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SARDAR PATEL UNIVERSITY

T.Y.B.Sc. Fifth Semester(CBSC)] Examination 2021-22 No. of Printed Pages: 2

SEAT No. \_\_\_\_\_

25-11-2021, Thursday [NOVEMBER- Regular]

Session: Evening [ Time: 03 : 00 pm to 05: 00 pm ]

Subject Code: US05CPHY23

Subject Title: Thermodynamics and Statistical Mechanics



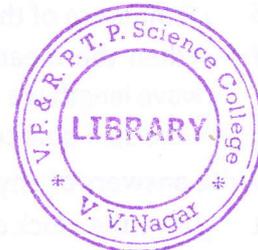
Max Marks: 70

Write correct answer for each of the following MCQs.

Q: 1

[10]

- If disorder of the system increases, the entropy of the system \_\_\_\_\_.
  - becomes zero
  - decreases
  - remains constant
  - Increases
- In which of the following process pressure remains constant.
  - An isochoric
  - An adiabatic
  - An isobaric
  - An isothermal
- Gibbs function  $G$  is given by \_\_\_\_\_.
  - $U + PV$
  - $H - TS$
  - $U - PV$
  - $H + TS$
- Which of the following physical parameters remains constant in a system of micro canonical ensemble?
  - $[E, N, V]$
  - $[E, V, \mu]$
  - $[T, V, N]$
  - $[T, V, N]$
- A reversible cycle has following processes.
  - 4 isothermal
  - 2 isothermal and 2 adiabatic
  - 4 adiabatic
  - 4 isobaric
- Gibbs paradox in statistical mechanics related to \_\_\_\_\_.
  - Additive property of entropy
  - Additive property of momentum
  - Additive property of energy
  - Additive property of temperature
- In which of the following ensemble energy exchange between system and reservoir
  - Canonical ensemble
  - Grand Canonical ensemble
  - Micro Canonical ensemble
  - Gibbs Canonical ensemble
- The Stirling formula  $N! =$  \_\_\_\_\_.
  - $N \ln n$
  - $N \ln N - N$
  - $N \ln N$
  - $N \ln n - N$
- In Maxwell – Boltzmann system, the mean separation between the particles is \_\_\_\_ than the thermal length.
  - equal
  - greater
  - smaller
  - None of above
- The spin quantum number  $S$  each of the alpha particles and deuteron is \_\_\_\_\_.
  - 1
  - 0
  - 0.5
  - 4



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(P.T.O.)

**Q-2 Do as Directed (fill in the blanks and True or False)**

(08)

- 1 First law of thermodynamics which gives the law of conservation of energy. (TRUE/FALSE)
- 2 In First order phase transition both volume and entropy not change. (TRUE/FALSE)
- 3 The triple point on a U-V-S surface is a plane triangle. (TRUE/FALSE)
- 4 In a reversible an isothermal process Volume remains constant. (TRUE/FALSE)
- 5 The canonical ensemble is also called a \_\_\_ system.
- 6 A measure of the disorder of the system is called \_\_\_\_.
- 7 When the mean distance between the particles is larger than the de Broglie wave length we apply \_\_\_\_\_ distribution.
- 8 The spin quantum number of electron is \_\_\_\_.

**Q-3 Write answers of any ten questions in brief**

(20)

- 1 Draw the block diagram for a heat Engine and a Refrigerator.
- 2 Define isentropic process.
- 3 .Define Absolute zero.
- 4 Obtain first TdS equation.
- 5 Write important application of the joule – Kelvin effect.
- 6 Define throttling process.
- 7 Define Phase space and Phase path.
- 8 Derive Sckur- Tetorde formula.
- 9 Define and discuss in brief about Canonical Ensemble.
- 10 Define Grand Canonical Ensemble.
- 11 Define F- D system with proper example.
- 12 Define most probable energy  $E_p$  and velocity  $V_p$  ?



**Q-4 Answer the following questions (Attempt any 4 out of 8)**

(32)

- 1 Using work diagram Obtaining Clausiu's theorem derives the equation of second law of thermodynamics.
- 2 With the help of the Carnot cycle of an ideal gas prove that ideal gas temperature and Kelvin temperatures are equal.
- 3 Using alternative method obtain Maxwell's four thermo dynamical equations.
- 4 Write a note on Joule- Kelvin effect with the help of porous -plug.
- 5 Explain entropy of a perfect gas in a Micro Canonical ensemble.
- 6 Define Canonical ensemble. Obtain Canonical distribution equation for close system in terms of classical and quantum statics.
- 7 Define Bose - Einstein system. Obtain expression for the B-E distribution of the particles among various states.
- 8 Write Maxwell –Boltzmann velocity distribution law. Using this law show that for an ideal gas  $V_p < V_{av} < V_{rms}$ .

