Enrollment No: _____ Exam Seat No: _____

C.U. SHAH UNIVERSITY
Winter Examination-2021

Subject Name: Thermal Physics and Statistical Mechanics

Subject Code: 4SC03TPS1   **Branch: B.Sc. (Chemistry, Mathematics)**

Semester: 3   **Date: 17/12/2021**   **Time: 02:30 To 05:30**   **Marks: 70**

Instructions:
(1) Use of Programmable calculator & any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

Q-1   **Attempt the following questions:**   **(14)**

a) State the Second Law of Thermodynamics.   01
b) Give the expression for heat absorbed by a system (ΔQ) in an isothermal process.   01
c) What is a phase space?   01
d) Name the thermodynamic potentials.   01
e) State the Equipartition theorem.   01
f) What is a Carnot cycle?   01
g) Define compressibility.   01
h) Give the statement of Zeroth law of thermodynamics.   01
i) Mention the statistics followed by Bosons.   01
j) Express the Clausius-Clayperon equation.   01
k) What do you understand by a microscopic state?   01
l) What does the Nernst theorem highlight?   01
m) What is an isothermal process?   01
n) Which particles come under the classification of "fermions"?   01

Attempt any four questions from Q-2 to Q-8

Q-2   **Attempt all questions**   **(14)**
a) Derive the four Maxwell's relations using thermodynamic potentials.   07
b) Derive the expression for Bose-Einstein's distribution law.   07

Q-3   **Attempt all questions.**
                                                                                           (14)
a) Considering a system of ideal gas having n molecules, derive the Maxwell-Boltzmann   07
distribution law for the same.
b) Explain the application of First law of thermodynamics.   04
c) Concisely explain the Third law of thermodynamics. Which parameter does it mention? 03

Q-4   **Attempt all questions**   **(14)**
a) Taking the help of a PV diagram explain the Carnot's theorem.   07

	b)	Derive the expression connecting C_p and C_v.	04
	c)	Differentiate the terms "Microstate" and "Macrostate" of a thermodynamic system, based on their definition.	03

Q-5   **Attempt all questions**   **(14)**

a)	Explain in detail the transport phenomena for kinetic theory of gases.	07
b)	Elaborate on the TdS equation.	04
c)	While stating the First law of thermodynamics, explain each of its terms.	03

Q-6   **Attempt all questions**   **(14)**

a)	Explain the temperature- entropy diagram of a Carnot's cycle.	05
b)	Write a note discussing in detail the concept of phase space.	05
c)	Mentioning the Clausius-Clapeyron's first latent heat equation, discuss the effect of pressure on the boiling point of a liquid.	04

Q-7   **Attempt all questions**   **(14)**

a)	Point out the differences among Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics.	07
b)	Derive an expression for the work-done during an isothermal process.	04
c)	Briefly explain the law of Equipartition of energy.	03

Q-8   **Attempt all questions**   **(14)**

a)	Derive the expression for Maxwell's velocity distribution law, stating the necessary assumptions.	07
b)	Write a short note on reversible and irreversible processes.	04
c)	In a concise manner, explain the term "mean free path" of a gas molecule.	03