

/Roll No.

E-316

**M. Sc. (First Semester)
EXAMINATION, Dec.-Jan., 2020-21**

GEOLOGY

Paper Third

(Geochemistry)

Time : Three Hours]

[Maximum Marks : 80

[Minimum Pass Marks : 16

Note : Attempt all Sections as directed.

Section—A

1 each

(Objective/Multiple Choice Questions)

Note : Attempt all questions.

Choose the correct answer :

1. A stable state of geochemical system refers to the configuration with :
 - (a) Minimum possible Gibbs free energy
 - (b) Maximum possible Gibbs free energy
 - (c) Minimum possible entropy
 - (d) Maximum possible entropy

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2. Based on the first law of thermodynamics, which one of the following is correct ?
- (a) For an isothermal process, $q = + w$
 - (b) For an isochoric process, $\Delta U = - q$
 - (c) For an adiabatic process, $\Delta U = - w$
 - (d) For a cyclic process, $q = - w$
3. Which is not a LILE ?
- (a) K
 - (b) Rb
 - (c) Pb
 - (d) Zr
4. For an equilibrium reaction, Gibbs' free energy (ΔG) =
- (a) 0
 - (b) 1
 - (c) < 1
 - (d) > 1
5. is used as a standard reference for S_{31}/S^{32} .
- (a) CDT
 - (b) SMOW
 - (c) NBS
 - (d) PDB

6. Elements which readily form ions with an outermost 8-electron shell are :
- (a) Siderophile
 - (b) Chalcophile
 - (c) Lithophile
 - (d) Atmosphere
7. Which of the following have least Electro-Negativity (EN) ?
- (a) Lithophiles
 - (b) Chalcophiles
 - (c) Siderophiles
 - (d) Atmosphiles
8. Rubidium is usually found dispersed in :
- (a) K-rich minerals
 - (b) Ca-rich minerals
 - (c) Na-rich minerals
 - (d) Al-rich minerals
9. Residence time, t_r , in the chemistry of seawater is defined as :
- (a) ratio of the dissolved mass in a reservoir
 - (b) the ratio of the TDS in the ocean divided by the flux to the ocean
 - (c) the ratio of the mass TDS in the ocean divided by the flux to the ocean
 - (d) None of above

10. Which of the following pairs is not correct ?
- (a) HFSE – Zr, Hf
 - (b) LILE – Ta, Nb
 - (c) PGE – Pd, Os
 - (d) REE – Lu, Sn
11. Which of the following arrangements of the elements are in the increasing order of their abundance in the solar system ?
- (a) $H > He > O > C > N$
 - (b) $He > H > C > O > Fe$
 - (c) $H > He > O > N > C$
 - (d) $Si > Fe > H > He > O$
12. The transformation from parent rock to soil is generally accompanied by
- (a) Decrease in Ca, Mg, Na and K and increase in Si.
 - (b) Increase in Ca, Mg, Na and K and decrease in Si.
 - (c) Much loss of Al and Fe.
 - (d) No change in parent composition.
13. ϵNd and ϵSr are positive in :
- (a) Crust and mantle respectively
 - (b) Mantle and crust respectively
 - (c) In the crust
 - (d) In the mantle

14. If we start with 100 gm ^{238}U , what would be the amount of ^{238}U and ^{206}Pb after 4 half-lives ?
- (a) 25 and 75 grams
 - (b) 12.5 and 87.5 grams
 - (c) 6.25 and 93.75 grams
 - (d) 3.12 and 96.88 grams
15. Which among the following minerals is commonly dated by K-Ar isotopic system ?
- (a) Garnet
 - (b) Zircon
 - (c) Monazite
 - (d) Muscovite
16. is not a chalcophile element.
- (a) S
 - (b) Sn
 - (c) Pb
 - (d) Rb
17. In fractional crystallization process, if Sr content depletes, it indicates fractionation.
- (a) plagioclase
 - (b) opaques
 - (c) olivine
 - (d) quartz

18. Garnet present in the lower mantle is known as
- (a) Perovskite
 - (b) Wadsleyite
 - (c) Orthopyroxene
 - (d) Majorite
19. Siderites consist essentially of a :
- (a) Nickel-iron alloy
 - (b) Nickel-iron alloy and silicates
 - (c) Silicates only
 - (d) Silicates and graphites
20. As the percentage of partial melting of mantle increases, the concentration of incompatible elements in the residue.
- (a) increases
 - (b) decreases
 - (c) No change
 - (d) increases first and then decreases

Section—B

2 each

(Very Short Answer Type Questions)

Note : Attempt all questions. Answers should be in 3 or 4 lines only.

1. What is Pallasite ?

2. Describe Phase rule.
3. What are the factors governing partition co-efficient ?
4. What are Incompatible elements ?
5. Write the Upper mantle mineralogy.
6. What do you mean by Concordia and Discordia ?
7. What is HIMU mantle ?
8. What is Eutrophication ?

Section—C

3 each

(Short Answer Type Questions)

Note : Attempt all questions. Write the answers within 75 words.

1. Write about the geochemical classification of elements.
2. Write a note on the behavior of Ni, Mg and REE during fractional crystallization.
3. Write a note on the Classification of Meteorite.
4. Write a note on ophiolite.
5. Write a note on the geochemistry of crust.
6. Write a note on the use of Sm-Nd isotope systematics in various petrogenetic studies.
7. Write a note on various mantle reservoirs.
8. Write a note on biogeochemical cycling of soil.

Section—D

5 each

(Long Answer Type Questions)

Note : Attempt any *four* questions. Write the answers within 150 words.

1. Write a note on nucleosynthesis.

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2. What is partial melting of mantle ? Discuss the behavior of trace elements during partial melting.
3. Write a note on lower mantle mineralogy.
4. Write a note on the stable isotope and use of stable isotopes in various geological interpretations/applications.
5. Write a note on the composition of seawater.