'oxidation exsolution'? How is it related to the stability of spinels containing Fe and Ti? Comment on the stability of maghemite and titanomaghemite with respect to T and $f\text{O}_2$. 1+2+2=5

(3)

- (c) What is *todorokite*? What factor causes stabilization of todorokite structure? Enumerate the differences between two polymorphs of MnSiO_3 . 1+2+2=5
- (d) Why natural manganese carbonate deposits usually contain relicts of higher oxides of manganese? Comment on the solid solution between CaCO_3 and MnCO_3 . 3+2=5
- (e) Discuss about Troilite and Mackinawite. 5
- (f) Why 743°C is an important temperature in Fe–S system? Discuss about the stability of pyrite with temperature in sulfur-excess and sulfur-deficient conditions. 2+3=5
- (g) What is the principle of sphalerite barometry? State the limitation of sphalerite barometry. Comment on the viability of this barometer. 1+1+3=5
- (h) Write notes on : 2.5x2=5
- (i) Mn-pyroxenoids
- (ii) Low temperature minerals of intermediate Solid Solution in Cu-Fe-S system.

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