

Roll No.

Total Pages : 3

Exam. Code

6014

8076

BT-2/M-11

CHEMISTRY (2005 Onward)

Paper : CH-101(E)

Time : Three Hours]

[Maximum Marks : 100

Note : Attempt *five* questions in all, selecting at least *one* question from each unit. All questions carry equal marks.

UNIT-I

1. (a) Derive a mathematical expression for the change in free energy in an isothermal process. 6
- (b) Consider the combination of $\text{SO}_2(\text{g})$ and $\text{O}_2(\text{g})$ to produce $\text{SO}_3(\text{g})$ at 25°C . Calculate the free energy of the above reaction. Given ΔH and $\Delta S = -23490$ cal and -22.7 cal deg^{-1} respectively for the above reaction. Is the above reaction thermodynamically possible? 7
- (c) The free energy changes at 24°C and 35°C are -3.98 and -3.37 kcal respectively for the reaction.

$$\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g}).$$
 Calculate the heat of reaction at 35°C . 7
2. (a) State and explain any *five* terms frequently used in Phase rule equation. 10
- (b) Consider the phase diagram of Sulphur system. Discuss the following phase equilibria in it :
 - (i) $S_R \rightleftharpoons S_M$
 - (ii) Fusion process of $S_R \rightarrow S_M$
 - (iii) Metastable equilibria in the above system. 6

- (c) An alloy of Sn and Pb contains 73% of Sn. Find out the mass of eutectic in 1 kg of solid alloy. The eutectic contains 64% of Sn and remaining % of Pb. 4

UNIT-II

3. (a) How would you estimate the alkalinity present in the given water sample ? Mention the various types of alkalities (Free form and Combined form). Why is the combination of hydroxyl and bicarbonate alkalies not possible in alkaline water system ? 8
- (b) 9.6 mL of EDTA solution consumes exactly 10.2 mg of CaCO_3 equivalents. 100 mL of a given hard water sample consumes 17.5 mL of above EDTA solution. 250 mL of the above hard water sample was boiled completely and the boiled off sample consumed 35 mL of above EDTA solution. Calculate the temporary and permanent hardness of above hard water sample in oCl and oFr as CaCO_3 equivalents. 8
- (c) Draw the structural formulae of the titrant and indicator used in the estimation of hardness by Complexometric titration method. 4
4. (a) What are Scales and Sludges ? How are they formed ? Discuss the ill-effects of hard water used in the generation of steam. 10
- (b) How will you soften the hard water using Ion-exchange resins ? Illustrate your answer with chemical reactions involved in the softening of hard water and regeneration of exhausted resin. 10

5. (a) Differentiate between Wet and Dry corrosion. Explain sacrificial anodic protection of controlling corrosion. 10
- (b) How can the material selection and design can prevent corrosion ? What protective coatings can be used for corrosion prevention ? 10
6. (a) Point out the main difference between the Boundary and Extreme pressure lubrication. 5
- (b) Write short notes on the following :
- (i) Additives for lubricants.
 - (ii) Viscosity index.
 - (iii) Pour point.
 - (iv) Saponification value.
 - (v) Flash point. 15

UNIT-IV

7. (a) Discuss the preparation, properties and technical applications of Phenol-formaldehyde resin. 10
- (b) What are Polymers ? Distinguish the Atactic, Isotactic and syndiotactic polymers with *one* example of each. 10
8. Briefly describe any *three* of the following :
- (i) Elementary discussion on Flame photometry.
 - (ii) Differential thermal analysis.
 - (iii) Conductometric titration method.
 - (iv) Thermogravimetric analysis. 20