MASTER OF SCIENCE EXAMINATION, 2025

(1st Year, 1st Semester)

APPLIED GEOLOGY

PAPER : CORE/TH/02

(Geochemistry)

Time : 2 *Hours* *Full Marks* : 40

Use separate answer scripts for each part.

PART—I

(20 Marks)

Answer Question No. **1** and *any* **one** from *Q*2 and *Q*3

1. Accept or reject the statements with reason. 4×3=12

(a) ''Chemical species do not disperse if there is no concentration gradient'' **CO1**

(b) ''A1-rich phase tends to nucleate on the A1-poor phase'' **CO4**

(c) ''Solubility of a solute (solid) in an aqueous solution can not increase during cooling'' **CO3**

2. *(a)* Derive the Nernst Partition coefficient (D).**CO2** 4

(b) What is the major difference between "Rayleigh and batch fractionation processes"?
Can an element in basaltic melt behave compatible as well as incompatible under a given pressure and temperature? Justify. **(CO3)** 2+2

3. *(a)* Derive a relation that helps to calculate the volume strain of a shear zone using the bulk compositions of the sheared and its wall rock. **CO4** 5

(b) What is 'diffusion coefficient'? What factors do the 'diffusion coefficient' depend on? **CO3** 1+2

PART—II

(20 Marks)

Answer any ***four*** questions

1. Define the terms *(a)* fractionation factor and *(b)* relative enrichment factor as used in stable isotope geochemistry. Briefly discuss the factors that control stable isotope fractionations in nature.**CO7** 2+3

2. Using necessary sketch, briefly discuss the evolution of $\delta^{34}S_{H2S}$ and $\delta^{34}S_{SO_4}$ during bacterial reduction of seawater sulphate (SO_4^{2-}) to sulphide (H_2S) when the system is closed to both sulphate and sulphide." The volume fraction of fluid generated from an oxidized granitic magma plays important role in controlling sulphur isotope fractionation between melt and fluid". Explain. **CO7** 3+2

3. Derive the fundamental equation of U-Th-Pb_{Total} chemical dating. What are the advantages and disadvantages of such dating? **CO8** 3+2

4. Briefly discuss the methods of isochron dating of rocks and minerals. " The initial $^{87}Sr/^{86}$ Sr ratios of a set of co-genetic igneous rock samples are same whereas their initial $^{87}Rb/^{86}$ Sr ratios are different"– accept or reject the statement with reasons. **CO8** 3+2

5. Briefly describe the steps in determining the €Nd value from a suite of co-genetic igneous rocks." The €Nd and €Sr value of the crust-derived igneous rocks would be positive and negative respectively"- accept or reject the statement with reasons. **CO6** 2+3

6. Write short notes on *(a)* mass independent fractionations of sulphur isotopes. *(b)* Radiogentic isotopic character of HIMU mantle and depleted mantle. **CO7+ CO6** 2½×2½

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