SEAT NO._____ No. of Printed Pages:2

[108]

SARDAR PATEL UNIVERSITY

5th Semester B. Sc. (under CBCS) Examination-2020

Monday, 28th December 2020

02.00 pm to 04.00 pm

Subject : PHYSICS (US05CPHY23)

(Thermodynamics And Statistical Mechanics)

Total MARKS : 70

N.B.: (i) All the symbols have their usual meanings.
(ii) Figures at the right side of questions indicate full marks.

Q.1 **To answer the multiple choice questions choose the correct option** [10]

(1) At absolute zero temperature, the entropy of a system _____
(a) increases (b) remains zero (c) remains constant (d) decreases

(2) The area under the curve $\int TdS$ is equal to the
(a) work done (b) heat transferred (c) internal energy change (d) none of the these

(3) A reversible cycle has following processes.
(a) 4 isothermal (b) 4 adiabatic (c) 2 isothermal and 2 adiabatic (d) none of the above

(4) Integral of dQ/T of a reversible path is given by
(a) $S_i - S_f$ (b) $S_f - S_i$ (c) $S_i + S_f$ (d) $-S_i - S_f$

(5) Helmholtz function is given by
(a) $H = U + W$ (b) $G = h - TS$ (c) $h = U + PV$ (d) $A = U - TS$

(6) An adiabatic process occurs at Constant _____
(a) Volume (b) Pressure (c) heat (d) Temperature

(7) Which of the following physical parameters remain constant in a system of micro-canonical ensemble?
(a) [E, T, μ] (b) [N, E, T] (c) [N, V, E] (d) [E, V, μ]

(8) The Stirling formula is ln N ! = _____
(a) $\ln\left(\frac{N}{e}\right)$ (b) N ln n (c) N ln N (d) N ln N – N

(9) Maxwell-Boltzmann law is for the _____
(a)) Distinguishable Particles (b) Indistinguishable Particles
(c) Particles with half integral spin (d) Particles with integral spin

(10) The Spin quantum number(s) of the _____ is zero
(a) Photon (b) Positron (c) α - Particle (d) π - meson

Q.2 **Fill in the Blanks and True-False**
State whether True or False [08]

(1) All Carnot engines operating between the same two reservoirs have different efficiency.

(2) During a reversible adiabatic process, the entropy of a system remains constant.

(3) The triple point on a U-V-S surface is a plane triangle.

(4) For a reversible, isothermal, isobaric process the Gibbs function of the system not remains constant.

(P.T.O.)

Fill in the Blanks

(5) Phase space is a _____ dimensional space.

(6) The three physical parameters [N, V, T] remains constant in _____ ensemble

(7) In M–B System, the mean separation between the particles is _____ than the thermal length.

(8) Maxwell-Boltzmann statistics cannot be applied to _____ particle.

Q.3 **Answer briefly the following questions (Attempt any Ten)** [20]

(1) Define Refrigerator and Refrigerant.

(2) Define Absolute zero.

(3) Write two Ehrenfest's equations.

(4) Show that for isotropic solid compressibility $k = 3\delta$.

(5) Derive Energy equation $\left(\frac{\partial U}{\partial V}\right)_T = T\left(\frac{\partial P}{\partial T}\right)_V - P$.

(6) Give the difference between enthalpy and internal energy

(7) Write additive property of entropy.

(8) Define: Phase Space and Phase point.

(9) Define: Macroscopic States and Microscopic states

(10) Obtain expression for entropy in the Maxwell – Boltzmann System

(11) Define Degeneracy and Chemical Potential.

(12) Explain Grand Canonical Ensemble.

Q.4 **Answer in detail of the following questions (Attempt any 4)** [32]

(1) Obtaining Clausius' theorem derive the equation of second law of thermodynamics.

(2) Derive Clausius Clapeyron's latent heat equation

(3) Define entropy and obtain first and second T – dS equations

(4) Explain Expansivity with proper diagram and figure.

(5) State Liouville's theorem and prove that $\frac{d\rho}{dt} = 0$ using proper diagram

(6) What is Gibbs Paradox in microcanonical ensemble? How it is removed

(7) Define Bose- Einstein system Obtain the expression for Bose – Einstein distribution of the particles among various states

(8) Define Fermi – Dirac system obtain the expression for Fermi – Dirac distribution of the particles among various states

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