

K.S ACADEMY, SALEM**PG TRB & TNSET COACHING CENTRE FOR PHYSICS****MODEL EXAMINATION FOR DIRECT RECRUITMENT OF POST GRADUATE
ASSISTANT IN GOVERNMENT SCHOOLS****Unit - Statistical mechanics**

TIME:1/2HOUR

Marks: 30

General Instruction to Candidates :

- Read questions carefully before answering.

- Which of the following is not true about phonon
 - Phonon is a quasiparticle
 - Phonon is a quanta of optical wave with energy $E = \hbar\omega$
 - Phonon does not obey conservation law
 - Phonon are bosons
- The spin degeneracy of spinless bosons is
 - 0
 - 2
 - 1
 - 2
- The fraction of particle occupying the ground state below Bose-Einstein condensation temperature T_c is
 - $\frac{N_0}{N} = \left(\frac{T}{T_c}\right)^{3/2}$
 - $\frac{N_0}{N} = 1 - \left(\frac{T}{T_c}\right)^{3/2}$
 - $\frac{N_0}{N} = \left(\frac{T_c}{T}\right)^{3/2}$
 - $\frac{N_0}{N} = 1 - \left(\frac{T_c}{T}\right)^{3/2}$
- The classical and quantum particles are
 - Individually recognizable and are not individually recognizable.
 - Individually not recognizable and individually recognizable.
 - Both are distinguishable.
 - Indistinguishable and distinguishable.
- Richardson – Bushman equation for thermionic emission is

a) $J = T^4 e^{-\phi/KT}$	b) $J = AT^2 e^{-\phi/KT}$
c) $J = AT^3 e^{-\phi/KT}$	d) $J = AT^4 e^{-\phi/KT}$

7. The number of microstate corresponding to any given macrostate is called its
- Thermodynamics
 - Thermistor
 - thermodynamic frequency
 - frequency
8. A second order phase transition is one in which
- The free energy , entropy and specific heat are continuous functions of temperature.
 - The free energy is continuous while entropy and specific heat are discontinuous at transition temperature
 - The free energy and entropy is continuous while specific heat are discontinuous at transition temperature
 - All the three (free energy, entropy and specific heat) are discontinuous at transition temperature
9. The average energy of electron in a three dimensional free electron gas $3eV$. The Fermi energy of the system is.
- $1.8 eV$
 - $3 eV$
 - $4 eV$
 - $5 eV$
10. Pauli's exclusion principle is imposed on
- Maxwell – Boltzmann statistics
 - Bose Einstein statistics
 - Fermi – Dirac statistics.
 - all these three
11. The Fermi temperature is
- $T_F = \frac{E_F}{K}$
 - $T_F = K E_F$
 - $T_F = \frac{K}{E_F}$
 - $T_F = \frac{1}{K E_F}$
12. Fermions have a spin value of
- $1/2$
 - zero
 - 1
 - any value
13. Maxwell Boltzmann's statistics states that the average kinetic energy per molecule associated with each degree of freedom is
- KT
 - $1/2KT$
 - $3/2KT$
 - $3KT$
14. In the canonical ensembles the system
- is not maintained at a fixed temperature
 - can exchange energy with the surrounding
 - can exchange no of particles with the surrounding
 - is completely isolated from the surrounding

15. Fermions are characterised by
 a. antisymmetric wave function
 c. symmetric wave function
 b. Integral spin
 d. zero spin .
16. Planck's law governing the black body radiation can be deduced by using
 a) Maxwell-Boltzmann statistics
 c) Fermi – Dirac statistics
 b) Bose Einstein statistics
 d) All these three.
17. Stefan's law derived from
 a. Pauli's law
 c. Planck's law
 b. Newton's law
 d. Thomson law .
18. B-E and F-D statistics reduced to M-B statistics when
 a. high temp and low density
 c. low temp and low density
 b. high temp and high density
 d. low temp and high density .
19. Fermi level is the highest occupied energy level at
 a. 273° c
 b. 0° c
 c. room temperature
 d. ok
20. The Maxwell – Boltzmann statistics could not explain.
 a) Energy b) temperature C) Specific heat at low temp d) pressure
21. As the temperature of the filament is reduced to half, then the thermionic current
 a) increases 4 times
 c) increases twice
 b) decreases 4 times
 d) reduced to half
22. The most probable velocity of the molecules in a gas is.
 a) $\sqrt{\frac{3KT}{m}}$
 b) $\sqrt{\frac{8KT}{m}}$
 c) $\sqrt{\frac{6KT}{m}}$
 d) $\sqrt{\frac{2KT}{m}}$
23. The Planck's law for black body radiation is
 a) $E_{\lambda} = \frac{8\pi hc^2}{\lambda^5 (e^{hc/\lambda KT} - 1)}$
 c) $E_{\lambda} = 0.987531 \frac{8\pi hc}{\lambda^4} (e^{hc/\lambda KT} - 1)$
 b) $E_{\lambda} = \frac{8\pi hc}{\lambda^5 (e^{hc/\lambda KT} - 1)}$
 d) $E_{\lambda} = \frac{8\pi hc}{\lambda^5} (e^{hc/\lambda KT} - 1)$
24. The unit of phase space volume is
 a) $J^3 S^{-3}$
 b) Js
 c) m^3
 d) $kg^3 m^6 s^{-3}$
25. The distribution law according to Maxwell – Boltzmann statistics is.
 a) $n_i = \frac{g_i}{f e^{\beta E_i - 1}}$
 c) $n_i = \frac{g_i}{e^{\beta E_i}}$
 b) $n_i = \frac{g_i}{f e^{\beta E_i + 1}}$
 d) $n_i = \frac{g_i}{f e^{\beta E_i}}$

26. The Fermi temp θ_F is

- a) $\theta_F = K \times E_F$ b) $\theta_F = \frac{E_F}{K}$
 c) $\theta_F = \frac{K}{E_F}$ d) $\theta_F = K + E_F$

27. the microstate is defined by

- a) pressure and volume of the gas.
 b) pressure and temp of the gas.
 c) pressure, temp of the gas.
 d) position & velocity component of the molecules

28. At absolute Zero temp, the semiconducting material have.

- a) partially filled conduction band
 b) partially filled valence band
 c) Completely empty conduction band
 d) Completely empty valence band

29. The density of state in the phase space can be shown to be equal to.

- a) h^3 b) $\frac{1}{h^3}$ c) h^2 d) h

30. The quantum statistics become identical with the Maxwell Boltzmann statistics in the limit

- a) $e^\alpha e^{\epsilon/KT} = 1$ b) $e^\alpha e^{\epsilon/KT} = -1$
 c) $e^\alpha e^{\epsilon/KT} \gg 1$ d) $e^\alpha e^{\epsilon/KT} \ll 1$

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Statistical mechanics – answer key

Q.NO	ANSWER	Q.NO	ANSWER	Q.NO	ANSWER
1	B	11	A	21	D
2	C	12	B	22	B
3	B	13	B	23	D
4	A	14	A	24	D
5	B	15	B	25	B
6	C	16	C	26	D
7	C	17	A	27	C
8	D	18	D	28	B
9	C	19	C	29	A
10	A	20	B	30	C