B.Tech 1st Semester Exam., 2013

ENGINEERING CHEMISTRY

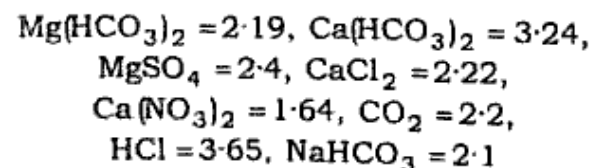Time : 3 hours   Full Marks : 70

Instructions :

(i) Marks are indicated in the right side 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* of the following :   2×7=14

    (a) A 1·2% solution of organic compound is isotonic with 1·6% of urea (NH_2CONH_2) solution. The molecular weight of organic compound is —— a.m.u.

    (b) Hardness of water containing 1·46 mg/litre magnesium bicarbonate and 1·36 mg/litre $CaSO_4$ is —— p.p.m. —— Cl.

    (c) Define Pilling and Bedworth rule.

    (d) Dacron is the polymer of ——.

    (e) What is azeotropic mixture?

    (f) Why is ethylene glycol added to water used in car radiator in cold countries?

    (g) Arrange benzene, ethylene, hexane and cyclohexane in the increasing order of their calorific values.

    (h) The absorbent of carbon monoxide in Orsat's apparatus is ——.

    (i) Define cetane number.

    (j) Why are gaseous fuels better than liquid fuel (three characters)?

2. (a) Describe the lime-soda method of softening of hard water. Give chemical reaction involved in it.   5

    (b) How is hardness of water determined by soap titration method?   4

    (c) Calculate the amount of lime and soda required for softening 250 m³ water containing following in mg/litre :   5

$$Mg(HCO_3)_2 = 2·19, \quad Ca(HCO_3)_2 = 3·24,$$
$$MgSO_4 = 2·4, \quad CaCl_2 = 2·22,$$
$$Ca(NO_3)_2 = 1·64, \quad CO_2 = 2·2,$$
$$HCl = 3·65, \quad NaHCO_3 = 2·1$$

3. (a) What is ideal solution? Explain positive and negative deviations from ideal behaviour of liquid pairs.   5

   (b) Deduce the relationship between elevation of boiling point of solution and the mole fraction of solute dissolved.   4

   (c) Two elements A and B form compounds AB_3 and AB_4 which do not dissociate or associate. When 1.0 g each AB_3 and AB_4 dissolved separately in 20 g benzene, lowers the freezing point 2.3 K and 1.3 K respectively. $(K_f$ for benzene $= 5.1$) Find atomic weight of A and B.   5

4. (a) Write the construction, working and reactions involved in a dry cell.   6

   (b) What is galvanic series? Give its importance.   3

   (c) What is the pH of the solution of cell given below if its cell potential is 0.16 volt at 25 °C? $(E^{\circ}_{M|M^{+2}} = 0.25\ V)$ 5

   $M|M^{+2}(0.1\ M)\ ||\ HCl\,(pH = ?)\,|H_2\,(1\ atm);\ Pt$

5. (a) Explain the tacticity in polymer.   3

   (b) What is vulcanisation of rubber?   3

   (c) Give the preparation and uses of the following :   8

      (i) Bakelite

      (ii) Neoprene   akubihar.com

      (iii) Nylon-6,6

      (iv) ABC polymer

6. (a) Describe Fischer-Tropsch process for manufacturing of gasoline.   5

   (b) What are the significances of proximate and ultimate analysis of coal?   3

   (c) A coal sample was found to contain following composition by weight :

      $C = 72, H = 4, O = 9, S = 5, N = 6$ and rest ash

      (i) Find gross and net calorific value of coal.

      (ii) Find minimum amount of air by weight necessary for complete combustion of 1 kg coal (air contains 23% O_2 by weight).   3+3=6

7. What are the causes, drawbacks and methods of prevention of the following?   6+4+4=14

   (a) Scale formation

   (b) Caustic embrittlement

   (c) Priming and foaming

8. *(a)* What are the laws of dry corrosion? Explain with examples. 4

(b) Write the mechanism of wet corrosion. 4

(c) Describe the various methods employed for prevention of corrosion. 6

9. Write short notes on the following : $3\frac{1}{2}\times4=14$

(a) Pitting corrosion

(b) Waterline corrosion

(c) Colligative properties

(d) Knocking

★★★