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# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Four Year B.Tech I Semester End Examinations (Supplementary) - January, 2019

Regulation: IARE – R18

## ENGINEERING CHEMISTRY

Time: 3 Hours

(Common to CSE | IT | EEE)

Max Marks: 70

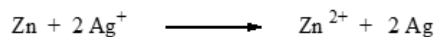
Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

### UNIT – I

- What is electrochemical series and explain its application. Can we store  $CuSO_4$  in zinc vessel or silver vessel? Justify your answer. [7M]
  - Derive Nernst equation for reduction electrode potential. Calculate the EMF of the following Zn-Ag cell at  $22.3^\circ C$  if the concentration of  $ZnSO_4$  and  $AgNO_3$  are 0.091 M and 0.0289 M. Given that  $E^0_{Zn^{2+}/Zn} = -0.76$  v and  $E^0_{Ag^+/Ag} = +0.8$  v [7M]
- What is wet corrosion? Explain the theory and mechanism of electrochemical corrosion. [7M]
  - What is standard electrode potential? Write the anode and cathode reactions and calculate the standard EMF of a cell which involves the following cell reaction. [7M]



$$\text{Given } E^0(Zn^{2+}, Zn) = -0.76 \text{ v}; E^0(Ag^+, Ag) = 0.80 \text{ v}$$

### UNIT – II

- How will you determine the total, Temporary and permanent hardness of water using complexometric method? [7M]
  - Calculate temporary and permanent hardness of a water sample which contains 6.8mg of  $CaSO_4$ , 33mg of  $CaCl_2$ , 40mg of  $Na_2SO_4$ , 24mg of  $MgSO_4$  per liter of the water sample. (Given Molar mass of Ca=40g, Na=23g, Mg=24g, S=32g, O=16g, Cl=35g) [7M]
- What is desalination? Describe desalination by reverse osmosis and write its advantages. [7M]
  - A sample of water on analysis was found to contain  $Mg(HCO_3)_2 = 73$  mg/L;  $Ca(HCO_3)_2 = 162$  mg/L;  $CaSO_4 = 136$  mg/L;  $MgCl_2 = 95$  mg/L; NaOH = 40 mg/L. Calculate the permanent, temporary and total hardness. [7M]

### UNIT – III

5. (a) Give the reasons for the following [7M]  
i. O<sub>2</sub> is paramagnetic  
ii. N<sub>2</sub> is diamagnetic  
iii. CO is diamagnetic  
iv. NO is paramagnetic  
(b) Calculate number of bonding and anti bonding orbital's in O<sub>2</sub>, N<sub>2</sub>, F<sub>2</sub>, CO & NO molecules? [7M]
6. (a) With the help of suitable illustrations explain the crystal field theory of square planar geometry? [7M]  
(b) How crystal field splitting takes place in following complexes: [7M]  
i. Tetrahedral  
ii. Square planar

### UNIT – IV

7. (a) Write short note on stereochemistry of organic compounds. [7M]  
(b) What is nucleophilic substitution? Explain the mechanism, factors affecting and rate of S<sub>N</sub>2 mechanism. [7M]
8. (a) Explain the structure, synthesis and pharmaceutical applications of Paracetamol. [7M]  
(b) The concentration of an optically active compound dissolved in chloroform is 6.15/100ml. A portion of this solution in a 5cm polarimeter tube produced an observed rotation of  $-1.2^{\circ}$ . Calculate the specific rotation of the compound. [7M]

### UNIT – V

9. (a) What is proximate analysis of coal? How it is carried out and write its significance. [7M]  
(b) A sample of coal was found to have the following percentage composition: C=75%, S=1.2%, H=5.2%, N=3.7%, O=12.8% and ash=2.1%. Oxygen in air is 23% by weight. Calculate the minimum amount of air required for complete combustion of 1kg of coal sample. [7M]
10. (a) What is calorific value of a fuel? Define gross calorific value and net calorific value of a fuel and write down the relation between them. [7M]  
(b) Calculate the gross and net calorific values of a coal sample containing 84% of carbon, 1.5% of Sulphur, 6% of nitrogen, 5.5% of hydrogen and 8.4% of oxygen. The calorific value of carbon, hydrogen and Sulphur are 8080 kcal/kg, 34500 kcal/kg and 2240 kcal/kg, respectively, and latent heat of steam is 587 cal/g. [7M]

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