

Name:			
Enrolment No:			
UPES End Semester Examination, December 2025			
Course: Elements of Geochemistry		Semester: V	
Program: B.Sc. Geology		Time : 03 hrs.	
Course Code: PEGS2048		Max. Marks: 100	
Instructions: All questions are mandatory			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	Explain how the Periodic Table helps in understanding geochemical behavior of elements.	4	CO1
Q 2	Define incompatible elements and state why LREE behave differently from HREE during partial melting.	4	CO2
Q 3	Define CHUR? Mention its role in S_m-N_d isotope geochemistry.	4	CO2
Q 4	Distinguish between ordinary, carbonaceous, and enstatite chondrites based on composition and origin.	4	CO3
Q 5	Explain the influence of pH on the solubility of metals in aqueous systems.	4	CO4
SECTION B (4Qx10M= 40 Marks)			
Q 6	Critically analyze isotopic and elemental fractionation during evaporation, condensation, and crystallization, using suitable examples involving oxygen isotopes.	10	CO1
Q 7	A charcoal sample shows ^{14}C activity equal to 18% of modern wood. Apply the radioactive decay law (using the ^{14}C half-life) to determine its age and evaluate the geological significance of this result.	10	CO2
Q 8	Define the thermocline and plot a typical temperature-depth profile. Explain how seasonal changes and currents the thermocline, nutrient distribution and marine life.	10	CO3
Q 9	A granite sample has a present-day $^{87}Rb/^{86}Sr = 2.15$ and $^{87}Sr/^{86}Sr = 0.7215$. Assume the initial $^{87}Sr/^{86}Sr = 0.7040$ and use the decay constant $\lambda(^{87}Rb) = 1.42 \times 10^{-11} \text{ yr}^{-1}$. (a) Calculate the age of the granite using the isochron equation: (b) Interpret whether the calculated age is more typical of Precambrian or Phanerozoic granitoids. OR Assess the underlying principles of ^{36}Cl dating and critically interpret how the measurement of $^{36}Cl/Cl$ ratios is used to determine the upliftment rate of fluvial terraces.	10	CO4
SECTION-C (2Qx20M=40 Marks)			
Q 10	Evaluate the influence of thermocline-based and light-penetration ocean zones on marine ecosystems and biological productivity and justify the ecological significance of each zone.	20	CO3
Q 11	A zircon crystal gives the following isotopic ratios: $(^{206}Pb/^{238}U) = 0.124$; $(^{207}Pb/^{235}U) = 0.955$. Assume Decay constants: $\lambda_{238} = 1.55125 \times 10^{-10} \text{ yr}^{-1}$; $\lambda_{235} = 9.8485 \times 10^{-10} \text{ yr}^{-1}$. Calculate the $^{206}Pb/^{238}U$ age and $^{207}Pb/^{235}U$ age. Comment whether the zircon is concordant or discordant based on your results. OR i. Calculate the age of a rock sample if the half-life of the parent isotope is 10 million years and the remaining parent isotope is 25% of the original amount. ii. A sample of organic material contains 40% of the original carbon-14. Using a half-life of 5730 years for carbon-14, calculate the age of the sample.	20	CO4