



## Q.1. Multiple choice questions.

[10]

- 1) Conservation of Energy is represented by .....of thermodynamics.  
[a] first [b] second [c] zeroth [d] third
- 2) Refrigerator works on..... law of thermodynamics.  
[a] zeroth [b] first [c] second [d] third
- 3) In which of the following process temperature remains constant.  
[a] an isochoric [b] an adiabatic [c] an isobaric [d] an isothermal
- 4) Helmholtz free energy is given by.....  
[a]  $H = U + PV$  [b]  $F = U + TS$  [c]  $F = U - TS$  [d]  $H = U - PV$
- 5) There is no heat change during..... process.  
[a] adiabatic [b] isobaric [c] isochoric [d] isentropic
- 6) Gibbs paradox in statistical mechanics is related to additive properties of .....  
[a] energy [b] momentum [c] position [d] none of these
- 7) The Nernst's Heat theorem is called.....  
[a] Third law of thermodynamics [b] first law of thermodynamics  
[c] second law of thermodynamics [d] none of above
- 8) Which of the following physics parameters remains constant in a canonical ensemble.....  
[a]  $[T, V, \mu]$  [b]  $[N, V, E]$  [c]  $[T, V, N]$  [d] None of these
- 9) When constituent particle of gas.....with one another, it terms as an ideal gas.  
[a] interact [b] do not interact [c] highly interact [d] none of above
- 10) In F-D statistics, the particles are.....  
[a] distinguishable [b] indistinguishable [c] non identical [d] None of these

## Q.2. Answer the following questions in short: (Attempt any ten)

[20]

- 1) Explain the first order phase transition
- 2) What is absolute zero temperature?
- 3) Explain expansivity in short.
- 4) Write down the working principle of refrigerator.
- 5) Write down two T-dS equations.
- 6) Explain Nernst's theorem in brief.
- 7) Explain canonical ensemble in short.
- 8) Explain grand canonical ensemble in short.
- 9) What is chemical potential?
- 10) Define fermi Dirac system.
- 11) State Pauli's exclusion principle.
- 12) Give two difference between microcanonical ensemble and canonical ensemble.

C.P.T.O.O



**Q.3.**

- [a] Explain the working of Refrigerator. [4]  
[b] Explain the second order phase transition and derive Ehrenfest's equation. [6]

**OR**

- [a] Explain first order phase transition and derive Clapeyron's equation. [6]  
[b] Explain in detail the T-S diagram of pure substance. [4]

**Q.4.**

- [a] State and prove the Liouville theorem. [4]  
[b] What is Gibbs paradox in micro canonical ensemble? How it is removed? [6]

**OR**

- [a] Define entropy. Obtain expression for entropy of a perfect gas in a micro canonical ensemble [6]  
[b] Derive Sackur-Tetrode formula for a perfect gas. [4]

**Q.5**

- [a] Define most probable velocity and derive its expression. [6]  
[b] Write a note on canonical partition function. [4]

**OR**

- [a] Explain in brief Equivalence of Microcanonical and Canonical ensembles. [6]  
[b] Derive formula for thermodynamic quantities for an ideal gas in a grand canonical ensemble. [4]

**Q.6**

- [a] Define Bose-Einstein system and obtain the expression for B-E distribution of the particles among various states. [10]

**OR**

- [a] Define Maxwell Boltzmann system and obtain expression for the M-B distribution of the particles among various states. [10]

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