Code : 231201

B.Tech 2nd Semester Exam., 2015

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. Fill in the blanks/answer any *seven* questions : 2×7=14

(a) 50 ml of water sample require 1·5 ml *M* / 50 HCl solution using methyl orange indicator. The temporary hardness of water is —— ppm.

(b) Natural rubber is polymer of ——.

(c) Terylene is condensation polymer of —— and ——.

(d) Arrange hydrogen gas, LPG, water gas and biogas in increasing order of their calorific value.

(e) Aluminium vessels are used to store conc. HNO_3. Explain.

(f) Why is boiling point of water increases when KCl added?

(g) Large cathode and small anode area results in intense corrosion. Explain.

(h) Arrange in increasing order of freezing point of 0·1 *M* solution of acetic acid, glucose, sodium chloride and calcium nitrate.

(i) What is power alcohol?

(j) Why are brass utensils tinned?

2. (a) Describe the principle of lime-soda process of softening of water. Give chemical reaction involved during softening of water. 5

(b) What are advantages and disadvantages of lime-soda process? 2

(c) A water sample containing the following in mg/litre :

$Ca(HCO_3)_2 = 16 \cdot 2$
$Mg(HCO_3)_2 = 14 \cdot 6$
$MgCl_2 = 9 \cdot 5$
$MgSO_4 = 1 \cdot 2$
$CaCl_2 = 2 \cdot 22$
$HCl = 3 \cdot 65$
$CO_2 = 2 \cdot 2$
$NaHCO_3 = 4 \cdot 2$

Calculate the amount of lime and soda required for softening 10 m^3 water. 7

3. (a) What is flue gas? How is analysis of flue gas done by Orsat's apparatus? 2+4

(b) What is the significance of the flue gas analysis. 2

(c) A coal sample contains following percentage composition by weight :

C = 80, H = 6, O = 8, N = 6

Find the minimum amount of oxygen and air by weight for complete combustion of 1 kg of coal. Also calculate the weight of air if 15% excess air is supplied (air contains 23% O_2 by weight). 6

4. (a) Derive Nernst equation and discuss its application. 6

(b) Calculate the e.m.f. of a concentration cell at 25 °C consisting two Ag electrode immersed in a solution of Ag^+ of 0·01 *M* and 0·001 *M* concentration. 4

(c) For a cell reaction

$$2A + 3B^{+2} = 2A^{+3} + 3B$$

at 298 K the equilibrium constant is $1 \cdot 0 \times 10^4$. Calculate E° cell. 4

5. (a) Define degree of polymerization. 3

(b) Explain the free radical polymerization mechanism. 3

(c) What is glass transition temperature? 4

(d) Write the preparation and uses of (i) neoprene and (ii) nylon-6,6. 4

6. (a) Discuss the mechanism of electrochemical corrosion. 3

(b) What are the factors that effect the rate of corrosion? 4

(c) How is corrosion prevented by cathodic protection? 3

(d) What is percentage of iron rusted ($Fe_2O_3 \cdot 2H_2O$) when its weight increased by 25%? 4

7. (a) Deduce the relationship between the boiling point elevation of a solution and mole fraction of dissolved solute. 6

(b) Explain the terms hypertonic, isotonic and hypotonic solutions. 4

(c) At 100 °C the vapour pressure of solution of 4·5 g of solute in 108 g water is 742 mm. Find the boiling point of the solution (K_b of $H_2O = 0 \cdot 52$ and water vapour pressure at 100 °C is 760 mm). 4

8. (a) Explain caustic embrittlement in boiler and how it can be prevented. 5

(b) What are the causes of boiler corrosion? How can the boiler corrotion be prevented? 5

(c) What are the causes of—

(i) scale formation;

(ii) priming and foaming? 4

9. Write short notes on : $3\frac{1}{2} \times 4 = 14$

(a) Water-line corrotion

(b) Crevices corrotion

(c) Octane number

(d) Colligative properties

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