

Time: 3 Hours

Max. Marks: 60

Note: Question No. 1 is compulsory. Attempt five questions from section A and B, taking at least two questions from each section.

Section-A

- Explain why blocks of magnesium are often stripped to the steel hulls of ocean-going ships?
 - What is colloidal conditioning of boiler feed water?
 - What is the importance of IR spectroscopy in finger print region?
 - How will you verify that a particular signal in NMR spectrum arises from -OH, -NH or -SH groups?
 - How does temperature affect rate of photosynthesis in plants?
 - A substance Z has its triple point at 18°C and 0.5 atm., its normal melting and boiling points are 20°C and 300°C respectively. Sketch the schematic phase diagram for Z.
 - For a cell reaction $A(s) + 2B(aq) \rightarrow A^{2+}(aq) + 2B(s)$ at 298 K, the equilibrium constant is 1.0×10^{10}
 - What is R_f value in chromatography?
 - Why does $Mg(HCO_3)_2$ require double amount of lime for softening?
 - What is UV spectrum? Give various regions associated with UV spectrum.

Section-B

- Calculate E^0_{cell} .
- What are lime and soda? Compare hot and cold soda lime process for softening of hard water.
 - Calculate the amount of lime (84%pure) and soda (92%pure) required for treatment of 20,000 litres of water whose analysis is as follows:
 $Ca(HCO_3)_2 = 40.5$ ppm; $Mg(HCO_3)_2 = 36.5$ ppm; $MgSO_4 = 30$ ppm; $CaSO_4 = 34$ ppm; $CaCl_2 = 27.75$ ppm; $NaCl = 10$ ppm. Also calculate temporary and permanent hardness of water sample. [Given atomic masses of H = 1, Na = 23, Ca = 40, Mg = 24, O = 16, C = 12, S = 32, Cl = 35.5]
 - What is demineralised water? How is it different from soft water?
- Discuss the importance of design and material selection in controlling corrosion.
 - Discuss briefly
 - Galvanic corrosion
 - Stress corrosion
 - Why steel does not rust if covered with ice?
- What are various classes of chromatography? Bring out clearly the principles involved in each case.
 - Write short notes on the following:
 - Liquid chromatography
 - Vapour phase chromatography
- What is Nernst equation? Write its applications.
 - The e.m.f. of the cell reaction $3Sn^{4+} + 2Cr \rightarrow 3Sn^{2+} + 2Cr^{3+}$ is 0.89V. Calculate the standard free energy change for the reaction.

Section-C

- State and explain Einstein's law of photochemical equivalence.
 - Describe and discuss Jablonski diagram for depicting various photo processes.
 - Write a short note on lasers and their uses.
- Define the term bathochromic shift and hypsochromic shift. What structural feature may produce bathochromic of a hypsochromic shift in an organic compound.
 - In an absorption cell, the transmittance of 0.1M solution of a substance X is 80% and that of 0.1 M solution of another substance Y is 60% at a given wavelength. What is the transmittance of solution that is simultaneously 0.1M in X and 0.1 M in Y.
 - Using IR spectroscopy, how will you determine whether the oxygen in an organic compound is present as a carbonyl or hydroxyl group?
- How will you distinguish primary, secondary and tertiary alcohols on the basis of PMR spectroscopy?
 - Write brief notes on the following
 - Chemical Shift
 - Spin-spin coupling
 - Coupling constant
- State Gibbs phase rule and explain the terms involved in it.
 - Discuss the application of phase rule to potassium iodide-water system. Explain the formation of freezing mixtures by addition of suitable salts to ice.