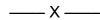
OR

- (a) 'An isotopically depleted mantle reservoir is responsible for generation of N-MORB through high degree of partial melting at shallow depth'—accept or reject the statement with reasons.
  - (b) What do you mean by 'High-μ (HIMU) mantle reservoir? How do you differentiate the magma composition generated from HIMU reservoir from that of 'Enriched Mantle-II (EM-II) mantle reservoir by Nd-Sr-Pb isotopic signatures?
  - (c) In which tectonic set up the alkali-olivine basaltic magma is commonly generated? Is it possible to differentiate this magma composition from that of a magma of continental origin from trace element normalized diagram? Justify with reasons.



## **MASTER OF SCIENCE EXAMINATION, 2017**

(1st Year, 1st Semester)

## **APPLIED GEOLOGY**

Paper : III

**Igneous Petrology** 

Time: Two hours Full Marks: 50

Answer any *four* questions.

- 1. (a) Why does rock melting curve shift to lower temperature in the hydrous system?
  - (b) State the mechanism that determines the solubility of H<sub>2</sub>O in silicate melts. "Mafic melts generally can dissolve less water than felsic ones"–justify the statement.
  - (c) How does the mechanism of CO<sub>2</sub> solubility differ from that of H<sub>2</sub>O solubility in silicate melts? How do the compositions of fluids in the C-O-H fluid system influence the solubility of CO<sub>2</sub> in the silicate melt?
  - (d) Why does hydrous granitic magma commonly solidify before erupting to the surface?

$$2^{1}/_{2}+3^{1}/_{2}+3^{1}/_{2}+3=12^{1}/_{2}$$

- (a) "Water saturated system at high lithostatic pressure may be responsible for plagioclase rich composition of rock like anorthosite." State the validity of the statement with reasons.
  - (b) Explain the following textures with reference to suitable phase diagram(s): (i) A rock composed of phenocrysts of enstatite, smaller phenocrysts of anorthite in a eutectic groundmass of enstatite, anorthite and tridymite. (ii) A rock composed of phenocrysts of enstatite with forsterite core, smaller phenocrysts of anorthite in a eutectic groundmass of enstatite, anorthite and tridymite.
  - (c) In what condition(s) would the hydrous minerals such as micas and amphiboles be stabilized in magma? How does the activity of water in a H<sub>2</sub>O-CO<sub>2</sub> mixture influence the stability of the hydrous phase?

    31/<sub>2</sub>+5+4=121/<sub>2</sub>

OR

- 3. (a) What are melting mechanism and origin of M- and I-type granitoids? In what tectonic conditions are they formed?
  - (b) Write short notes on (any **two**):  $6^{1}/_{2}+6=12^{1}/_{2}$ 
    - (i) Reverse zoning in plagioclase
    - (ii) Leucite in volcanic rocks of syenitic composition
    - (iii) Aluminous granite.  $6^{1}/_{2}+6=12^{1}/_{2}$

- 4. (a) What is Komatiite? 'The chemical characteristics of "Barbarton-type" komatiite is helpful in understanding the depth and degree of melting of source rock for the generation of Al-depleted komatiitic magma'—discuss with reasons.
  - (b) What is 'Spinifex' texture? What are the factors that govern the growth of this texture typically in komatiite rocks but not in others?
  - (c) 'Komatiite magmatism is effusive rather than explosive in nature'—accept or reject the statement with reasons.  $4\frac{1}{2}+4\frac{1}{2}+3\frac{1}{2}=12\frac{1}{2}$
- (a) What could be the primitive magma type of island arc set up? Discuss the role of subducting and overriding plate in magma generation in such tectonic setting.
  - (b) 'The arc basalt can easily be identified from midoceanic ridge basalt through normalized trace element signatures.'—Explain how?
  - (c) What is 'seriate' texture? Why this texture is commonly found in porphyritic andesite but not in basalts?  $4^{1}/_{2}+4^{1}/_{2}+3^{1}/_{2}=12^{1}/_{2}$