

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034**B.Sc. DEGREE EXAMINATION – PHYSICS****FIFTH SEMESTER – NOVEMBER 2023****UPH 5502 – THERMAL PHYSICS**

Date: 03-11-2023

Dept. No.

Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

SECTION A - K1 (CO1)**Answer ALL the Questions****(10 x 1 = 10)****1. Answer the following**

- a) Define absolute zero temperature.
 b) State zeroth law of thermodynamics.
 c) Define enthalpy.
 d) Define entropy.

e) What is mnemonic diagram?

2. Fill in the blanks

- a) The MB distribution concerns the distribution of an amount of energy between identical but _____ particles.
 b) _____ is the average distance traversed by a molecule between two successive collisions.
 c) The physical quantity that relates with first law of thermodynamics is _____
 d) Net energy of a system in Carnot's cycle is _____
 e) For a thermodynamic system to be in equilibrium all intensive and extensive thermodynamic properties must be _____

SECTION A - K2 (CO1)**Answer ALL the Questions
10)****(10 x 1 =****3. True or False**

- a) The molecules of an ideal gas have only kinetic energy.
 b) The processes which produce permanent change in the thermodynamic state and cannot be retraced are reversible.
 c) Internal energy of a real gas depends only on the temperature of gas.
 d) Entropy remains constant in isothermal process.
 e) The derivative of Gibb's function with respect to the temperature and pressure is continuous at transition point.

4. Match the following

- a) Degrees of freedom - $\Delta G = \Delta H - T\Delta S$
 b) Mayer's relation - $T_2 * Q_1/T_1$
 c) Efficiency - $\frac{1}{2} KT$
 d) Entropy (unavailable energy) - $-(1-T_2/T_1)$
 e) Change in free energy - $C_p - C_v$

SECTION B - K3 (CO2)**Answer any TWO of the following****(2 x 10 = 20)**

5. Define average speed, root mean square speed and obtain an expression for them using Maxwell's distribution law.
 6. Derive an expression for mean free path using first order approximation.
 7. Deduce an expression for the adiabatic process and derive Mayer's relation for the specific heat

	capacity of a gas from the first law of thermodynamics.
8.	Obtain an expression for the change in entropy in a reversible and irreversible process.
SECTION C – K4 (CO3)	
Answer any TWO of the following (2 x 10 = 20)	
9.	Show that the pressure exerted by an ideal gas is two-thirds its kinetic energy per unit volume.
10.	a) Explain the concept of temperature and write down the zeroth law of thermodynamics (5 mark) b) What is an equation of state? Give its limitations. (5 mark)
11.	What is internal energy of a system? Explain the different forms of internal energy and show that the internal energy of a system is a function of state of the system.
12.	Obtain Clausius inequality.
SECTION D – K5 (CO4)	
Answer any ONE of the following (1 x 20 = 20)	
13.	Derive expression for Maxwell distribution of the velocities.
14.	a) Discuss and derive Vander Waals equation of state (10 mark) b) What are thermodynamic systems, thermodynamic variables and thermodynamic processes? (10 mark)
SECTION E – K6 (CO5)	
Answer any ONE of the following (1 x 20 = 20)	
15.	a) Describe the Carnot's forward and reverse cycles and derive an expression for the efficiency of the Carnot's engine(15 mark) b) Give Kelvin-Planck statement of second law of thermodynamics(5 mark)
16.	Derive Maxwell's thermodynamic equations connecting the thermodynamic quantities.
