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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

Q: 1 **Write correct answer for each of the following MCQs.** [10]

1 If disorder of the system increases, the entropy of the system _____.
   a) becomes zero
   b) decreases
   c) remains constant
   d) Increases

2 In which of the following process pressure remains constant.
   a) An isochoric
   b) An adiabatic
   c) An isobaric
   d) An isothermal

3 Gibbs function G is given by___.
   a) U + PV
   b) H - TS
   c) U - PV
   d) H + TS

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

5 A reversible cycle has following processes.
   a) 4isothermal
   b) 2 isothermal and 2 adiabatic
   c) 4aidiabatic
   d) 4 isobaric

6 Gibbs paradox in statistical mechanics related to _____.
   a) Additive property of entropy
   b) Additive property of momentum
   c) Additive property of energy
   d) Additive property of temperature

7 In which of the following ensemble energy exchange between system and reservoir
   a) Canonical ensemble
   b) Grand Canonical ensemble
   c) Micro Canonical ensemble
   d) Gibbs Canonical ensemble

8 The Stirling formula N! = ____
   a) N ln n
   b) N ln N - N
   c) N ln N
   d) N ln n - N

9 In Maxwell – Boltzmann system, the mean separation between the particles is ____ than the thermal length.
   a) equal
   b) greater
   c) smaller
   d) None of above

10 The spin quantum number S each of the alpha particles and deuteron is ____ .
   a) 1
   b) 0
   c) 0.5
   (d) 4

(P.T.O.

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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 $V_p < V_{av} < V_{rms}$.