LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **PHYSICS**

FIFTH SEMESTER – **NOVEMBER 2024**

UPH 5502 – THERMAL PHYSICS

Date: 11-11-2024 Dept. No. Max. : 100 Marks

Time: 09:00 am-12:00 pm

	SECTION A - K1 (CO1)	
	Answer ALL the Questions	**(10 x 1 = 10)**
1.	**Fill in the blanks**	
a)	The average energy of a molecule obeying Maxwell's law is _____	
b)	The _____ quantities that determine the properties of the state of the system are called thermodynamic variables.	
c)	The efficiency of reversible Carnot engine is _____	
d)	The dependence of magnetic properties with temperature is known as _____ effect.	
e)	The Clausius–Clapeyron equation governing the temperature variation of pressure for first order phase transition is_____	
2.	**MCQ**	
a)	The law of equipartition of energy states that thermal energy is equally divided amongst various active degrees of freedom of a molecule and its magnitude is a) $3K_b T/2$ b)$K_b T/2$ c) $2K_b T/3$ d) $K_b T/4$	
b)	A pressure cooker is an example of which of the following? (a) Open System (b) Closed System (c) Isolated System (d) None of the mentioned	
c)	The first law of thermodynamics deals with (a) conservation of heat (b) conservation of momentum (c) conservation of mass (d) conservation of energy	
d)	The entropy of an isolated system a) decreases b) increases c) constant d) none of the above	
e)	When the system is in equilibrium with the surroundings, it must be in (a) pressure equilibrium (b) temperature equilibrium (c) chemical equilibrium (d) all of the mentioned	

	SECTION A - K2 (CO1)
	Answer ALL the Questions **(10 x 1 = 10)**
3.	**Match the following**
a)	1 kilomole - – SdT + Vdp
b)	Survival equation (N) - exchanging matter with a system
c)	Diffusive interaction - $\oint \delta Q/T \leq 0$
d)	Clausius inequality - 6.03 X10 ^ 26
e)	dG - $N_0 \exp(-x/\lambda)$
4.	**True or False**
a)	Temperature is inversely proportional to average (kinetic) energy of molecules.
b)	A system is said to be in thermodynamic equilibrium if its state does not change in anyway with time.
c)	All reversible engines operating between the different temperature limits have the same efficiency.
d)	In P – T diagram where all three phases co-exist is known as triple point.
e)	During an isothermal process, entropy may change but temperature remains constant. So one of the conditions of equilibrium obviously is dT = 0.
	SECTION B - K3 (CO2)
Answer any TWO of the following in 100 words each.	**(2 x 10 = 20)**
5.	Discuss in detail the kinetic interpretation of temperature.
6.	Derive the Van der Waal's equation of state for a real gas and obtain the constants.
7.	Explain the first law of thermodynamics and mention its limitations.
8.	Explain thermodynamical mnemonic diagrams with proper illustrations
	SECTION C – K4 (CO3)
Answer any TWO of the following in 100 words each.	**(2 x 10 = 20)**
9.	Define average speed, root mean square speed and obtain an expression using Maxwell's distribution law.
10.	State and explain Zeroth law of thermodynamics and hence give an interpretation for the concept of temperature.
11.	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.
12.	Obtain an expression for the change in entropy in a reversible and irreversible process.
	SECTION D – K5 (CO4)
Answer any ONE of the following in 250 words	**(1 x 20 = 20)**
13.	Derive all the Maxwell's thermodynamic relations.
14.	Describe Carnot's cycle with neat diagram and derive an expression for the efficiency of an ideal heat engine.
	SECTION E – K6 (CO5)
Answer any ONE of the following in 250 words	**(1 x 20 = 20)**
15.	Describe how the state of a system is defined by thermodynamic variables.
16.	Derive all the three TdS equations. Give the importance of the TdS equations.

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