(f) 'Magma produced by partial melting of an amphibole-bearing source rock would have higher K/Rb than would magma derived from a source without amphibole' – accept or reject the statement with justification.

—— X ——

Ex./M.Sc-1/G-1/III/3/2018

MASTER OF SCIENCE EXAMINATION, 2018

(1st Year, 1st Semester)

APPLIED GEOLOGY

Igneous Petrology

Paper - III

Time : Two hours Full Marks : 50

Answer ***all*** questions
(use appropriate phase diagrams and sketches)

1. Write significant chemical, mineralogical and petrographic differences between tholeitic and alkaline basalts. Give trace element and isotopic evidences in favour of chemically heterogeneous mantle. Write in details generation of tholeitic and alkaline basalts from a (i) chemically uniform mantle and (ii) chemically heterogeneous mantle. 3+3+4=10

OR

Explain why the subducted crust and mantle wedges are principal sources of arc magmas. Explain the melting processes of subducted crust and mantle wedges in an arc setting. 4+6=10

2. (a) Explain why the following mineral assemblages are never found in rocks :
(i) quartz and nepheline, (ii) quartz and forsteritic olivine 5
(b) Explain why the *decompression melting* is not an effective process of *mantle melting* in an arc setting. $2^1/_2$
(c) Explain the occurrence of *seismic low velocity layer* inside the Earth. $2^1/_2$

OR

(a) Explain why first melt of a garnet lherzolite is not the same as the first melt of a plagioclase lherzolite of same composition. 3
(b) Explain why MORBs cannot be *primary magmas*, but are *derivative magmas* resulting from fractional crystallization. 3
(c) How do you explain occurrence of normal zoning, reverse zoning and oscilatory zoning of plagioclase phenocryst in volcanic igneous rocks ? Why are these features not common in plutonic igenous rocks ? 4

3. 'Komatiites provide a record of thermal and chemical characteristics of mantle through time'–explain using appropriate diagrams. 5

OR

Explain why Al-depleted komatiites indicate greater depth of origin ? Draw the chondrite normalized REE pattern for Al-depleted komatiites. Why do crustally contaminated Al-undepleted komatiites show lower Nb/Ta ratios than uncontaminated komatiites ? 2+1+2=5

4. Answer any ***five*** questions : 5x5=25

(a) What are the major differences between Archean layered Anorthosite and Proterozoiz massif-type Anorthosite ? Why do large massif-type anorthosites are absent during the Archean time ?

(b) Plutonic rocks exhibit intra-cryatalline textures in alkali feldspar crystals that are not seen in volcanic rocks. – Justify the statement with proper diagra. Why does anorthoclase confined to volcanic rocks ?

(c) How do you explain the different a values of $^{87}Sr/^{86}Sr$ ratio of two coeval rocks derived from the same source rock ? Answer with a suitable diagram. Why many anorthosite REE diagrams show a pronounced positive Eu anomaly ?

(d) A pophyritic granite contains large megacrysts of K-feldspar. Can this textural feature alone suggest its magmatic origin ?

(e) How do you explain the formation of coarse-grained pegmatites and fine-grained aplites that are closely associated with the granitic plutons ? Give proper diagram.