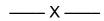(4)

10. What are meant by V-SMOW, PDB, SLAP? Define Henry's law? Is Henry's law valid to explain the chemical behavior of K in granitic rocks? Justify your answer. Which of the two phases, ice and water, fractionate heavier oxygen isotope? Justify.

—— X ——

MASTER OF SCIENCE EXAMINATION, 2017

(1st Year, 1st Semester)

APPLIED GEOLOGY

Paper : II

Geochemistry

Time : Two hours   Full Marks : 50

Use a separate Answer-Script for each group.

GROUP - A (25 marks)

Answer any *two* questions.

1. Using necessary sketches compare the evolution of $^{87}Sr/^{86}Sr$ and $^{143}Nd/^{144}Nd$ isotopic ratios of crust and depleted mantle with respect to primitive mantle since a major crust-building event at approximately 2.7 Ga. What does $\in$ (epsilon) mean in the context of geochronology? How can you distinguish between a crust-derived and depleted mantle-derived igneous rock based on their $\in$Nd and $\in$Sr values? $7+2+3^1/_2=12^1/_2$

2. Explain the term "blocking temperature" of a mineral as used in geochronology. Discuss how blocking temperature, in conjunction with mineral age, can be used to decipher the cooling history of magma. "Useful

(Turn Over)

mineral crystallization age can be obtained only when blocking temperature is $\geq$ crystallization temperature"– accept or reject the statement with reason.

$$2+7^1/_2+3=12^1/_2$$

3. "During magmatic to hydrothermal transition of a granitic magma, the exsolved hydrothermal fluid may or may not carry the same sulphur isotope signature as that of the melt"–accept or reject the statement with reasons". How would the $\delta^{34}S$ values of evaporite and marine sulphide, precipitated from seawater, differ from the $\delta^{34}S$ value of seawater-sulfate and why? Among pyrite, chalcopyrite, galena and sphalerite, which of the mineral pair would be the best for stable isotope thermometry and why? $\qquad$ $7+3+2^1/_2=12^1/_2$

4. Write short notes on the following : $\qquad$ $5 \times 2^1/_2=12^1/_2$

   (a) Model age

   (b) Chemical age of minerals

   (c) U and Pb isotope characteristics of HIMU mantle and possible explanation

   (d) Reasons of changing SO_2/H_2S ratio of evolving hydrothermal fluid

   (e) Stable isotope fractionation factor and relative enrichment factor.

GROUP - B (25 marks)

Answer any *four* questions.

All questions carries euqal marks.

5. Explain why heavier isotopes prefer substances having stronger bond strength.

6. What is kinetic fractionation of stable isotopes ? Give an example of kinetic fractionation of stable carbon isotopes.

7. Derive an equation that relate the fractionation parameters δ and α. Explain why the materials are derived from the crustal sources isotopically heavier than the materials derived from the mantel.

8. Deduce Nernst-Barthelot equation. What are LILE and HFSE ? Give examples.

9. How do you calculate volume strain of a metasomatic rock using the compositions of metasomatic rock and its precursor ?