Roll No.

1621

GSM/M-20

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 :

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

- (b) Explain the term Gibb's free energy. Drive an expression for change in free energy for a process under isothermal condition.
- 3. (a) What do you mean by "Thermodynamic scale of temperature? Explain. 3
 - (b) Describe Nernest heat theorem. 2
 - (c) $FClO_3$ molecule can have four possible arrangements with nearly same energy. Calculate the residual entropy of $FclO_3$ molecule. 1

4. (a) Derive
$$\Delta S_{\text{mixing}} = -R\Sigma x_i \ln x_i$$
 3

(b) Derive
$$\Delta S = Cp \ln \frac{P_2}{P_1}$$
 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
$$(dG)_{P, T} \leq O$$
 and explain. 2

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(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.

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.
- 9. (a) What is liquid junction potential? How can be it minimised? 2

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(b) Calculate the EMF of the following concentration cell at $25^{\circ}C$

- (c) Write short note on the following :
 - (i) Electrolytic cell
 - (ii) Standard Hydrogen Electrode. 2