



K.R. MANGALAM UNIVERSITY
THE COMPLETE WORLD OF EDUCATION

Roll no.....

End Semester Examination, December 2024
B.Sc. Chemistry (Honors/Honors with Research) – IIIrd Semester
Physical Chemistry-II (SCCH201)

Time: 2.5 hrs.

Max Marks: 50

Note: *All Questions are compulsory. Marks are indicated against each question.*

PART-A

Q.1 *First question will consist of 7 small questions covering entire syllabus out of which student has to attempt 5 questions and understanding level will be assessed.*

- (a) Explain the applications of Raoult's Law. [CO-1] [L-] 2
- (b) State and explain the Zeroth law of thermodynamics. [CO-1] [L-] 2
- (c) Differentiate between the State function and the Path function with suitable examples. [CO-1] [L-] 2
- (d) Distinguish between intensive and extensive variables in thermodynamics. [CO-1] [L-] 2
- (e) Define entropy and explain its significance in the second law of thermodynamics. [CO-1] [L-] 2
- (f) How is bond energy different from bond dissociation energy? Provide a brief explanation. [CO-1] [L-] 2
- (g) Define residual entropy and give an example of where it occurs. [CO-1] [L-] 2

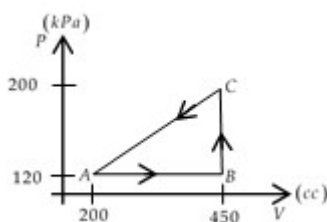
2x5

PART-B

There will be five questions each covering one specific Course Outcome from the complete syllabus. There shall be an internal choice in each of the questions covering the same (set) of COs and BL. Questions carrying 10 marks can be further sub divided as per the paper setter choice.

- Q.2 (i) Derive the Gibbs-Helmholtz equation
(ii) Calculate the work done by the gas in the state diagram shown

[CO-2] [L-] 10

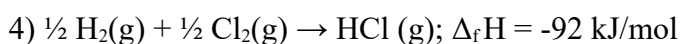
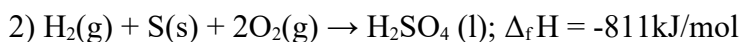
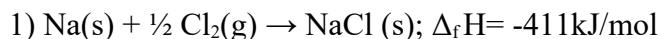


OR

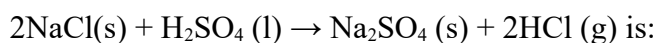
- (i) Derive an expression for the Joule-Thomson coefficient for Vander Waal gas.

- (ii) The bond energy of F_2 and Cl_2 are 36.6 and 580 kcal mol⁻¹ respectively. Heat liberated in the reaction $F_2 + Cl_2 \rightarrow 2FCl$ is 26.6 kcal. Find the bond energy of F-Cl bond.
[CO-2] [L-] 10

Q.3 (i) The enthalpy changes of the following reactions at 27°C are [CO-4] [L-4] 5



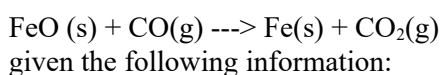
From the above data, the heat change of reaction at constant volume (in kJ/mol) at 27°C for the process



- (ii) Discuss the effect of temperature, pressure, and volume on enthalpy of reactions and Derive Kirchhoff's equation. [CO-3] [L-] 10

OR

- (i) What is the standard enthalpy of reaction for the reduction of iron (II) oxide by carbon monoxide?



- (ii) Derive the Gibbs-Duhem equation and explain its importance in understanding the relationship between chemical potential and composition in a mixture. [CO-3] [L-] 10

Q.4 Describe the process of calculating the absolute entropy of a molecule from statistical thermodynamics. Outline the key steps involved. [CO-4] [L-] 10

OR

- (i) One mole of an ideal gas expands isothermally and reversibly from 1 litre to 100 liters at 27°C. Calculate W, q, ΔE , ΔH and ΔS .
(ii) 1 mole of steam is condensed at 100 °C and water is cooled to 0°C and frozen to ice. Calculate the entropy change for the process. Latent heat of fusion and evaporation of ice and water are 80 and 540 cal/g respectively.

[CO- 4] [L-] 10

Q.5 What are Maxwell's relations? Derive any two Maxwell Equations?

[CO-5] [L-] **10**

OR

Write a short note on the following:

- (i) Osmotic Pressure
- (ii) relative lowering of vapor pressure

[CO- 5] [L-] **10**