

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc DEGREE EXAMINATION MAY 2022
(Fourth Semester)

Branch – PHYSICS

APPLIED THERMODYNAMICS & STATISTICAL MECHANICS

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions

ALL questions carry EQUAL marks (10 x 1 = 10)

- 1 Entropy remains constant at ___ process.
(i) Isothermal (ii) Adiabatic (iii) Isobaric (iv) Isochoric
- 2 The efficiency of Carnot cycle may be increased by -----.
(i) Increasing the highest temperature (ii) Decreasing the highest temperature
(iii) Increasing the lowest temperature (iv) Decreasing the lowest temperature
- 3 A point in phase space or μ -space can be represented with -----.
(i) Six position coordinates (ii) Six momentum coordinates
(iii) Three position and three momentum coordinates
(iv) Six position and six momentum coordinates
- 4 All microstates are equally probable for a given macrostate is called -----.
(i) statistical postulate (ii) thermodynamic postulate
(iii) postulate of equal a priori probability (iv) postulate of equality.
- 5 Maxwell-Boltzmann statistics is applicable to -----.
(i) identical and distinguishable particles
(ii) identical and indistinguishable particles
(iii) fermions
(iv) bosons
- 6 Fermi – Dirac particles _____ Pauli's exclusion principle.
(i) does not react (ii) do not obey
(iii) obey (iv) none of these
- 7 What is the ratio of specific heats for a monatomic gas?
(i) 5/3 (ii) 5/2 (iii) 7/5 (iv) 9/5
- 8 The quantity of heat required to raise temperature of unit mass of a substance through one degree is -----.
(i) latent heat (ii) specific heat
(iii) thermal capacity (iv) water equivalent
- 9 In the shortcomings of Debye's theory, a solid can be assumed to be _____ as it made of some definite crystals.
(i) Perfectly isotropic (ii) Isolated
(iii) Molecular Ionization (iv) Collusion
- 10 For a perfectly black body, the absorptive power is _____.
(i) 10 (ii) 5 (iii) 1 (iv) 100

Cont...

SECTION - B (35 Marks)

Answer ALL Questions

ALL Questions Carry EQUAL Marks (5 x 7 = 35)

- 11 a State and explain how first law of thermodynamics leads to the concept of internal energy.
- OR**
- b Obtain an expression for the efficiency of a reversible Carnot's engine.
- 12 a Discuss the microcanonical ensemble based on quantum mechanics.
- OR**
- b Elucidate the mean value and fluctuations in canonical and grand canonical ensemble.
- 13 a Obtain an expression for Maxwell Boltzmann statistics.
- OR**
- b Discuss Bose – Einstein condensation and derive an equation of an ideal gas.
- 14 a Explain the concept of molecular beams with suitable theory.
- OR**
- b Derive the expression for specific heat capacity of a diatomic gas.
- 15 a Discuss Debye's theory of specific heat of solids as an improvement over the Einstein's theory.
- OR**
- b Outline the concept of Negative temperature.

SECTION - C (30 Marks)

Answer any THREE Questions

ALL Questions Carry EQUAL Marks (3 x 10 = 30)

- 16 Obtain an expression for Maxwell's thermodynamical relations.
- 17 State and Prove Liouville's theorem.
- 18 Two particles are to be distributed in three cells. Find out the total number of possible ways both from formula and in tabular form if the particles follow (i) MB statistics (ii) BE statistics (iii) FD statistics.
- 19 Enumerate the experimental verification of Maxwell-Boltzmann speed distribution with suitable theory.
- 20 Obtain an expression for the specific heat of solid according to Einstein's theory. Discuss the success and limitations of this theory.

Z-Z-Z

END