

Roll No.

Total Pages : 4

GSM/M-20

1621

CHEMISTRY

PHYSICAL CHEMISTRY (THEORY)

Paper–XII-CH-205

Time Allowed : 3 Hours]

[Maximum Marks : 32

Note : Attempt **five** questions in all, selecting at least **two** questions from each Unit. Question No. 1 is compulsory. All questions carry equal marks.

Compulsory Question

1. (a) What do you understand by term entropy? Give physical significance of entropy. 2
- (b) What is meant by efficiency of an engine? Explain the terms source and sink. 2
- (c) Explain why Kcl is used as electrolyte in salt bridge. 1
- (d) If T_1 is 75% of T_2 , then what is efficiency of engine. 1
- (e) Explain the following :
 - (i) Concentration cell
 - (ii) Reference electrode. 2

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UNIT-I

2. (a) Derive the formula :

$$\eta = \frac{W}{q_2} = \frac{T_2 - T_1}{T_2} . \quad 3$$

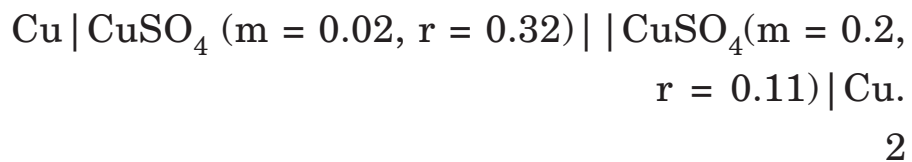
- (b) Explain the term Gibb's free energy. Drive an expression for change in free energy for a process under isothermal condition. 3
3. (a) What do you mean by "Thermodynamic scale of temperature? Explain. 3
- (b) Describe Nernst heat theorem. 2
- (c) FCIO_3 molecule can have four possible arrangements with nearly same energy. Calculate the residual entropy of FclO_3 molecule. 1
4. (a) Derive $\Delta S_{\text{mixing}} = -R \sum x_i \ln x_i$ 3
- (b) Derive $\Delta S = C_p \ln \frac{P_2}{P_1}$ 2
- (c) What is residual entropy? What is its origin. Explain. 1
5. (a) Derive Gibb's-Helmholtz equation. Give the applications of Gibb's Helmholtz equation. 3
- (b) Derive $(dG)_{P, T} \leq 0$ and explain. 2

- (c) Calculate the free energy change which occurs when 5 moles of an ideal gas expands reversibly and isothermally at 300k from the initial volume 6 litres to 60 litres. 1

UNIT-II

6. (a) Compare Galvanic cell and Electrolytic cell. 3
- (b) Predict whether zinc and silver react with in sulphuric acid to give out hydrogen gas or not. Given that the standard reduction potentials of zinc and silver are -0.76 volt and 0.80 volt respectively. 3
7. (a) Derive Nernst equation for measuring EMF of the cell. 3
- (b) Discuss the determination of solubility and solubility product of a sparingly soluble salts from EMF measurement? 3
8. (a) State the third law of thermodynamics. Give its importance. 3
- (b) Derive an expression for Electrode concentration cell without transference. 3
9. (a) What is liquid junction potential? How can be it minimised? 2

- (b) Calculate the EMF of the following concentration cell at 25°C



- (c) Write short note on the following :

(i) Electrolytic cell

(ii) Standard Hydrogen Electrode. 2