

Section 1 - M Sc - Physics

1) The wave function for identical fermions is antisymmetric under particle interchange. Which of the following is a consequence of this property?

- A) Bohr correspondence principle
 - B) Bose-Einstein condensation
 - C) Pauli-exclusion principle
 - D) Heisenberg uncertainty principle
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2) Bragg's condition in reciprocal lattice is given as

- A) $2k \cdot G + k^2 = 0$
 - B) $2G \cdot k + k^2 = 0$
 - C) $2k \cdot G + G^2 = 0$
 - D) $2G \cdot k + k^2 = n\pi$
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3) According to special theory of relativity which one is not an absolute quantity

- A) Time
 - B) Both (A) and (B)
 - C) Mass
 - D) Height
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4) Which of the following is called total heat function?

- A) Enthalpy
- B) Gibb's function
- C) Helmholtz function
- D) Entropy

5) When applied to solar radiation, Planck's law reduces to Wein's law in the

- A) infrared region
 - B) ultraviolet region
 - C) microwave region
 - D) visible region
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6) Maxwell-Boltzmann statistics cannot be applied to

- A) Photons
 - B) Molecules
 - C) Atoms
 - D) None of above
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7) If V_{mp} , V_{av} and V_{rms} are the most probable speed, average speed and root mean square speed for an ideal gas obeying Maxwell Boltzmann statistics, which of the following statement is true

- A) $V_{av} > V_{mp} < V_{rms}$
 - B) $V_{rms} > V_{av} > V_{mp}$
 - C) $V_{mp} > V_{av} > V_{rms}$
 - D) $V_{mp} < V_{av} > V_{rms}$
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8) How can one differentiate between a neutrino and antineutrino?

- A) On the basis of charge
 - B) On the basis of mass
 - C) On the basis of helicity
 - D) On the basis of spin angular momentum
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9) If density of $CuCl$ which crystallizes as fcc structure is 3.4 g cm^{-3} . The unit cell dimension of $CuCl$ is

- A) $5.78 \times 10^{-8} \text{ cm}$
 - B) None of above
 - C) $4.68 \times 10^{-6} \text{ cm}$
 - D) $0.79 \times 10^{-11} \text{ cm}$
-

10) Except for mass, the properties of the muon most closely resemble the properties of the

- A) Photon
 - B) Electron
 - C) Pion
 - D) Proton
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11) Which thermodynamics law is law of increasing entropy?

- A) First Law o
 - B) Second law
 - C) Zeroth Law
 - D) Third Law
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12) The work done on moving a charge of $2C$ in a circular path of radius $2m$ around a charge of $10C$ is

- A) $5 J$
 - B) $6.66 J$
 - C) $10J$
 - D) Zero
-

13) The inductance is a measure of

- A) Magnetization of dipoles
 - B) Magnetic field stored by the material
 - C) EMF generated by energizing the coil
 - D) Electric charges stored by the material
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14) A particle of charge ' e ' and mass ' m ' moves with a velocity ' v ' in a magnetic field ' B ' applied perpendicular to the motion. The radius ' r ' of its path in the field is

- A) Be/mv
 - B) ev/mB
 - C) vB/me
 - D) mv/Be
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15) Half-life of neutron is

- A) 10.2 mins
 - B) 1.05 year
 - C) 1.2 hours
 - D) 100.7 mins
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16) The average energy of a harmonic oscillator in three-dimension is given as, where k is the Boltzmann constant and T is a given temperature.

- A) $(3/2) kT$
 - B) kT
 - C) $(3/4) kT$
 - D) $3kT$
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17) The particle decay $\Lambda^0 = p + \pi^-$ must be a weak interaction because

- A) The Λ^0 has spin zero
 - B) It does not conserve angular momentum
 - C) It does not conserve strangeness
 - D) No neutrino is produced
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18) If E_F is Fermi energy and k_B is Boltzmann constant, Fermi function $f(E)$ at a given temperature is given as the reciprocal of the term

- A) $\exp [(E-E_F)/k_B T + 1]$
 - B) $\exp [(E-E_F)/k_B T] + 1$
 - C) $\exp [(E-E_F)/k_B T] - 1$
 - D) $\exp [(E-E_F)/k_B T - 1]$
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19) Gibbs potential is defined as

- A) $G=U+PV+TS$
 - B) $G=U-PV+TS$
 - C) $G=U+PV-TS$
 - D) $G=U-PV-TS$
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20) On which factor kinetic energy of photoelectron depends

- A) Distance between source of radiation and target
 - B) Intensity of incident radiation
 - C) Frequency of incident radiation
 - D) Cross section
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21) Two photons A and B are travelling towards one another with a velocity c . The relative velocity of A w.r.t B is

- A) $0.5\ c$
 - B) Zero
 - C) $2\ c$
 - D) c
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22) Electromagnetic waves are reflected back by ionosphere due to their interaction with

- A) all of these
 - B) neutrons
 - C) protons
 - D) electrons
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23) The primary function of the bias circuit is to

- A) ensure proper gain is achieved
 - B) hold the circuit stable at the designed Q-point
 - C) hold the circuit stable at V_{in}
 - D) hold the circuit stable at V_{CC}
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24) In Wein's displacement law ($\lambda_m T = b$), the value of b is

- A) $2.897mK$
- B) $2.897 \times 10^{-3}mK$
- C) $3.898 \times 10^{-2}mK$
- D) 3.898×10^2mk

25) If the energy of a quantum harmonic oscillator is $E_n = nh\nu$, $n=0, 1, 2, \dots$, the partition function of the system of oscillator is

A)
$$e^{-\frac{h\nu}{kT}}$$

B)
$$\frac{1}{1 - e^{-\frac{h\nu}{kT}}}$$

C)
$$e^{\frac{h\nu}{kT}}$$

D)
$$\frac{1}{e^{\frac{h\nu}{kT}} - 1}$$

26) If the maximum energy of the recoil electrons be 1 MeV in Compton scattering of certain gamma-rays, what is the energy of photon?

A) 0.52 MeV

B) 0.98 MeV

C) 2.234 MeV

D) 1.234 MeV

27) Let ΔW be the work done in a quasi static reversible thermodynamic process. Which of the following statements about ΔW is correct?

- A) ΔW is always a perfect differential
 - B) ΔW is a perfect differential if the process is adiabatic
 - C) ΔW is a perfect differential if the process is isothermal
 - D) ΔW cannot be a perfect differential
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28) The wavefunction $\psi(x) = Ae^{-\frac{b^2 x^2}{2}}$, where A and b are real constants, is a normalized eigenfunction of the Schrodinger equation for a particle of mass M and energy E in a one-dimensional potential $V(x)$ such that $V(x)=0$ at $x=0$. Which of the following

A) $E = \frac{\hbar^2 b^4}{2M}$

B) $E = \hbar^2 b^2 (1 - b^2 x^2)$

C) $V = \frac{\hbar^2 b^4 x^2}{2M}$

D) $V = \frac{\hbar^2 b^2}{2M}$

29) An electric dipole is placed in a uniform electric field at an angle θ . For what value of θ , the potential energy of the dipole is maximum

- A) $\pi/4$
 - B) π
 - C) $\pi/2$
 - D) 0
-

30) If the electron in a hydrogen atom is in $3d$ state, what is the magnitude of orbital angular momentum (L)

- A) $\sqrt{2} \hbar$
 - B) $\sqrt{6} \hbar$
 - C) $\hbar$
 - D) None of these
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31) Exchange particle for strong forces

- A) Gluons
 - B) $W^\pm$
 - C) pions
 - D) photons
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32) The output voltage of an emitter follower is

- A) 180° out of phase with input voltage
 - B) much greater than input voltage
 - C) 90° out of phase with input voltage
 - D) in phase with input voltage
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33) When a material particle of rest mass m attains speed c , its mass becomes

- A) $2m$
 - B) Zero
 - C) $4m$
 - D) Infinite
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34) On inserting the sheet of bakelitewith in the plates of a parallel plate capacitor, the capacitance wiil

- A) increase
 - B) becomes zero
 - C) remains same
 - D) decrease
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35) At what velocity the kinetic energy of a particle is equal to its rest mass energy

- A) $c\sqrt{5/2}$
 - B) c
 - C) $c\sqrt{3/2}$
 - D) $c/2$
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36) In order to double the period of a simple pendulum, the length of the string should be

- A) Doubled
 - B) Quadrupled
 - C) Halved
 - D) none of the mentioned
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37) In a common base configuration of transistor circuit, collector current (I_c) is 0.96 mA and base current is $40\text{ }\mu\text{A}$, what is the value of α

- A) 1.02
 - B) 0.75
 - C) 1.36
 - D) 0.96
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38) The relative permittivity of the free space is

- A) 100
 - B) 1
 - C) 10
 - D) 0
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39) When two bodies stick together after collision, the collision is said to be

- A) completely inelastic
 - B) partially elastic
 - C) none of these
 - D) perfectly elastic
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40) If r is the radius of the atom in a crystal having simple cubic structure, then the nearest neighbour distance is

- A) $r/2$
 - B) $3r/2$
 - C) $4r$
 - D) $2r$
-

41) Phase space is a

- A) 5 Dimensional Space
 - B) 3 Dimensional Space
 - C) 6 Dimensional Space
 - D) 4 Dimensional Space
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42) The binding energy for a cooper pair is of the order

- A) 10^2 eV
 - B) 10^6 eV
 - C) 10^{-3} eV
 - D) 10^{-8} eV
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43) In a 3 dimensional crystal system how many Bravais lattices are associated with orthorhombic crystal system

- A) 1
- B) 2
- C) 3
- D) 4

44) The Hamiltonian operator in the Schrodinger equation can be formed from the classical Hamiltonian by substituting

- A) gaussian distributions of observables for exact values
 - B) sums over discrete eigenvalues for integrals over continuous variables
 - C) wavelength and frequency for momentum and energy
 - D) none of these
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45) The energy associated with each degree of freedom of molecule is

- A) $kT/2$
 - B) $2kT$
 - C) kT
 - D) $kT/4$
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46) What would be the *rms* speed for oxygen molecule at 300 K?

- A) 612 m/s
 - B) 798 m/s
 - C) 821 m/s
 - D) 483 m/s
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47) A blackbody at temperature T_1 radiates energy at a power level of 10 (mW). The same blackbody, when at a temperature of $2T_1$ radiates energy at a power level of

- A) 80 mW
 - B) 40 mW
 - C) 10 mW
 - D) 160 mW
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48) If (3 2 6) are the Miller indices of a plane, the intercepts made by the plane on three crystallographic axis are

- A) (a, b, c)
- B) (3a, 2b, 6c)
- C) (a, 2b, 3c)
- D) (2a, 3b, c)

49) The average kinetic energy of an electron is related to Fermi energy at absolute zero (E_{F0}) as

- A) $E_o=5/7E_{F0}$
 - B) $E_o=5/2E_{F0}$
 - C) $E_o=7/3E_{F0}$
 - D) $E_o=3/5E_{F0}$
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50) The magnetostatics highly relies on which property

- A) None of these
- B) Resistance
- C) Capacitance
- D) Inductance

Answer Keys**Question Paper No: 60872_7**

1	C	26	D
2	C	27	B
3	B	28	C
4	A	29	B
5	B	30	B
6	A	31	C
7	B	32	A
8	C	33	D
9	A	34	A
10	B	35	C
11	B	36	B
12	D	37	D
13	C	38	B
14	D	39	A
15	A	40	D
16	D	41	C
17	C	42	C
18	B	43	D
19	C	44	D
20	C	45	A
21	D	46	B
22	D	47	D
23	B	48	D
24	B	49	D
25	D	50	D