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:

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

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

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

Ψ(x)=Nx(L− x) for 0<x<L =0

elsewhere

What are the values of <x> and <x^2 > ?

[Question ID = 10245]

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

[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

$\Psi(x)$=Acos(kx) + Bsin(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 Lx and y denote the x and y components of the angular momentum operator and the position operator, respectively, the value of the commutator, [Lx,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]

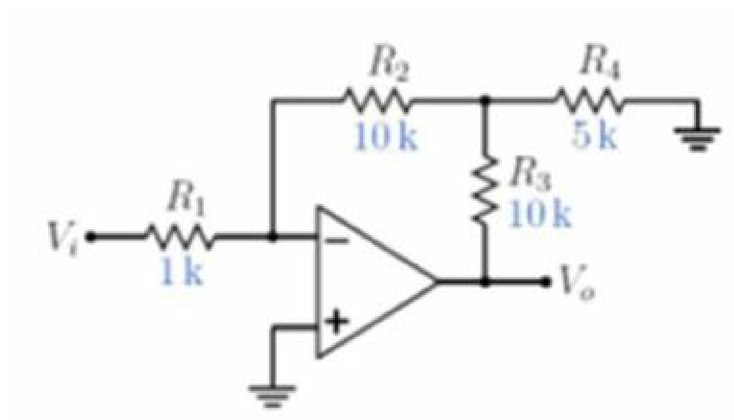
13) **For a silicon (ε_r=11.7) one-sided abrupt junction with $N_a = 10^{18}\ cm^{-3}$, $N_d = 10^{15}\ cm^{-3}$ ($N_a >> N_d$) and $n_i = 1.5 \times 10^{10}\ cm^{-3}$ the depletion layer width at T = 300 K is[Question ID = 10250]**
1. 0.259 µm [Option ID = 40997]
2. 0.493 µm [Option ID = 40998]
3. 0.987 µm [Option ID = 40999]
4. 1.21 µm [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 Ω, h_{re}= 2.5×10^{-4}, h_{fe}= 50 and h_{oe}= 25 µΩ. If the load and source resistance are 1k Ω, 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 µsec [Option ID = 41009]
2. 127 µsec [Option ID = 41010]
3. 8 µsec [Option ID = 41011]
4. 1 µsec [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 isonly 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 x 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 $H(\boldsymbol{q},\boldsymbol{p}) = \boldsymbol{p}^2/2m + \lambda|\boldsymbol{q}|$[illegible], where $\boldsymbol{q} = (q_1,q_2,q_3)$ is the displacement of the particle from its mean position, $\boldsymbol{p} = (p_1,p_2,p_3)$ 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 = 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 $\mathbf{B}$ 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 $E = \alpha\,\hat{x} + 2\,\hat{y}$ and a magnetic field $B = 3\alpha\,\hat{y} - \hat{z}$, 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 30^0 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. $|E'| = 1$, $|B'| = 2$

[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 E as

[Question ID = 10271]

1. $\varrho = \mathbf{E} \cdot \nabla (\varepsilon/\sigma)$

[Option ID = 41081]

2. $\varrho = \mathbf{E} \cdot \nabla (\sigma/\varepsilon)$

[Option ID = 41082]

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

[Option ID = 41083]

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

[Option ID = 41084]

35) Consider a line of equidistant ions of R with alternative charges equal to ±q. The potential energy in units of $\frac{q^2}{4\pi\varepsilon_0}$ is

[Question ID = 10272]

1. log2

[Option ID = 41085]

2. −2log2

[Option ID = 41086]

3. log3

[Option ID = 41087]

4. 2log3

[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 μV 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= 8.62×10^{-5} 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 <111> 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- + 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 $3P_{1/2}$ (τ = 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 x 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]