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SARDAR PATEL UNIVERSITY

Fifth Semester B. Sc. Examination Under CBCS

Thursday, 12-04-2018

Time: 2:00 pm to 5:00 pm

Subject: PHYSICS [US05CPHY04]

Thermodynamics and Statistical Physics

Total Marks [70]

INSTRUCTION: (1) Attempt all questions.
(2) The symbols have their usual meanings.
(3) Figure to the right indicates full marks.

Q-1 Choose correct option to answer the following questions. [10]

1 At absolute zero temperature, entropy of the system is _____.

(a) zero (b) constant (c) increased (d) decreased

2 An isochoric process of the system occurs at constant____.

(a) energy (b) volume (c) pressure (d) temperature

3 Thermodynamical potential enthalpy H is given by____.

(a) H= U+P-V (b) H= U+P+V (c) H=U+PV (d)) H=U-PV

4 For a system defined by f position coordinates and f momentum coordinates of the constituent particles, the degree of freedom of the system is ____ .

(a) 6f (b) 2f (c) 4f (d) f

5 An ensemble for which (q,p,t) is constant along the trajectories in the phase space is known as____.

(a) stationary ensemble (b) dynamic ensemble

(c) canonical ensemble (d) none of these

6 For microcanonical ensemble, _____ parameters remain constants.

(a) [V E T] (b) [N V E] (c) [μ V T] (d) [μ N E]

7 _____ parameters remains constant in grandcanonical ensemble.

(a) [V E T] (b) [N V E] (c) [V T μ] (d) [μ N E]

8 The spin quantum number s of the ____ is 1.

(a) μ-meson (b) π-meson (c) neutron (d) alpha particle

9 In B-E system, the mean separation between the particles is smaller than the____.

(a) thermal length (b) wavelength

(b) De-Broglie length (d) Debye length

10 _____ of particles obeys the Pauli's exclusion principle.

(a) F-D system (b) B-E system (c) M-B system (d) none of these

(PTO)

Q-2 Answer any ten questions from the followings in brief. [20]

1 Explain Nernst heat theorem.
2 Prove that internal energy U remains constant for an isochoric adiabatic process.
3 What do you mean by second order phase transition? Enlist its proper examples.
4 Explain macroscopic and microscopic states.
5 Deduce postulates of equal priori probability.
6 Define the terms: Phase point and Phase path.
7 Prove that most probable velocity $V_{mp} = \sqrt{\frac{2kT}{m}}$.
8 Distinguish between canonical and grand canonical ensemble.
9 Write the expression for canonical partition function in classical statics and quantum statics.
10 What do you understand by Fermi Dirac system?
11 Define most probable energy E_p and velocity V_p.
12 Derive an expression for entropy of the perfect gas for the B-E distribution.

Q-3 (a) Define first order phase transition and obtain Clausius-Clapeyron latent heat equation. [05]

(b) Define Entropy. Obtain first and second T.dS equations. [05]

OR

Q-3 (a) Derive Maxwell's thermodynamical relations using alternative method. [05]

(b) Define Helmholtz free energy (F). Obtain an expression for change in Helmholtz free energy during in an infinitesimal reversible process. [05]

Q-4 (a) Define Microcanonical ensemble with suitable figure and obtain an equation for Gibb's Microcanonical distribution function. [06]

[b] Obtain Sackur-Tetrode formula for a perfect gas. [04]

OR

Q-4 [a] State Liouville's theorem and prove that $\frac{d\varrho}{dt} = 0$ using proper diagram. [06]

[b] Write a note on fluctuation in a physical quantity. [04]

Q-5 [a] Write a note on grandcanonical partition function. [05]

[b] Discuss different thermodynamical quantities for grandcanonical ensemble. [05]

OR

Q-5 [a] Discuss Maxwell-Boltzmann distribution of velocities for gas in form of cartesian components. [05]

[b] Discuss canonical average deriving necessary equation. [05]

Q-6 Define Maxwell-Boltzmann system. Obtain an expression for the M-B distribution of the particles among various states. [10]

OR

Q-6 What is Bose-Einstein system? Discuss the Bose-Einstein distribution of the particles among various states. [10]

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