V.P. & R.P.T.P. Science College V. Vidhyanagar

T Y B Sc (Sem.V)   USO5CPHY04   Total Marks 50

Thermodynamics and Statistical Physics

Date: 05/10/2018   Friday   Time: 10.00 am to 12.00 pm

**Q:1   Multiple choice questions:**   [8]

(i) Gibbs function is given by
(a) H=U+W   (b) G=h-TS
(c) h=U+PV   (d) F= U-TS

(ii) In first order phase transition process
(a) No change in heat but change in entropy and volume
(b) change in heat, entropy and volume
(c) change in heat but no change in entropy and volume
(d) No change in heat, entropy and volume

(iii) For a system of a large number of identical particle, the concept of ensemble average was introduced by
(a) Planck   (b) Kelvin
(c) Helmholtz   (d) Gibbs

(iv) The Sterling formula is ln N!=
(a) $N\ln\left(\frac{e}{N}\right)$ (b) $N\ln N-N$

(c) $N\ln n$ (d) $e\ln\left(\frac{N}{e}\right)$

(v) Which of three physical parameters remain constant in the system of interest in canonical ensemble?
(a) N,V,T   (b) E,P S,µ
(c) N,P,S   (d) none of above

(vi) In quantum statistics, the canonical partition function is ….
(a) $Z_n=\sum_n exp(-E_n/KT)$ (b) $Z_n=\int exp(-E(q,p)/KT)\, dqdp$
(c) $\rho(q,p)=D exp(-E(q,p)/KT)$ (d) none of above

(vii) In Bose-Einstein system constituent particle of the gas are ……..from one another
(a) Distinguishable   (b) Indistinguishable
(c) Fixed   (d) none of above

(viii) The spin quantum number S=1 for particle is
(a) α- particle   (b) photon
(c) deuteron   (d) none of above

Q:2   Short Questions : (Attempt any five)   [10]

(i) Explain paramagnetic and ferromagnetic material.

(ii) State second law of thermodynamics in terms of entropy.

(iii) Define: Phase space and τ-space.

(iv) State Nernst's heat theorem.

(v) Define: Degeneracy and Chemical Potential.

(vi) Show that the most probable velocity of a particle is $\sqrt{\frac{2KT}{m}}$

(vii) State the Pauli's exclusion principle.

(viii) What is thermal length and write formula of it.
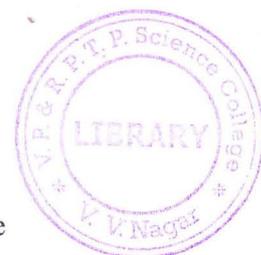
Q:3 Obtain the Clausius Clapeyron's latent heat equation for equation for first order phase transition [8]

$$\frac{dP}{dT} = \frac{L}{T(V_2 = V_1)}$$

OR

Q:3 Explain enthalpy with necessary formula. [8]

Q:4 Write note on: Liouville's theorem. [8]

OR

Q:4 Show that Sackur-Tetrode formula for entropy of a perfect gas is [8]
(1) free from the Gibbs paradox
(2) It violets the third law of thermodynamics.

Q:5 Derive an expression of Maxwell distribution of velocities of particle. [8]

OR

Q:5 Derive formulas for thermodynamical quantities for gas in grand canonical ensemble. [8]

Q:6 Discuss the Maxwell-Boltzmann distribution of particle among various states. [8]

OR

Q:6 (i) Derive a condition for application of the M.B. distribution. [8]
(ii) Derive expression for entropy in the three distributions.