

(26)

No. of Printed Pages: 2.

SARDAR PATEL UNIVERSITY

Fifth Semester B. Sc. Examination Under CBCS

Wednesday, 20th Nov.-2013

Time: From 10:30 am to 1:30 pm

Subject: PHYSICS [US05CPHY04]

Thermodynamics and Statistical Physics

Total Marks [70]

INSTRUCTION: (1) Attempt all questions (2) The symbols have their usual meaning (3) Figure to the right indicates full marks

Q-1

Choose correct option to answer the question

[10]

- 1 At absolute zero temperature entropy of the system _____.
(a) increases (b) is constant (c) is zero (d) decreases
- 2 If a system undergoes from first state to second state with a constant heat then the process is called _____.
(a) An isochoric (b) an isobaric (c) an isothermal (d) an adiabatic
- 3 Which of the following expression represent second law of thermodynamics
(a) $\delta Q = T ds$ (b) $ds = PV$ (c) $T = dS.PdV$ (d) $S = PV$
- 4 A measure of the disorder of the system is called _____.
(a) entropy (b) an enthalpy (c) heat (d) work-done
- 5 Gibbs paradox in a statistical mechanics is related to additive property of _____.
(a) energy (b) entropy (c) position (d) momentum
- 6 Which of the following parameters remains constant in canonical ensemble
(a) $[V, E, T]$ (b) $[N, V, T]$ (c) $[\mu, V, T]$ (d) $[\mu, N, E]$
- 7 The mean square fluctuation of energy in canonical ensemble is _____.
(a) $\beta^2 C_p$ (b) $\beta^2 C_v$ (c) $K T^2 C_v$ (d) $K T^2 C_p$
- 8 The spin quantum number S of the _____ is $\frac{1}{2}$.
(a) μ -meson (b) π -meson (c) photon (d) alpha particle
- 9 In BOSE EINSTEIN system the mean separation between the particle is smaller than the _____.
(a) Thermal length (b) wavelength
(c) De-Broglie length (d) Debye length
- 10 In which of the following system $\lambda < d$.
(a) M-B system (b) B-E system (c) F-D system (d) None of these

Q-2

Attempt any ten questions

[20]

- 1 Write first law of thermodynamics.
- 2 Define enthalpy and prove that enthalpy remains constant in an isobaric adiabatic process.
- 3 Explain Nernst heat theorem in brief.

PTO

- 4 Derive expression for temperature in case of a Micro canonical ensemble.
- 5 Define : Phase space and Phase path
- 6 State Liouville's theorem.
- 7 Prove that $V_{mp} = \sqrt{\frac{2KT}{m}}$
- 8 What is chemical potential?
- 9 Obtain expression for Helmholtz free energy F and internal energy U in case of canonical ensemble.
- 10 Define M-B system in brief.
- 11 Define ideal M-B gas and obtain energy distribution function for it.
- 12 Derive expression for entropy of the gas in a case of B- E distribution.
- Q-3 (a) Derive Maxwell's thermo dynamical relations using alternative method. [05]
- (b) What is entropy? Obtain first and second T.dS equations [05]
- OR
- Q-3 (a) Define first order phase transition and obtain Clausius clapeyron latent heat equation. [05]
- (b) Prove that change in Helmholtz free energy (F) during an infinitesimal process. [05]
- Q-4 (a) Define Micro canonical ensemble and obtain Gibb's Micro canonical distribution function. [05]
- [b] Obtain Sackur- Tetrode formula for a perfect gas. [05]
- OR
- Q-4 [a] What is Gibbs paradox in Micro Canonical ensemble? How it is remove.. [06]
- [b] Write note on fluctuation in a physical quantity. [04]
- Q-5 [a] Calculate thermo dynamic quantities of a system in grand canonical ensemble in quantum mechanical picture. [06]
- [b] Write equivalence of micro canonical and canonical ensemble. [04]
- OR
- Q-5 [a] Discuss Maxwell- Boltzmann distribution for absolute velocity. [06]
- [b] Explain partition function for grand canonical ensemble in quantum and classical statistics [04]
- Q-6 Define Fermi-Dirac constant. Obtain expression for the F-D distribution of the particles among various states. [10]
- OR
- Q-6 What is Bose -Einstein system? Discuss the Bose -Einstein distribution of the particles among various states . [10]