[81]

Seat No._____ No. of Printed Pages : 2

SARDAR PATEL UNIVERSITY

5th Semester B. Sc. (Under CBCS) Examination-2019

Monday, 18th November-2019

Time: 10:00 am to 01:00 pm

Subject: PHYSICS [US05CPHY04]

[Thermodynamics and Statistical Physics]

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 Multiple Choice Questions. [10]

(1) If the disorder of the system decreases, than the entropy of the system _____.
(a) increases (b) constant (c) zero (d) decreases

(2) An adiabatic process occurs at constant _____.
(a)pressure (b) energy (c) temperature (d) volume

(3) Helmholtz free energy is given by ---------
(a) H = U + PV (b) F = U-TS (c) F = U + TS (d) H = U - PV

(4) 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

(5) The stirling formula is lnN! = ____.
(a) $N \cdot \ln N - N$ (b) $N \cdot \ln(\frac{e}{N})$ (c) $N \cdot \ln n$ (d) $e \cdot \ln(N)$

(6) The mean kinetic energy of particle per degree of freedom is____.
(a) KT (b) $\frac{KT}{2}$ (c) $\frac{3KT}{2}$ (d) None of above

(7) In classical statistics the expression for canonical partition function is a dimensional quantity by dividing which factor it is made dimensionless quantity.
(a) h^{2N} (b) h^{4N} (c) h^{3N} (d) h^{N}

(8) 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

(9) In Fermi-Dirac system the mean separation between the particles is ___ than the thermal length.
(a)smaller (b) more (c)same (d) None of above

(10) In _____ system, the particles obey the Pauli's exclusion principle.
(a) F- D (b) B- E (c) M- B (d) Gibbs

Q-2 Answer the following questions in short : (Attempt Any Ten) [20]

(1) State second law of thermodynamics.

(2) Prove that internal energy (U) remains constant during an I isochoric adiabatic process.

(3) Define entropy and state zeroth law of thermodynamics.

(4) Explain postulate of equal a priori probability.

(5) Define : μ - space and gamma space

(6) Discuss in brief Micro canonical ensemble.

(7) Explain Grand Canonical Ensemble.

(8) Define Degeneracy and Chemical potential.

(9) Write the expression for canonical partition function in classical and quantum statistics.

(10) Explain in brief M - B energy distribution law for an ideal gas.

(11) Derive expression for entropy in the B- E distribution.

(12) Prove that average velocity $\overline{V} = 1.596\sqrt{\frac{KT}{m}}$.

Q-3 (a) Derive Clausius Clapeyron's latent heat equation for first order phase changes. [06]

(b) What is thermodynamic potential? Explain in brief any two thermodynamic potentials. [04]

OR

Q-3 (a) Write the general expression for Maxwell's thermo dynamical equation, and Obtain Maxwell's six thermodynamic relation. [06]

(b) Obtain first and second T.dS equations. [04]

Q-4 (a) What is Gibbs paradox in micro canonical ensemble? How it is remove. [06]

(b) Show that in a steady state probability density is independent of the co-Ordinates of the phase space.. [04]

OR

Q-4 (a) Define entropy. Obtain expression for entropy of a perfect gas in a micro canonical ensemble. [06]

(b) Derive Sackur –Tetrode formula for a perfect gas. [04]

Q-5 (a) Define canonical ensemble .Discuss Gibbs Canonical distribution equation for a close system in a classical and quantum statistics. [05]

(b) Explain in brief Equivalence of Micro canonical and Canonical ensembles. [05]

OR

Q-5 (a) Derive formula for thermo dynamical quantities for an ideal gas in a Grand Canonical ensemble. [05]

(b) Define most probable velocity. Obtain $V_{mp} = \sqrt{\frac{2KT}{m}}$. [05]

Q-6 (a) Define Bose – Einstein system and obtain expression for B-E distribution of the particles among various states. [10]

OR

Q-6 (a) Define Maxwell-Boltzmann system and obtain expression for M-B distribution of the particles among various states. [10]

—X—