Code : 231201

B.Tech 2nd Semester Exam., 2014

ENGINEERING CHEMISTRY

Time : 3 hours *Full Marks* : 70

Instructions :

(i) *The marks are indicated in the right-hand margin.*

(ii) *There are* ***NINE*** *questions in this paper.*

(iii) *Attempt* ***FIVE*** *questions in all.*

(iv) *Question No.* ***1*** *is compulsory.*

1. Answer/Fill in the blanks (any *seven*) : 2×7=14

(a) Arrange the following 0·1 *M* solution in the increasing order of freezing point : Aluminium chloride solution; Urea solution; Acetic acid solution; Calcium chloride solution.

(b) Arrange LPG, water gas, producer gas and hydrogen in decreasing order of their calorific value.

(c) A 0·82% solution of organic compound is isotonic with 0·1 *M* urea solution. The molecular weight of organic compound is ——.

(d) What are the functions of salt bridge?

(e) What is tacticity in polymers?

(f) Plexiglass is polymer of ——.

(g) Hardness of water containing 1·62 mg/lit, $Ca(HCO_3)_2$ and 7·3 mg/lit magnesium bicarbonate is — — p.p.m. Cl.

(h) Why does impure metal corrode faster than pure metal?

(i) 0·1 *M* acetic acid solution is —— to 0·1 *M* sucrose solution.

(j) Why does smaller anodic area result in intense corrosion?

2. (a) What are the causes of scale and sludge formation? 3

(b) Write the drawbacks of scale and sludge formation. 3

(c) Describe the methods used for the prevention of scale and sludge formation. 4

(d) 2·1 gm coal sample heated with excess NaOH which expelled all nitrogen present in coal as ammonia. The ammonia required 16·2 ml (1 *M*) H_2SO_4. Find the percentage of nitrogen in coal. 4

3. *(a)* What are the significances of proximate and ultimate analyses of coal? 4

(b) How is analysis of flue gas done by Orsat's apparatus? 5

(c) Calculate the amount of lime (74% pure) and soda (84% pure) required for softening 250 m^3 water which contains following in mg/lit : 5

$Ca(HCO_3)_2 = 4 \cdot 86$, $Mg(HCO_3)_2 = 4 \cdot 38$, $MgSO_4 = 3 \cdot 0$, $CaCl_2 = 2 \cdot 22$, $CO_2 = 2 \cdot 2$, $HCl = 3 \cdot 65$, $NaHCO_3 = 2 \cdot 1$

4. *(a)* Predict whether or not of the following reactions will occur spontaneously in acid solution. Determine E°_{cell} for the reaction that is predicted to occur : 8

(i) Oxidation of NO to NO_3^- by Sn^{+4}

(ii) Reduction of Mn^{+2} to Mn by Zn

(iii) Reduction of Br_2 to Br^- by H_2O_2

(iv) Reduction of Br_2 to Br^- by Fe^{+2}

$E^\circ_{Zn/Zn^{+2}} = 0 \cdot 76$ V, $E^\circ_{Fe^{+3}/Fe^{+2}} = 0 \cdot 77$ V,

$E^\circ_{NO_3^-/NO} = 0 \cdot 96$ V, $E^\circ_{Sn^{+4}/Sn^{+2}} = 0 \cdot 15$ V,

$E^\circ_{Mn/Mn^{+2}} = 1 \cdot 18$ V, $E^\circ_{Br_2/Br^-} = 1 \cdot 07$ V,

$E^\circ_{O_2/H_2O_2} = 0 \cdot 68$ V

(b) Calculate the electrode potential of cell

$Fe \mid Fe^{+2}(1\ M) \parallel Ag^{+1}(1\ M) \mid Ag$

after 50% Ag^+ reacted given that

$E^\circ_{Fe/Fe^{+3}} = 0 \cdot 44$ V, $E^\circ_{Ag^{+1}/Ag} = 0 \cdot 80$ V 6

5. *(a)* Explain with examples : 3+3=6

(i) Addition polymerization and condensation polymerization

(ii) Conducting and non-conducting polymers

(b) What is vulcanization of rubbers? 4

(c) Outline the preparation and uses of—

(i) ABS polymer;

(ii) Teflon. 4

6. *(a)* What is ideal solution? Explain positive and negative deviation from ideal behavior of liquid pairs. 5

(b) Derive the relationship between freezing point depression of a solution with the mole fraction of the dissolved solute. 5

(c) Find the molality of a solution containing a non-volatile solute if its v.p. is 5% below the v.p. of pure water. 4

7. (a) What are laws of dry corrosion? Explain with examples. 4

(b) Discuss the mechanism of wet corrosion. 4

(c) Discuss the methods used to prevent corrosion. 6

8. What are the causes and preventions of the following? 3½×4=14

(a) Boiler corrosion

(b) Caustic embrittlement

(c) Priming and foaming

(d) Knocking

Write short notes on the following : 3½×4=14

(a) Glass transition temperatur

(b) Colligative properties

(c) Waterline corrosion

(d) Secondary cell

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