Code : 231101

B.Tech 1st Semester Exam., 2017

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 (any *seven*) : 2×7=14

(a) Temporary hardness is removed by boiling due to the reaction ____.

(b) The difference in HCV and LCV of fuel sample is equal to ____.

(c) Calorific value of a gaseous fuel is determined by ____ calorimeter.

(d) The colligative property depends on ____ in solution and not on nature of solute.

(e) In an electrochemical cell ____ energy gets converted into ____ energy.

(Turn Over)

(f) A copolymer is one which is made of more than one type of ____.

(g) Polyacetylene doped with iodine is an example of ____ polymer.

(h) According to electrochemical theory of corrosion, corrosion occurs at ____.

(i) Low temperature carbonization yields coke which is suitable for ____.

(j) In the determination of total hardness of water by EDTA method, the indicator employed is ____.

2. *(a)* Why do we add buffer solutions during titration of hard water by EDTA method? 2

(b) What is zeolite? Why zeolite softened water is unsuitable for use in boiler? 4

(c) A sample of water gives the following results on analysis :

CO_2 = 22 ppm, HCO_3^- = 365 ppm,
Ca^{2+} = 40 ppm, Mg^{2+} = 48 ppm

Calculate the amount of lime and soda that would be required to soften 10000 litres of water, if 139 ppm of $FeSO_4 \cdot 7H_2O$ is used as coagulant. 8

3. *(a)* Explain caustic embrittlement in boiler. How does it effect the boiler? How can this be prevented? 4

(b) Name the factors which are responsible for corrosion in boilers. How can this be minimised? 4

(c) Explain the function of the following in water treatment : 3+3

(i) Calgon

(ii) Bleaching powder

4. (a) What do you understand by the term low temperature carbonization? 2

(b) How is coke obtained by using Otto-Hofmann reactor? What are the advantages of using this reactor? 6

(c) Describe the indirect coal to liquid conversion process. Draw the diagram and give the reactions involved in this process. 6

5. (a) A gaseous fuel has the following composition by volume :

H_2 = 14%, CH_4 = 20%, C_2H_6 = 26%, C_2H_4 = 15%, CO = 15%, CO_2 = 5%, N_2 = 5% and O_2 = 5%

Calculate—

(i) minimum amount of air required for complete combustion of this fuel;

(ii) percentage composition of dry products of combustion, if 10% excess air is supplied. 5+5

(b) What are polymers? Classify them on the basis of their thermal behaviour. Give suitable example. 4

6. (a) Explain isotactic and syndiotactic polymers. 4

(b) Write short notes on the following : 6

(i) Polymer degradation

(ii) Glass transition temperature

(c) 42 g of propene was polymerised by radical polymerisation process and $\overline{DP}$ was found to be 1000. Calculate the number of molecules of PP produced. 4

7. (a) What do you mean by EMF of a cell? 4

(b) How is the EMF of a cell determined? 4

(c) An iron wire is immersed in a solution containing $ZnSO_4$ and $NiSO_4$. The conc. of each salt is 1 *M*.

Predict giving reasons, which of the following reactions is likely to proceed :

(i) Iron reduces Zn^{2+} ions

(ii) Iron reduces Ni^{2+} ions

Given :

$$E^{\circ}_{(Zn^{2+}/Zn)} = -0.76\,V$$

$$E^{\circ}_{(Fe^{3+}/Fe)} = -0.44\,V$$

$$E^{\circ}_{(Ni^{2+}/Ni)} = -0.25\,V$$

6

8. *(a)* Define corrosion. Why do metals corrode and what are the consequences of corrosion? 4

(b) Explain the Pilling-Bedworth rule, taking example. 4

(c) Write brief accounts of the following : 3+3

(i) Passivation

(ii) Stress corrosion

9. *(a)* Establish the relationship between osmotic pressure and lowering vapour pressure. 4

(b) Under what conditions the abnormal molecular weight values of solutes are obtained from the measurement of colligative properties? 4

(c) Calculate the osmotic pressure of a 0·5% aqueous solution of sucrose (MW = 342) at 27 °C. If the density of solution is 1·017 kg dm^{-3}, calculate the height of the column of the solution in cm which will just balance this osmotic pressure. 6