GOVERNMENT ZIRTIRI RESIDENTIAL SCIENCE COLLEGE

Subject: Physics
Paper name: Thermal and Statistical Mechanics
Paper No: Phy/VI/CC/18
Semester: VI

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A. Multiple choice questions [25 (5 from each unit)]

1. The coefficient of viscosity of a gas varies with temperature as-
   a) $\eta \propto T$
   b) $\eta \propto \sqrt{T}$
   c) $\eta \propto T^2$
   d) $\eta \propto \frac{1}{T}$
2. The most probabale velocity of a gas at NTP is $1\ m/s$, then its rms velocity is
   a) $1\ m/s$
   b) $1.225\ m/s$
   c) $1.414\ m/s$
   d) $1.5\ m/s$
3. The phenomenon of viscosity arises due to transport of-
   a) mass
   b) momentum
   c) energy
   d) velocity
4. According to Maxwell's law of distribution of velocities, the probability of a molecule to have zero velocity is
   a) 0
   b) 0.25
   c) 0.5
   d) 1
5. An ideal gas possess
   a) only kinetic energy
   b) only potential energy
   c) both kinetic and potential energy
   d) neither kinetic nor potential energy
6. Total heat of a substance is known as
   a) Internal energy
   b) thermal capacity
   c) entropy
   d) enthalpy
7. At constant temperature, the c_p does not vary with pressure for
   a) real gas
   b) ideal gas
   c) both real and ideal gas
   d) none of these

8. At a given temperature, which of the following has highest thermal conductivity
   a) hydrogen
   b) helium
   c) oxygen
   d) carbon dioxide
9. At a given temperature, the variation of c_v with volume is zero for
   a) real gas
   b) ideal gas
   c) both real and ideal gas
   d) none of these
10. Which of the following is not a symbol for thermodynamic potential.
   a) E
   b) F
   c) G
   d) H
11. "All accessible microstates corresponding to possible macrostates are equally probable." This is the postulate of
   a) Equal a priori probability
   b) Equipartition of energy
   c) Phase space
   d) None of these

12. The number of accessible microstates in energy interval E and $E + dE$ is
   a) $\phi(E)$
   b) $\sigma(E)$
   c) $\Omega(E)$
   d) $\psi(E)$

13. The six (6) dimensional space for a single particle is called
   a) α −space
   b) β −space
   c) Γ −space
   d) μ −space

14. According to statistical mechanics, β parameter equals
   a) $\frac{1}{kT}$
   b) kT
   c) $\frac{k}{T}$
   d) $\frac{1}{(kT)^2}$
15. When systems A and B are in equilibrium, the probability of system A and B possessing energies E and E' respectively will be
   a) zero
   b) infinite
   c) minimum
   d) maximum

16. In Microcanonical ensemble, which of the following combination of independent variables are correct-
    a) T, V, μ
    b) E, N, V
    c) T, N, V
    d) E, N, Ω
17. In Canonical ensemble, which of the following combination of independent variables are correct-
    a) T, V, μ
    b) E, N, V
    c) T, N, V
    d) E, N, Ω
18. In Stirling's approximation, the value of $\ln n!$ is equal to
    a) $n \ln n$
    b) $n \ln n - n$
    c) $\ln n - n$
    d) $\ln n - n!$
19. The grand potential in grand canonical ensemble is given by
    a) $\Omega = U - TS$
    b) $\Omega = TS$
    c) $\Omega = TS - \mu n$
    d) $\Omega = U - TS - \mu n$
20. In grand canonical ensemble, for fixed p and τ, Gibb's free energy is given by
    a) $G = \mu\tau$
    b) $G = \mu\rho$
    c) $G = \rho\tau$
    d) $G = \mu n$
21. In classical statistics, it has been assumed that all the energy levels are
    a) accessible to all particles
    b) accessible to selected particles
    c) inaccessible to all particles
    d) inaccessible to selected particles

22. In quantum statistics, all the energy levels are
    a) accessible to all particles
    b) accessible to selected particles
    c) inaccessible to all particles
    d) inaccessible to selected particles
23. The volume of a phase cell cannot be less than
    a) h
    b) h^2
    c) h^3
    d) zero
24. BE statistics is obeyed by
    a) Fermions
    b) Bosons
    c) Baryons
    d) Hyperons

25. Fermi energy at absolute zero represents the highest energy level in which all the quantum states are
    a) unoccupied
    b) occupied
    c) partially occupied
    d) None of these

B. Fill up the blanks [15 (3 from each unit)]

1. The thermal conductivit (κ) of a gas is _____ times the coefficient of viscosity (η).
2. The mean free path (λ) of a gas varies directly as _____ and inversely as _____.
3. The mean free path (λ) of a gas is _____ density.
4. Maxwell's thermodynamic relations are based on _____ thermodynamic potential(s).
5. Internal energy (U) remains constant during _____ processes.
6. Enthalpy (H) remains constant during _____ processes.
7. In kinetic theory of an ideal gas, molecules move at _____ in all directions.
8. At absolute zero, the molecules are in a perfect state of _____.
9. In _____, heat is transmitted from one body to another body without heating the intervening medium.
10. _____ law of thermodynamics states that, "if two bodies A and B are each separateely in thermal equilibrium with a third body C, then A and B are also in thermal equilibrium with each other."
11. Amount of heat is taken to be _____, if heat is supplied to the system.
12. In Carnot's engine, _____ is the working substance.
13. In _____, particles are identical but distinguishable.
14. Fermions are particles having _____ integral spin.
15. In _____, particles obey Pauli's exclusion principle.

Key Answers

A. Multiple choice questions [replace x]

1. b	2. b	3. b	4. a	5. a	6. d	7. b
8. a	9. c	10. a	11. a	12. a	13. d	14. a
15. d	16. b	17. c	18. b	19. d	20. d	21. a
22. b	23. c	24. b	25. b			

B. Fill up the blanks

1. specific heat at constant volume (c_v)
2. temperature, pressure
3. inversely proportional to
4. four (4)
5. isochoric adiabatic
6. reversible isobaric adiabatic
7. Random
8. Rest
9. Radiation
10. Zeroth
11. Positive

12. Ideal gas
13. MB statistics
14. half
15. FD statistics