

**Engineering Chemistry**  
**(CH-101, May.2005)**

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**

1. (a) What are zeolites? Why is water softened by zeolite process unfit for use in boilers?  
(b) State two conditions for wet corrosion to take place.  
(c) What do you understand by UV spectroscopy?  
(d) What is meant by photosynthesis?  
(e) Why do electrochemical cells stop functioning after some time?  
(f) What is phase rule? What is its significance?  
(g) What type of nuclei show NMR spectra?  
(h) What is Differential Aeration?  
(i) Why do we express hardness of water in terms of  $\text{CaCO}_3$  equivalents?  
(j) What do you understand by distribution ratio (D) in chromatography?

**Section-B**

2. (a) What is break point chlorination? Explain showing different zones. What are the advantages of break-point chlorination?  
(b) A sample of water was analyzed and found to contain temporary magnesium hardness 25 mg/lit. Permanent magnesium chloride hardness is 15 mg/lit and permanent. Calcium sulphates hardness 20 mg/lit  $\text{SiO}_2 = 300$  mg/lit. Calculate the lime and soda required for softening 30,000 liters of hard water.
3. (a) What is atmospheric corrosion? Why metals like Cu, Pb and Al are corroded slowly than metals like Na, Ca, Fe etc  
(b) Give important cathodic and anodic reactions in presence and absence of oxygen in corrosion.
4. (a) How are chromatographic techniques classified? Discuss in brief chromatographic mechanism.  
(b) Explain the chromatographic development with suitable example.
5. (a) Describe a typical galvanic cell and show how the chemical energy is converted to electrical energy? What is the relation between free energy, enthalpy, entropy and EMF of the cell?  
(b) A cell uses  $\text{Zn}^{++}/\text{Zn}$  and  $\text{Ag}^+/\text{Ag}$  electrodes. Write the cell representation, half cell reactions and net cell reaction. Calculate EMF of the cell. Given:  
 $E^\circ \text{Zn}^{++}/\text{Zn} = -0.76 \text{ V}$  and  
 $E^\circ \text{Ag}^+/\text{Ag} = 0.8 \text{ V}$

**Section-C**

6. (a) Distinguish between:  
(i) Thermal and photochemical reactions  
(ii) Fluorescence and phosphorescence  
(b) The quantum efficiency of photochemical reaction:  
$$\text{H}_2(\text{g}) + \text{Cl}_2(\text{g}) \rightarrow 2\text{HCl}(\text{g})$$
  
Is  $1.0 \times 10^5$  with wavelength of 480 nm. Calculate the number of moles of  $\text{HCl}(\text{g})$  produced per joule of radiant energy absorbed.
7. (a) Define the triple point in water system.  
(b) Explain the phase diagram of Sulphur system in detail.
8. (a) Explain the following:  
(i) Frank-Condon principle.  
(ii) Chromophores and Auxochromes  
(b) A solution shows a transmittance of 20% when taken in a cell of 2.5 cm thickness. Calculate its concentration, if the molar absorption coefficient is  $12,000 \text{ dm}^3 \text{mol}^{-1} \text{cm}^{-1}$ .
9. (a) Predict the NMR spectra of  $\text{CH}_3 \text{CH}_2 \text{OH}$ ,  $\text{CH}_2 \text{Cl-CHCl}_2$   
(b) In relation to NMR spectra, explain any one of the following:  
(i) Chemical Shift and TMS  
(ii) Shielding and Deshielding