

**B. SC. GEOLOGICAL SCIENCES EXAMINATION, 2023**

( 1st Year, 2nd Semester )

**ELEMENTS OF GEOCHEMISTRY**

**PAPER – CORE/TH/03**

Time : Two hours

Full Marks : 40

(Use a separate Answer script for each Part)

**PART – I**

Answer **Q1** and *any one* from **Q2** and **Q3**.

1. Accept or reject the following statements with reason:

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- a) Heat and mass flow from lower to higher concentrations.
- b) Roul't's law is a special case of Henry's law.
- c) Spontaneity of any chemical reaction is only driven by the entropy change of that reaction.
- d) Fluid saturated magmas erupt violently compared to fluid under saturated magmas.

2. Derive Nernst-Barthelot equation. Assume that the Ni/Rb ratio of an ultramafic rock is 200 and a soil is developed on the rock. Do you expect the Ni/Rb ratio in the soil to drop below 200 under any circumstances? Justify your answer.

8

[ Turn over

[ 2 ]

3. a) "Ocean water freezes earlier than river water in the Scandinavian countries during the winter time"  
Accept or reject the statement with reason.
- b) Why is sanidine common in volcanic rocks? 8

**PART – II**

Answer *any four* questions. 4×5

1. Explain why the abundance of Li, Be and B are abnormally low in the solar system. Using suitable nuclear reactions explain the fundamental differences between "alpha" and "triple alpha process" of nucleosynthesis.  $2\frac{1}{2} + 2\frac{1}{2}$
2. What are "large ion lithophile elements (LILE)" and "high field strength elements (HFSE)"? Give example. "LILE are generally more mobile during chemical weathering and metamorphism than HFSE" – accept or reject the statement with reasons. Explain why Na is highly abundant whereas Al concentration is negligible in seawater. 1+2+2
3. "The Earth's present day atmosphere is secondary in nature" – accept or reject the statement with reason. Why the concentration of argon is anomalously high in the present day atmosphere? 3+2

[ 3 ]

4. Citing suitable examples, briefly discuss the main controlling factors of mass dependent fractionation of stable isotopes. Prove that  $\alpha_{A-B} = (\delta_A + 1000) / (\delta_B + 1000)$ .  $\alpha$  and  $\delta$  have their usual meaning as used in stable isotope geochemistry. 3+2
5. "For a suite of co-genetic igneous rocks the initial  $^{87}\text{Sr}/^{86}\text{Sr}$  ratios are same whereas the  $^{87}\text{Rb}/^{86}\text{Sr}$  ratios are different" – why? Using the law of radioactivity derive the fundamental geochronometric equation for Rb-Sr isotope system. 2+3
6. Write short notes on a) homogeneous and heterogeneous accretionary model for the formation of core and mantle, b) carbonaceous chondrite.  $2\frac{1}{2} + 2\frac{1}{2}$