

MASTER OF SCIENCE EXAMINATION, 2018

(1st Year, 1st Semester)

APPLIED GEOLOGY

Geochemistry

Paper - II

Time : Two hours

Full Marks : 50

Use separate answer script for each group.

GROUP - A (25 marks)

Answer **q.no. 1** is compulsory and any **two** from the rest.

1. Using necessary sketch briefly discuss the evolution of $\delta^{34}\text{S}_{\text{H}_2\text{S}}$ and $\delta^{34}\text{S}_{\text{SO}_4}$ during bacterial reduction of seawater sulphate (SO_4^{2-}) to sulphide (H_2S) when the system is closed to sulphate but open to sulphide. Which geological material is commonly used to decipher the sulphur isotopic composition of ancient seawater and why? "Interaction with the country rock can effectively change the $\text{SO}_2/\text{H}_2\text{S}$ ratio of an evolving hydrothermal fluid" – explain the statement. If the $\text{SO}_2/\text{H}_2\text{S}$ ratio of such an evolving fluid decreases during its cooling how that will be reflected in the $\delta^{34}\text{S}_{\text{H}_2\text{S}}$ values of H_2S in the fluid?

$$5+2+2\frac{1}{2}+3=12\frac{1}{2}$$

(Turn over)

(2)

2. What is mass independent fractionation (MIF) of stable isotope ? Using necessary sketch define and explain the mass dependent fractionation line (MFL) for sulphur isotope. What is the geological evidence of MIF of sulphur isotopes in nature ? What is the possible explanation of MIF of sulphur isotope ? How does the MIF to MDF (mass dependent fractionation) transition in rock record help in understanding the early atmospheric oxygenation ?

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

3. Using necessary sketch describe the construction of U-Pb concordia diagram. What is discordia and what is the significance of the upper and the lower intercept of a discordia with the concordia ? With proper explanation draw the possible discordia lines for a set of zircon grains that crystallized at 3.0 Ga and subsequently subjected to hydrothermal events at 2.0 Ga and 1.0 Ga.

$$5+2^{1/2}+5=12^{1/2}$$

4. Write short note on the following : $5 \times 2^{1/2} = 12^{1/2}$
- Blocking temperature of mineral and its significance in geochronology.
 - Chemical age.
 - Isochron age
 - C_{Nd} (epsilon) and C_{Sr} value of the depleted mantle.
 - Stable isotope fractionalism factor and relative enrichment factor.

(3)

GROUP - B (25 marks)

Answer **q.no. 5** and any **two** from the rest.

5. Define Henry's law. Using Henry's law deduce Nernst's partition coefficient (D_i). "In a binary plot of SiO_2 Vs Ni, a differentiated basaltic rock suits show step like negative slope". Accept or reject the statement with reason. Define compatible elements. 13
6. How do you calculate change of rock mass during weathering from the chemistry of weathered rock and its protolith ? 6
7. What is kinetic fractionation of stable isotope ? Why does kinetic fractionation of stable isotope occur ? Give two examples of kinetic fractionation. 6
8. With the help of a diagram show the change in activity (a)-composition(X) relation of a component in a solid solution. What is Rault's law region in an a-X diagram ? Does this region increase/decrease/remains the same, if temperature is increased ? Justify your answer. 6

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