

DU PhD in Physics

Topic:- PHY PHD

- 1) If a particle is moving on the trajectory $r(\theta) = Ae^{b\theta}$ in a central force field with the force law

$$\vec{F} = \frac{k}{r^n} \hat{r}$$

the value of the index n is

[Question ID = 10238]

1. 0

[Option ID = 40949]

2. $3/2$

[Option ID = 40950]

3. 2

[Option ID = 40951]

4. 3

[Option ID = 40952]

- 2) A particle obeys the equation of motion

$$m \frac{d^2 \vec{r}}{dt^2} = -\frac{k}{r^2} \hat{r}$$

Let $\vec{L}$ denotes the angular momentum vector, $\vec{r}$ the position vector, $\vec{p}$ the momentum vector, and $\hat{r}$ the unit vector in the radial direction. Define the vectors:

$$\vec{A} = \frac{L}{mk} \vec{p} - \vec{L} \times \hat{r}$$

$$\vec{B} = \hat{r} + \frac{1}{mk} \vec{L} \times \vec{p}$$

Which of these is/are conserved?

[Question ID = 10239]

1. Only $\vec{A}$

[Option ID = 40953]

2. Only $\vec{B}$

[Option ID = 40954]

3. Both $\vec{A}$ and $\vec{B}$

[Option ID = 40955]

4. Neither $\vec{A}$ nor $\vec{B}$

[Option ID = 40956]

- 3) Which of the following transformations is not canonical?

[Question ID = 10240]

1. $Q_i = q_i, P_i = p_i$

[Option ID = 40957]

2. $Q_i = p_i, P_i = q_i$

[Option ID = 40958]

3. $Q_i = -q_i, P_i = -p_i$

[Option ID = 40959]

4. $Q_i = p_i, P_i = -q_i$

[Option ID = 40960]

- 4) Which of the following statements is false? [Question ID = 10241]

1. Unbounded trajectories are allowed for motion under Coulomb potential. [Option ID = 40961]

2. Unbounded trajectories are not allowed for motion under Harmonic Oscillator potential. [Option ID = 40962]

3. Bounded trajectories for motion under Coulomb and Harmonic Oscillator potentials are closed. [Option ID = 40963]

4. Bounded trajectories for motion under both Coulomb and Harmonic Oscillator potentials have negative energies. [Option ID = 40964]

5)

Two identical simple pendulums of mass m and string unstretched length l have their bobs joined together by a spring of spring constant k . In the equilibrium position, both strings are vertical and the spring is horizontal and unstretched. One of the bobs is given an initial displacement and the system oscillates in a vertical plane. The Eigen frequencies for small oscillations are

[Question ID = 10242]

1. $\sqrt{\frac{g}{l}}$ and $\sqrt{\frac{g}{l} + \frac{k}{m}}$

[Option ID = 40965]

2. $\sqrt{\frac{g}{l}}$ and $\sqrt{\frac{g}{l} + \frac{2k}{m}}$

[Option ID = 40966]

3. $\sqrt{\frac{g}{l} + \frac{k}{m}}$ and $\sqrt{\frac{g}{l} + \frac{k}{m}}$

[Option ID = 40967]

4. $\sqrt{\frac{g}{l} + \frac{k}{m}}$ and $\sqrt{\frac{g}{l} + \frac{2k}{m}}$

[Option ID = 40968]

6) A particle of mass m moves in a one dimensional potential

$$V(x) = V_0 \frac{x}{x_0} \left(\frac{x^2}{x_0^2} - 1 \right)$$

where V_0 and x_0 are one dimensional constants. The frequency of small oscillations about the point of equilibrium is

[Question ID = 10243]

1. $\frac{V_0}{x_0^2}$

[Option ID = 40969]

2. $2\sqrt{3} \frac{V_0}{x_0^2}$

[Option ID = 40970]

3. $2 \frac{V_0}{x_0^2}$

[Option ID = 40971]

4. $\sqrt{3} \frac{V_0}{x_0^2}$

[Option ID = 40972]

7) The 3-dimensional anisotropic oscillator described by the Hamiltonian

$$H = \frac{p^2}{2m} + \frac{1}{2}m\omega^2(x^2 + 4y^2 + 9z^2)$$

What are the minimum energy and its corresponding number of degeneracy?[Question ID = 10244]

1. $3\hbar\omega$ and 1 [Option ID = 40973]

2. $3\hbar\omega$ and 2 [Option ID = 40974]

3. $4\hbar\omega$ and 1 [Option ID = 40975]

4. $4\hbar\omega$ and 2 [Option ID = 40976]

8) Consider a particle whose normalized wave function is

$$\Psi(x) = Nx(L-x) \text{ for } 0 < x < L \quad = 0$$

elsewhere

What are the values of $\langle x \rangle$ and $\langle x^2 \rangle$?

[Question ID = 10245]

1. $\frac{L}{2}$ and $\frac{2L}{7}$

[Option ID = 40977]

2. $\frac{L}{2}$ and $\frac{L^2}{4}$

[Option ID = 40978]

3. $\frac{L}{4}$ and $\frac{2L^2}{7}$

[Option ID = 40979]

4. L and L^2

[Option ID = 40980]

9) Consider the Hamiltonian given by 3x3 matrix.

$$H = \begin{pmatrix} 3 & 0 & 0 \\ 0 & 0 & \alpha \\ 0 & \alpha & 0 \end{pmatrix}$$

Which of the following values of α is correct such that H doesn't form a complete set of commuting operator.

[Question ID = 10246]

1. $\alpha = -1$

[Option ID = 40981]

2. $\alpha = 1$

[Option ID = 40982]

3. $\alpha = 2$

[Option ID = 40983]

4. $\alpha = 0$

[Option ID = 40984]

10) The wave function of a particle is given as

$$\Psi(x) = A \cos(kx) + B \sin(kx)$$

where A, B and k are constants. What should be the form of the potential and value of energy if it is a solution of Schrodinger equation?

[Question ID = 10247]

1. Potential $V(x)=0$, Energy = $\frac{P^2}{2m}$

[Option ID = 40985]

2. Potential $V(x)=1$, Energy = $\frac{\hbar^2 k^2}{2m}$

[Option ID = 40986]

3. Potential $V(x)=x$, Energy = $\frac{P^2}{2m}$

[Option ID = 40987]

4. Potential $V(x)=-x$, Energy = $\frac{\hbar k}{2m}$

[Option ID = 40988]

11) If L_x and y denote the x and y components of the angular momentum operator and the position operator, respectively, the value of the commutator, $[L_x, y]$ is

[Question ID = 10248]

1. $-i\hbar z$

[Option ID = 40989]

2. $2i\hbar z$

[Option ID = 40990]

3. $i\hbar z/2$

[Option ID = 40991]

4. $i\hbar z$

[Option ID = 40992]

12) A system consists of two particles of spin 1 and spin 1/2 each. The possible spin of the combined system is [Question ID = 10249]

1. 1 and 1/2 [Option ID = 40993]

2. 3/2 and 1/2 [Option ID = 40994]

3. 3/2 and 1 [Option ID = 40995]

4. 1/2 and 0 [Option ID = 40996]

13) For a silicon ($\epsilon_r=11.7$) one-sided abrupt junction with $N_a = 10^{18} \text{ cm}^{-3}$, $N_d = 10^{15} \text{ cm}^{-3}$ ($N_a \gg N_d$) and $n_i = 1.5 \times 10^{10} \text{ cm}^{-3}$ the depletion layer width at $T = 300 \text{ K}$ is [Question ID = 10250]

1. $0.259 \text{ } \mu\text{m}$ [Option ID = 40997]
2. $0.493 \text{ } \mu\text{m}$ [Option ID = 40998]
3. $0.987 \text{ } \mu\text{m}$ [Option ID = 40999]
4. $1.21 \text{ } \mu\text{m}$ [Option ID = 41000]

14) In a FET, as V_{GS} is changed from -1V to -1.5V keeping V_{DS} constant, I_D drops from 7 mA to 5 mA . The transconductance of the FET is [Question ID = 10251]

1. 4 mA/V [Option ID = 41001]
2. 0.8 mA/V [Option ID = 41002]
3. 24 mA/V [Option ID = 41003]
4. 0.96 mA/V [Option ID = 41004]

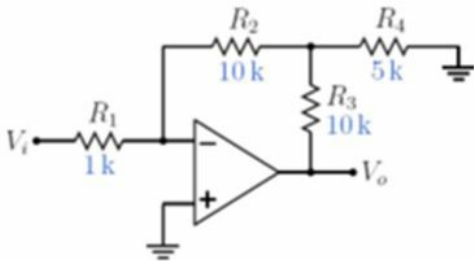
15) A CE amplifier has the following parameters: $h_{ie} = 1100 \text{ } \Omega$, $h_{re} = 2.5 \times 10^{-4}$, $h_{fe} = 50$ and $h_{oe} = 25 \text{ } \mu\text{S}$. If the load and source resistance are $1 \text{ k } \Omega$, the current gain is [Question ID = 10252]

1. 48.78 [Option ID = 41005]
2. 1.92 [Option ID = 41006]
3. 0.0487 [Option ID = 41007]
4. 2.00 [Option ID = 41008]

16) An 8-bit successive approximation type ADC uses a clock frequency of 1 MHz . The conversion time is [Question ID = 10253]

1. $255 \text{ } \mu\text{sec}$ [Option ID = 41009]
2. $127 \text{ } \mu\text{sec}$ [Option ID = 41010]
3. $8 \text{ } \mu\text{sec}$ [Option ID = 41011]
4. $1 \text{ } \mu\text{sec}$ [Option ID = 41012]

17) Find the voltage gain for the following circuit



[Question ID = 10254]

1. -10
[Option ID = 41013]
2. -25
[Option ID = 41014]
3. -60
[Option ID = 41015]
4. -40
[Option ID = 41016]

18) In a frequency modulated signal, if the frequency deviation is 60 kHz and the modulating frequency is 5 kHz , the modulation index is [Question ID = 10255]

1. 65 [Option ID = 41017]
2. 55 [Option ID = 41018]
3. 24 [Option ID = 41019]
4. 12 [Option ID = 41020]

19) If the probability that a problem will be solved by three students is $1/2$, $1/3$ and $1/6$, then what is the probability that the problem will be solved? [Question ID = 10256]

1. $13/18$ [Option ID = 41021]
2. $1/36$ [Option ID = 41022]
3. $1/18$ [Option ID = 41023]
4. $18/13$ [Option ID = 41024]

20) Find the eigenvalues of $4A^{-1} + 3A + 2I$ where I is identity matrix and $A = \begin{pmatrix} 1 & 0 \\ 100 & 4 \end{pmatrix}$

[Question ID = 10257]

1. $1, 1/4$
[Option ID = 41025]
2. $7, 28$
[Option ID = 41026]
3. $9, 15$
[Option ID = 41027]
4. $9, 36$

[Option ID = 41028]

21) Consider a matrix $M = \begin{pmatrix} p & q \\ r & s \end{pmatrix}$, with the elements $p > 0$, $q > 0$, $r > 0$, and $s > 0$. Which of the following is correct:

[Question ID = 10258]

1. All the eigenvalues of M are real and distinct, such that there is at least one positive eigenvalue.

[Option ID = 41029]

2. All the eigenvalues of M are real, but not distinct, such that there is only positive eigenvalue.

[Option ID = 41030]

3. All the eigenvalues of M are real, but not distinct, such that there is only negative eigenvalue.

[Option ID = 41031]

4. The eigenvalues of M are complex (having both non-zero real and imaginary parts), distinct, such that there is at least one positive eigenvalue.

[Option ID = 41032]

22)

Determine which of the following sets can be basis for three-dimensional real vector space?

$$M = \{(1,1,1), (1,2,3), (2,-1,1)\}$$

$$N = \{(1,1,2), (1,2,5), (5,3,4)\}$$

[Question ID = 10259]

1. Both M and N .

[Option ID = 41033]

2. Only M .

[Option ID = 41034]

3. Only N .

[Option ID = 41035]

4. Neither M nor N .

[Option ID = 41036]

23) What will be the value of the following complex integral, evaluated over a unit circle $|z| = 1$?

$$I = \int z^2 \exp\left(\frac{1}{z}\right) dz$$

[Question ID = 10260]

1. $I = 0$

[Option ID = 41037]

2. $I = i\pi$

[Option ID = 41038]

3. $I = \frac{i\pi}{3}$

[Option ID = 41039]

4. $I = \frac{i\pi}{2}$

[Option ID = 41040]

24) Which one is the most general form of 2×2 unitary, unimodular matrix:

[Question ID = 10261]

1. $U = \begin{pmatrix} a & b \\ -b^* & -a^* \end{pmatrix}, a^*a + b^*b = 1$

[Option ID = 41041]

2. $U = \begin{pmatrix} a & b \\ b^* & a^* \end{pmatrix}, a^*a - b^*b = 1$

[Option ID = 41042]

3. $U = \begin{pmatrix} a & b \\ -b^* & -a^* \end{pmatrix}, a^*a + b^*b = -1$

[Option ID = 41043]

4. $U = \begin{pmatrix} a & b \\ -b^* & a^* \end{pmatrix}, a^*a + b^*b = 1$

[Option ID = 41044]

25)

Consider a lattice of N distinguishable non-interacting particles in 3-dimensions at temperature T . Each particle is described by a classical

Hamiltonian of the form $H(\mathbf{p}, \mathbf{r}) = \frac{\mathbf{p}^2}{2m} + \frac{1}{2}k|\mathbf{r}|^4$, where $\mathbf{p} = (p_x, p_y, p_z)$ is the displacement of the particle from its equilibrium position.

Hamiltonian of the form $H(\mathbf{q}, \mathbf{p}) = \frac{\mathbf{p}^2}{2m} + \lambda |\mathbf{q}|^4$, where $\mathbf{q} = (q_1, q_2, q_3)$ is the displacement of the particle from its mean position, $\mathbf{p} = (p_1, p_2, p_3)$ is its momentum, and m and λ are positive constants. The specific heat C_V of the system is given by

[Question ID = 10262]

1. $(3/4)Nk_B$
[Option ID = 41045]
2. $(3/2)Nk_B$
[Option ID = 41046]
3. $(5/2)Nk_B$
[Option ID = 41047]
4. $(9/4)Nk_B$
[Option ID = 41048]

26) Consider an isolated system of 3 non-interacting indistinguishable bosons in equilibrium. Each particle can be in any of three states, all non-degenerate, of energies 0, ϵ , and 2ϵ . If the total energy of the system is 3ϵ , its entropy is

[Question ID = 10263]

1. $k_B \ln 2$
[Option ID = 41049]
2. $k_B \ln 3$
[Option ID = 41050]
3. $k_B \ln 9$
[Option ID = 41051]
4. $k_B \ln 10$
[Option ID = 41052]

27) Consider two unbiased random walkers A & B moving independently in one dimension along x-axis. A starts at $x = 0$ and B starts at $x = -2$ at same point of time. Each of them takes steps of unit length at a time. What is the closest value of probability that A & B meet each other either at $x = 0$ or at $x = -2$ after each of them takes 6 steps?

[Question ID = 10264]

1. $90000 \times (1/2)^{24}$
[Option ID = 41053]
2. $800 \times (1/2)^{12}$
[Option ID = 41054]
3. $300 \times (1/2)^{12}$
[Option ID = 41055]
4. $600 \times (1/2)^{12}$
[Option ID = 41056]

28) Given a square in the phase space whose vertices are $(x, p) \equiv (0,0), (0,1), (1,0)$ and $(1,1)$. Consider 1D motion of a classical particle governed by the Hamiltonian $H = kp$ ($k = \text{constant}, k > 0$). After a time t the square

[Question ID = 10265]

1. Moves in the $+x$ direction and is distorted
[Option ID = 41057]
2. Moves in the $-x$ direction and remains undistorted
[Option ID = 41058]
3. Moves in the $+p$ direction and remains undistorted
[Option ID = 41059]
4. Moves in the $-p$ direction and is distorted
[Option ID = 41060]

29) An electron of rest mass-energy $mc^2 = 0.511$ MeV and total energy 10 MeV is made to collide with another electron at rest in the laboratory frame. The total energy W (in MeV) in the center-of-mass frame is

[Question ID = 10266]

1. Zero
[Option ID = 41061]
2. 3.28
[Option ID = 41062]
3. 10
[Option ID = 41063]
4. 10.511
[Option ID = 41064]

30) A particle of mass m and charge Q is accelerated from rest through a potential difference V . After this, it passes through a slit and enters a region where there is a uniform magnetic field B in a direction perpendicular to the direction of motion of the particle. After a time $\frac{\pi mc}{QB}$, the speed v of the particle and the distance d from the slit are (assuming non-relativistic motion)

[Question ID = 10267]

1. $v = \sqrt{\frac{2QV}{m}}$, $d = \frac{2mvc}{QB}$.

[Option ID = 41065]

2. $v = \sqrt{\frac{QV}{2m}}$, $d = \frac{mv^2}{2QB}$.

[Option ID = 41066]

3. $v = \sqrt{\frac{2QV}{m}}$, $d = \frac{mv}{QB}$.

[Option ID = 41067]

4. $v = \sqrt{\frac{QV}{m}}$, $d = \frac{mvc}{QB}$.

[Option ID = 41068]

31) A particle of charge q is released from rest in the laboratory to a region in which there is an electric field $\mathbf{E} = \alpha \hat{x} + 2\hat{y}$ and a magnetic field $\mathbf{B} = 3\alpha \hat{y} - \hat{z}$, where α is a non-negative constant. It is always possible to find a Lorentz frame in which the particle would follow a circular helical path, if

[Question ID = 10268]

1. $\alpha < \frac{\sqrt{3}}{8}$

[Option ID = 41069]

2. $\frac{\sqrt{3}}{8} \leq \alpha < \frac{\sqrt{3}}{4}$

[Option ID = 41070]

3. $\alpha > \sqrt{\frac{3}{8}}$

[Option ID = 41071]

4. $\frac{\sqrt{3}}{4} < \alpha \leq \sqrt{\frac{3}{8}}$

[Option ID = 41072]

32) Consider a gas of free electrons acting as a perfectly conducting fluid. For a finite current density $\mathbf{j}$, due to the motion of the electrons with drift velocity $\mathbf{v}$, the rate of variation of the magnetic field $\mathbf{B}$ with time would be given by

[Question ID = 10269]

1. $\nabla \times (\mathbf{v} \times \mathbf{B})$

[Option ID = 41073]

2. $\mathbf{j} \times [\mathbf{B} \times (\nabla \times \mathbf{v})]$

[Option ID = 41074]

3. $\nabla \times (\mathbf{j} \times \mathbf{B})$

[Option ID = 41075]

4. $\mathbf{v} \times [\mathbf{j} \times (\nabla \times \mathbf{B})]$

[Option ID = 41076]

33) In a Lorentz frame S , the electric and magnetic field vectors are given (in appropriate units) respectively as $\mathbf{E} = \hat{x} + 3\hat{y}$ and $\mathbf{B} = \sqrt{3}\hat{x} - 2\hat{z}$. In another Lorentz frame S' , the transformed field vectors, $\mathbf{E}'$ and $\mathbf{B}'$, would make an angle 30° between them, if

[Question ID = 10270]

1. $|\mathbf{E}'| = 1$, $|\mathbf{B}'| = \sqrt{2}$

[Option ID = 41077]

2. $|\mathbf{E}'| = 2$, $|\mathbf{B}'| = 1$

[Option ID = 41078]

3. $|\mathbf{E}'| = \sqrt{2}$, $|\mathbf{B}'| = \sqrt{2}$

[Option ID = 41079]

4. $|\mathbf{E}'| = 1$, $|\mathbf{B}'| = 2$

[Option ID = 41080]

34) Consider an isotropic but inhomogeneous medium, of conductivity σ and dielectric permittivity ϵ . In order that a stationary current flows in the medium, there needs to be a distribution of charge with density ρ related to the electric field $\mathbf{E}$ as

[Question ID = 10271]

1. $\rho = \mathbf{E} \cdot \nabla (\epsilon/\sigma)$

[Option ID = 41081]

2. $\rho = \mathbf{E} \cdot \nabla (\sigma/\epsilon)$

[Option ID = 41082]

3. $\rho = \mathbf{E} \cdot \frac{(\sigma \nabla \epsilon - \epsilon \nabla \sigma)}{\sigma}$

[Option ID = 41083]

4. $\rho = \mathbf{E} \cdot \frac{(\epsilon \nabla \sigma - \sigma \nabla \epsilon)}{\epsilon}$

[Option ID = 41084]

35) Consider a line of equidistant ions of R with alternative charges equal to $\pm q$. The potential energy in units of $\frac{q^2}{4\pi\epsilon_0}$ is

[Question ID = 10272]

1. $\log 2$

[Option ID = 41085]

2. $-2\log 2$

[Option ID = 41086]

3. $\log 3$

[Option ID = 41087]

4. $2\log 3$

[Option ID = 41088]

36) A Josephson junction consists of two superconductors separated by a very thin insulating layer. When a DC voltage of $1.5 \mu\text{V}$ is applied across the junction, an AC current is produced of frequency (in Hz) [Question ID = 10273]

1. 2.253×10^8 [Option ID = 41089]

2. 4.253×10^8 [Option ID = 41090]

3. 7.253×10^8 [Option ID = 41091]

4. 8.25×10^8 [Option ID = 41092]

37) The period of Bloch oscillation for a one-dimensional crystal having lattice period 'a' is

[Question ID = 10274]

1. $\frac{h}{2eaE}$

[Option ID = 41093]

2. $\frac{h}{eaE}$

[Option ID = 41094]

3. $\frac{3h}{2eaE}$

[Option ID = 41095]

4. $2 \frac{h}{eaE}$

[Option ID = 41096]

38) The intrinsic carrier concentration of Si at 300 K is 1.5×10^{16} atoms/ m^3 . If the sample is doped with 10^{23} phosphorous atoms/ m^3 , what is the position of Fermi level relative to the intrinsic level. (Boltzmann Const. $k = 8.62 \times 10^{-5} \text{ eV/K}$) [Question ID = 10275]

1. 0.406 eV, below E_F [Option ID = 41097]

2. 0.216 eV, below E_V [Option ID = 41098]

3. 0.406 eV, above E_F [Option ID = 41099]

4. 0.216 eV, above E_V [Option ID = 41100]

39) Linear packing fraction f_l of a crystal is defined as the fraction of length of a lattice line that is taken up by atoms. Consider two BCC and FCC monoatomic crystals made of atoms of same sizes. The ratio of the linear packing fractions f_l^{BCC}/f_l^{FCC} along the $\langle 111 \rangle$ direction is equal to

[Question ID = 10276]

1. $\frac{\sqrt{3}}{2}$

[Option ID = 41101]

2. $\frac{1}{\sqrt{2}}$

[Option ID = 41102]

3. $\frac{1}{\sqrt{6}}$

[Option ID = 41103]

4. $\sqrt{6}$

[Option ID = 41104]

40) The number of atoms (of radius r) per unit area of the plane (010) of a simple cubic crystal is[Question ID = 10277]

1. $1/4r^2$ [Option ID = 41105]
2. $1/8r^2$ [Option ID = 41106]
3. $1/2r^2$ [Option ID = 41107]
4. $1/3r^2$ [Option ID = 41108]

41) A pion at rest decays into a muon and a neutrino. Assuming mass of neutrino to be zero, the energy of the outgoing neutrino (E_ν) in terms of the mass of the pion (m_π) and the mass of the muon (m_μ) is

[Question ID = 10278]

1. $E_\nu = \frac{(m_\pi^2 - m_\mu^2)c^2}{m_\pi}$

[Option ID = 41109]

2. $E_\nu = \frac{(m_\pi^2 - m_\mu^2)c^2}{m_\mu}$

[Option ID = 41110]

3. $E_\nu = \frac{(m_\pi^2 - m_\mu^2)c^2}{2m_\pi}$

[Option ID = 41111]

4. $E_\nu = \frac{(m_\pi^2 - m_\mu^2)c^2}{2m_\mu}$

[Option ID = 41112]

42) In nuclear reactions the mass number, A, is typically conserved. This indirectly implies the conservation of[Question ID = 10279]

1. Charge [Option ID = 41113]
2. Baryon number [Option ID = 41114]
3. Energy [Option ID = 41115]
4. Mass [Option ID = 41116]

43) If an electron is confined within a nucleus whose diameter is 10^{-14} m, its minimum kinetic energy will be[Question ID = 10280]

1. 51 MeV [Option ID = 41117]
2. 56 MeV [Option ID = 41118]
3. 61 MeV [Option ID = 41119]
4. 66 MeV [Option ID = 41120]

44) A certain odd parity shell-model state can hold up to a maximum of 16 nucleons. The possible l and j value of such a state would be[Question ID = 10281]

1. l=4; j=7/2 [Option ID = 41121]
2. l=3; j=7/2 [Option ID = 41122]
3. l=4; j=9/2 [Option ID = 41123]
4. l=3; j=5/2 [Option ID = 41124]

45) $C^{14} \rightarrow N^{14} + e^- + \text{anti-neutrino}$ is an example of[Question ID = 10282]

1. Fermi Transition [Option ID = 41125]
2. Forbidden Transition [Option ID = 41126]
3. Mixed Transition [Option ID = 41127]
4. Gamow-Teller Transition [Option ID = 41128]

46) How many distinct spin orbitals can be constructed for a two electron system using the single electron spin orbitals “ α ” and “ β ”?

[Question ID = 10283]

1. 1

[Option ID = 41129]

2. 3

[Option ID = 41130]

3. 4

[Option ID = 41131]

4. 6

[Option ID = 41132]

- 47) The Na D-line is emitted on the transition from the excited level $3P_{1/2}$ ($\tau = 16$ ns) into the ground state $3S_{1/2}$ ($\tau = \infty$). The measured line width for this transition is 1.7 GHz with the central frequency of 5.1×10^{14} Hz. What factors contribute to the width of his line?

[Question ID = 10284]

1. Natural broadening and Doppler broadening

[Option ID = 41133]

2. Natural broadening only

[Option ID = 41134]

3. Doppler broadening only

[Option ID = 41135]

4. Instrumental resolution only

[Option ID = 41136]

48) The orbitals for the molecular configuration $\sigma^2\sigma$ is :[Question ID = 10285]

1. $2\Sigma^+$ [Option ID = 41137]
2. $3\Sigma^+$, $3\Sigma^-$ [Option ID = 41138]
3. $1\Sigma^+$ [Option ID = 41139]
4. $1\Sigma^-$ [Option ID = 41140]

49) The rotational constant of a lighter isotope of a molecule will be[Question ID = 10286]

1. same [Option ID = 41141]
2. smaller [Option ID = 41142]
3. higher [Option ID = 41143]
4. zero [Option ID = 41144]

50) If line broadening $\Delta\nu$ in a laser system is 500 Hz, the corresponding coherence length would be

[Question ID = 10287]

1. 6.0 cm

[Option ID = 41145]

2. 6.0 m

[Option ID = 41146]

3. 6 Km

[Option ID = 41147]

4. 600 Km

[Option ID = 41148]