3D and Angular Momentum GATE

https://snboseplc.com/3d-and-angular-momentum-gate/

Q.No:1 GATE-2012

A particle of mass m is confined in a two dimensional square well potential of dimension a. This potential $V(x, y)$ is given by

$$\begin{cases} V(x,y) & = 0 \quad \text{for } -a < x < a \text{ and } -a < y < a \\ & = \infty \quad \text{elsewhere} \end{cases}$$

The energy of the first excited state for this particle is given by,

(A) $\frac{\pi^2\hbar^2}{ma^2}$

(B) $\frac{2\pi^2\hbar^2}{ma^2}$

(C) $\frac{5\pi^2\hbar^2}{2ma^2}$

(D) $\frac{4\pi^2\hbar^2}{ma^2}$

Q.No:2 GATE-2012

The ground state wavefunction for the hydrogen atom is given by $\psi_{100} = \frac{1}{\sqrt{4\pi}}\left(\frac{1}{a_0}\right)^{3/2} e^{-r/a_0}$, where a_0 is the Bohr radius.

The plot of the radial probability density, $P(r)$ for the hydrogen atom in the ground state is

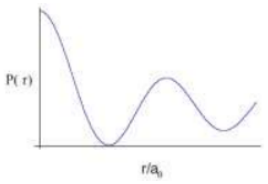


Figure 1: (A)

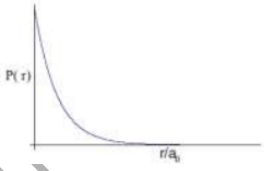


Figure 2: (B)

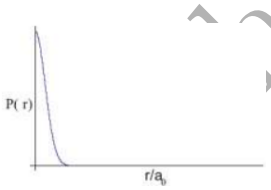


Figure 3: (C)

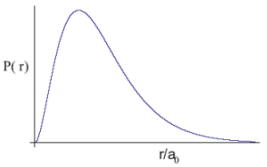


Figure 4: (D)

Q.No:3 GATE-2013

Which one of the following commutation relations is NOT CORRECT? Here, symbols have their usual meanings.

(A) $[L^2, L_z] = 0$

(B) $[L_x, L_y] = i\hbar L_z$

(C) $[L_z, L_+] = \hbar L_+$

(D) $[L_z, L_-] = \hbar L_-$

Q.No:4 GATE-2013

A proton is confined to a cubic box, whose sides have length $10^{-12}m$. What is the minimum kinetic energy of the proton? The mass of proton is $1.67 \times 10^{-27}kg$ and Planck's constant is $6.63 \times 10^{-34}Js$.

(A) $1.1 \times 10^{-17}J$

(B) $3.3 \times 10^{-17}J$

(C) $9.9 \times 10^{-17}J$

(D) $6.6 \times 10^{-17}J$

Q.No:5 GATE-2013

A spin-half particle is in a linear superposition $0.8|\uparrow\rangle + 0.6|\downarrow\rangle$ of its spin-up and spin-down states. If $|\uparrow\rangle$ and $|\downarrow\rangle$ are the eigenstates of σ_z then what is the expectation value, up to one decimal place, of the operator $10\sigma_z + 5\sigma_x$? Here, symbols have their usual meanings.

Q.No:6 GATE-2013

Consider the wave function $Ae^{ikr}(r_0/r)$, where A is the normalization constant. For $r = 2r_0$, the magnitude of probability current density up to two decimal places, in units of $(A^2\hbar k/m)$, is ---------.

Q.No:7 GATE-2014

An electron in the ground state of the hydrogen atom has the wave function

$$\Psi(\vec{r}) = \frac{1}{\sqrt{\pi a_0^3}} e^{-(r/a_0)}$$

where a_0 is constant. The expectation value of the operator $\hat{Q} = z^2 - r^2$, where $z = r\cos\theta$ is (Hint: $\int_0^\infty e^{-\alpha r} r^n dr = \frac{\Gamma(n)}{a^{n+1}} = \frac{(n-1)!}{a^{n+1}}$)

(A) $-a_0^2/2$

(B) $-a_0^2$

(C) $-3a_0^2/2$

(D) $-2a_0^2$

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Q.No:8 GATE-2014

A particle of mass m is subjected to a potential,

$$V(x,y) = \frac{1}{2}m\omega^2(x^2+y^2), -\infty \leq x \leq \infty, -\infty \leq y \leq \infty$$

The state with energy $4\hbar\omega$ is g-fold degenerate. The value of g is _____.

Q.No:9 GATE-2014

A hydrogen atom is in the state

$$\Psi = \sqrt{\frac{8}{21}}\psi_{200} - \sqrt{\frac{3}{7}}\psi_{310} + \sqrt{\frac{4}{21}}\psi_{321},$$

where n, l, m in ψ_{nlm} denote the principal, orbital and magnetic quantum numbers, respectively. If $\vec{L}$ is the angular momentum operator, the average value of L^2 is _____ $\hbar^2$.

Q.No:10 GATE-2014

If L_+ and L_- are the angular momentum ladder operators, then, the expectation value of $(L_+L_- + L_-L_+)$, in the state $|l=1, m=1\rangle$ of an atom is _____ $\hbar^2$.

Q.No:11 GATE-2015

Let $\vec{L}$ and $\vec{p}$ be the angular and linear momentum operators, respectively, for a particle. The commutator $[L_x, p_y]$ gives

(A) $-i\hbar p_z$

(B) 0

(C) $i\hbar p_x$

(D) $i\hbar p_z$

Q.No:12 GATE-2015

An operator for a spin-1/2 particle is given by $\hat{A} = \lambda\vec{\sigma}\cdot\vec{B}$, where $\vec{B} = \frac{B}{\sqrt{2}}(\hat{x}+\hat{y})$, $\vec{\sigma}$ denotes Pauli matrices and λ is a constant. The eigenvalues of $\hat{A}$ are

(A) $\pm\lambda B/\sqrt{2}$

(B) $\pm\lambda B$

(C) $0, \lambda B$

(D) $0, -\lambda B$

Q.No:13 GATE-2016

σ_x, σ_y and σ_z are the Pauli matrices. The expression $2\sigma_x\sigma_y + \sigma_y\sigma_x$ is equal to

(A) $-3i\sigma_z$

(B) $-i\sigma_z$

(C) $i\sigma_z$

(D) $3i\sigma_z$

Q.No:14 GATE-2016

Let $|l, m\rangle$ be the simultaneous eigenstates of L^2 and L_z. Here $\vec{L}$ is the angular momentum operator with Cartesian components (L_x, L_y, L_z), l is the angular momentum quantum number and m is the azimuthal quantum number. The value of $\langle 1, 0|(L_x + iL_y)|1, -1\rangle$ is

(A) 0

(B) $\hbar$

(C) $\sqrt{2}\hbar$

(D) $\sqrt{3}\hbar$

Q.No:15 GATE-2017

The wavefunction of which orbital is spherically symmetric:

(A) p_x

(B) p_y

(C) s

(D) d_{xy}

Q.No:16 GATE-2017

For the Hamiltonian $H = a_0 I + \vec{b}.\vec{\sigma}$ where $a_0 \in R$, $\vec{b}$ is a real vector, I is the 2×2 identity matrix, and $\vec{\sigma}$ are the Pauli matrices, the ground state energy is

(A) $|b|$

(B) $2a_0 - |b|$

(C) $a_0 - |b|$

(D) a_0

Q.No:17 GATE-2017

The degeneracy of the third energy level of a 3-dimensional isotropic quantum harmonic oscillator is

(A) 6

(B) 12

(C) 8

(D) 10

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Q.No:18 GATE-2018

Which one of the following represents the $3p$ radial wave function of hydrogen atom? (a_0 is the Bohr radius)

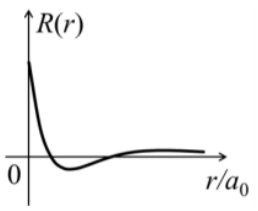


Figure 5: (A)

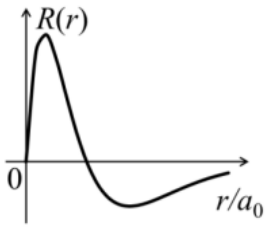


Figure 6: (B)

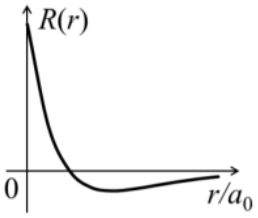


Figure 7: (C)

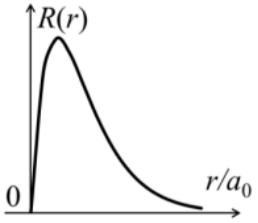


Figure 8: (D)

Q.No:19 GATE-2019

The Hamiltonian for a quantum harmonic oscillator of mass m in three dimensions is

$$H = \frac{p^2}{2m} + \frac{1}{2}m\omega^2 r^2$$

where ω is the angular frequency. The expectation value of r^2 in the first excited state of the oscillator in units of $\frac{\hbar}{m\omega}$ (rounded off to one decimal place) is _____.

Q.No:20 GATE-2019

Electrons with spin in the z-direction ($\hat{z}$) are passed through a Stern-Gerlach (SG) set up with the magnetic field at $\theta = 60^\circ$ from $\hat{z}$. The fraction of electrons that will emerge with their spin parallel to the magnetic field in the SG set up (rounded off to two decimal places) is _____.

$$\left[\sigma_x = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}, \sigma_y = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}, \sigma_z = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}\right]$$

Q.No:21 GATE-2020

$\hat{S}_x$ denotes the spin operator defined as $\hat{S}_x = \frac{\hbar}{2}\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$. Which one of the following is correct?

(A) The eigenstates of spin operator $\hat{S}_x$ are $|\uparrow\rangle_x \equiv \begin{pmatrix} 1 \\ 0 \end{pmatrix}$ and $|\downarrow\rangle_x \equiv \begin{pmatrix} 0 \\ 1 \end{pmatrix}$

(B) The eigenstates of spin operator $\hat{S}_x$ are $|\uparrow\rangle_x \equiv \frac{1}{\sqrt{2}}\begin{pmatrix} 1 \\ -1 \end{pmatrix}$ and $|\uparrow\rangle_x \equiv \frac{1}{\sqrt{2}}\begin{pmatrix} 1 \\ 1 \end{pmatrix}$

(C) In the spin state $\frac{1}{2}\begin{pmatrix} 1 \\ \sqrt{3} \end{pmatrix}$, upon the measurement of $\hat{S}_x$, the probability for obtaining $|\uparrow\rangle_x$ is $\frac{1}{4}$

(D) In the spin state $\frac{1}{2}\begin{pmatrix} 1 \\ \sqrt{3} \end{pmatrix}$, upon the measurement of $\hat{S}_x$, the probability for obtaining $|\uparrow\rangle_x$ is $\frac{2+\sqrt{3}}{4}$

Q.No:22 GATE-2020

The radial wave function of a particle in a central potential is given by $R(r) = A\frac{r}{a}\exp\left(-\frac{r}{2a}\right)$, where A is the normalization constant and a is positive constant of suitable dimensions. If γa is the most probable distance of the particle from the force center, the value of γ is _____.

Q.No:23 GATE-2020

A free particle of mass M is located in a three-dimensional cubic potential well with impenetrable walls. The degeneracy of the fifth excited state of the particle is _____.

Q.No:24 GATE-2020

An electron in a hydrogen atom is in the state $n = 3, l = 2, m = -2$. Let $\hat{L}_y$ denote the y-component of the orbital angular momentum operator. If $(\Delta\hat{L}_y)^2 = \alpha\hbar^2$, the value of α is _____.

Q.No:25 GATE-2021

Consider a spin $S = \hbar/2$ particle in the state $|\phi\rangle = \frac{1}{3}\begin{pmatrix} 2+i \\ 2 \end{pmatrix}$. The probability that a measurement finds the state with $S_x = +\hbar/2$ is

(A) 5/18

(B) 11/18

(C) 15/18

(D) 17/18

Q.No:26 GATE-2021

The normalized radial wave function of the second excited state of hydrogen atom is

$$R(r) = \frac{1}{\sqrt{24}}a^{-3/2}\frac{r}{a}e^{-r/2a}$$

where a is the Bohr radius and r is the distance from the center of the atom. The distance at which the electron

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is most likely to be found is $y \times a$. The value of y (in integer) is _____.

Q.No:27 GATE-2022

From the pairs of operators given below, identify the ones which commute. Here l and j correspond to the orbital angular momentum and the total angular momentum, respectively.

(a) l^2, j^2

(b) j^2, j_Z

(c) j^2, l_Z

(d) l_Z, j_Z

Q.No:28 GATE-2022

Pauli spin matrices satisfy

(a) $\sigma_\alpha\sigma_\beta - \sigma_\beta\sigma_\alpha = i\epsilon_{\alpha\beta\gamma}\sigma_\gamma$

(b) $\sigma_\alpha\sigma_\beta - \sigma_\beta\sigma_\alpha = 2i\epsilon_{\alpha\beta\gamma}\sigma_\gamma$

(c) $\sigma_\alpha\sigma_\beta + \sigma_\beta\sigma_\alpha = \epsilon_{\alpha\beta\gamma}\sigma_\gamma$

(d) $\sigma_\alpha\sigma_\beta + \sigma_\beta\sigma_\alpha = 2\delta_{\alpha\beta}$

Q.No:29 GATE-2022

In cylindrical coordinates (s, φ, z), which of the following is a Hermitian operator?

(a) $\frac{1}{i}\frac{\partial}{\partial s}$

(b) $\frac{1}{i}\left(\frac{\partial}{\partial s} + \frac{1}{s}\right)$

(c) $\frac{1}{i}\left(\frac{\partial}{\partial s} + \frac{1}{2s}\right)$

(d) $\left(\frac{\partial}{\partial s} + \frac{1}{s}\right)$

Q.No:30 GATE-2022

A particle of mass m is moving inside a hollow spherical shell of radius r so that the potential is

$$V(r) = \begin{cases} 0 & \text{for } r < a \\ \infty & \text{for } r \geq a \end{cases}$$

The ground state energy and wavefunction of the particle are E_0 and $R(r)$, respectively. Then which of the following options are correct?

(a) $E_0 = \frac{\hbar^2\pi^2}{2ma^2}$

(b) $-\frac{\hbar^2}{2m}\frac{1}{r^2}\frac{d}{dr}\left(r^2\frac{dR}{dr}\right) = E_0 R \ (r < a)$

(c) $-\frac{\hbar^2}{2m}\frac{1}{r^2}\frac{d^2R}{dr^2} = E_0 R \ (r < a)$

(d) $R(r) = \frac{1}{r}\sin\left(\frac{\pi r}{a}\right) \ (r < a)$

Q.No:31 GATE-2023

H is the Hamiltonian,$\vec{L}$ the orbital angular momentum and L_Z, $z-$component of $\vec{L}$. The 1-S state of the hydrogen atom in the non-relativistic formalism is an eigen function of which one of the following sets of operators?

(A) H, L^2 and L_Z

(B) $H, \vec{L}, L^2$ and L_z

(C) L^2 and L_Z only

(D) H and L_Z only

Q.No:32 GATE-2023

An atom with non-zero magnetic moment has an angular momentum of magnitude $\sqrt{12}\,\hbar$. When a beam of such atoms is passed through a Stern-Gerlach apparatus, how many beams does it split into?

(A) 3

(B) 7

(C) 9

(D) 25

Q.No:33 GATE-2023

In the vector model of angular momentum applied to atoms, what is the minimum angle in degrees (in integer) made by the orbital angular momentum vector and the positive z axis for a $2p$ electron?

Q.No:34 GATE-2023

A particle has wavefunction

$$\psi(x, y, z) = N\, z\, e^{-\alpha(x^2+y^2+z^2)},$$

where N is a normalization constant and α is a positive constant. In this state, which one of the following options represents the eigenvalues of L^2 and L_Z respectively?

Some values of Y_ℓ^m are :

$Y_0^0 = \sqrt{\frac{1}{4\pi}}, Y_1^0 = \sqrt{\frac{3}{4\pi}}\cos\theta, Y_1^{\pm 1} = \sqrt{\frac{3}{8\pi}}\sin\theta\, e^{\pm i\phi}$

(A) 0 and 0

(B) $\hbar^2$ and $-\hbar$

(C) $2\hbar^2$ and 0

(D) $\hbar^2$ and $\hbar$

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Q.No:35 GATE-2023

A spin $\frac{1}{2}$ particle is in a spin up state along the x-axis (with unit vector $\hat{x}$) and is denoted as $|\frac{1}{2}, \frac{1}{2}\rangle_x$. What is the probability of finding the particle to be in a spin up state along the direction $\hat{x}'$, which lies in the xy- plane and makes an angle θ with respect to the positive x-axis, if such a measurement is made?

(A) $\frac{1}{2}\cos^2\frac{\theta}{4}$

(B) $\cos^2\frac{\theta}{4}$

(C) $\frac{1}{2}\cos^2\frac{\theta}{2}$

(D) $\cos^2\frac{\theta}{2}$

Q.No:36 GATE-2023

Consider a particle in a two dimensional infinite square well potential of side L, with $0 \le x \le L$ and $0 \le y \le L$. The wavefunction of the particle is zero only along the line $y = \frac{L}{2}$, apart from the boundaries of the well. If the energy of the particle in this state is E, what is the energy of the ground state?

(A) $\frac{1}{4}E$

(B) $\frac{2}{5}E$

(C) $\frac{3}{8}E$

(D) $\frac{1}{2}E$

Q.No:37 GATE-2024

An electron in the Coulomb field of a proton is in the following state of coherent superposition of orthonormal states ψ_{nlm}:

$$\Psi = \frac{1}{3}\psi_{100} + \frac{1}{\sqrt{3}}\psi_{210} - \frac{\sqrt{5}}{3}\psi_{320}$$

Let E_1, E_2, and E_3 represent the first three energy levels of the system. A sequence of measurements is done on the same system at different times. Energy is measured first at time t_1 and the outcome is E_2. Then total angular momentum is measured at time $t_2 > t_1$ and finally energy is measured again at $t_3 > t_2$. The probability of finding the system in a state with energy E_2 after the final measurement is $P/9$. The value of P is _____ (in integer).

Q.No:38 GATE-2025

Two projectile protons P_1 and P_2, both with spin up (along the $+z$ direction), are scattered from another fixed target proton T with spin up at rest in the xy plane, as shown in the figure. They scatter one at a time. The nuclear interaction potential between both the projectiles and the target proton is $\lambda \vec{L} \cdot \vec{S}$, where $\vec{L}$ is the orbital angular momentum of the system with respect to the target, $\vec{S}$ is the spin angular momentum of the system, and λ is a negative constant in appropriate units. Which one of the following is correct?

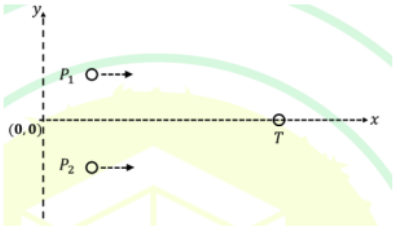


Figure 9: Scattering setup diagram

(A) P_1 will be scattered in the $+y$ direction (upward) and P_2 will be scattered in the $-y$ direction (downward)

(B) P_1 will be scattered in the $+y$ direction (upward) and P_2 will be scattered in the $+y$ direction (upward)

(C) P_1 will be scattered in the $-y$ direction (downward) and P_2 will be scattered in the $+y$ direction (upward)

(D) P_1 will be scattered in the $-y$ direction (downward) and P_2 will be scattered in the $-y$ direction (downward)

Q.No:39 GATE-2025

An electron with mass m and charge q is in the spin-up state

$$\begin{pmatrix}1\\0\end{pmatrix}$$

at time $t = 0$. A constant magnetic field is applied along the y-axis, $B = B_0\,\hat{j}$, where B_0 is a constant. The Hamiltonian of the system is

$$H = -\hbar\omega\sigma_y, \qquad \omega = \frac{qB_0}{2m} > 0, \qquad \sigma_y = \begin{pmatrix}0 & -i\\ i & 0\end{pmatrix}$$

The minimum time after which the electron will be in the spin-down state along the x-axis, i.e.

$$\frac{1}{\sqrt{2}}\begin{pmatrix}1\\-1\end{pmatrix},$$

is

(A) $\frac{\pi}{8\omega}$

(B) $\frac{\pi}{4\omega}$

(C) $\frac{\pi}{2\omega}$

(D) $\frac{\pi}{\omega}$

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Q.No:40 GATE-2025

A system of three non-identical spin–$\frac{1}{2}$ particles has the Hamiltonian

$$H = \frac{A}{\hbar^2}\,(\vec{S}_1 + \vec{S}_2)\cdot\vec{S}_3,$$

where $\vec{S}_1$, $\vec{S}_2$, and $\vec{S}_3$ are the spin operators of particles labelled 1, 2 and 3 respectively, and A is a constant with appropriate dimensions. The set of possible energy eigenvalues of the system is

(A) $0,\ \frac{A}{2},\ -A$

(B) $0,\ \frac{A}{2},\ -\frac{A}{2}$

(C) $0,\ \frac{3A}{2},\ -\frac{A}{2}$

(D) $0,\ -\frac{3A}{2},\ \frac{A}{2}$

Q.No:41 GATE-2026

Given

$$|v_1\rangle = \frac{1}{\sqrt{2}}\begin{pmatrix}1\\ i\end{pmatrix} \quad \text{and} \quad |v_2\rangle = \frac{1}{\sqrt{2}}\begin{pmatrix}1\\ -i\end{pmatrix},$$

the tensor product $|v_1\rangle \otimes |v_2\rangle$ is

(A) $\frac{1}{2}\begin{pmatrix}1\\ -i\\ i\\ 1\end{pmatrix}$

(B) $\frac{1}{2}\begin{pmatrix}1\\ i\\ -i\\ 1\end{pmatrix}$

(C) $\frac{1}{2}\begin{pmatrix}1 & i\\ i & -1\end{pmatrix}$

(D) $\frac{1}{2}\begin{pmatrix}1 & i\\ -i & 1\end{pmatrix}$

Q.No:42 GATE-2026

Consider an electron in the energy eigenstate $\psi_{211}(\vec{r})$ of the hydrogen atom. Given that the radial probability distribution of the electron in such a state takes its maximum value at $r = n_0 a$, where a is the Bohr radius, and n_0 is an integer. The value of n_0 (in integer) is _____.

The radial part of the wavefunction $\psi_{211}(\vec{r})$ is given by

$$R_{21}(r) = \frac{1}{\sqrt{24a^5}} r e^{-r/2a}.$$

Q.No:43 GATE-2026

Consider the Pauli matrices

$$\sigma_x = \begin{pmatrix}0 & 1\\ 1 & 0\end{pmatrix}, \quad \sigma_y = \begin{pmatrix}0 & -i\\ i & 0\end{pmatrix}, \quad \sigma_z = \begin{pmatrix}1 & 0\\ 0 & -1\end{pmatrix}.$$

The value of

$$\mathrm{Tr}(\sigma_z[\sigma_x, \sigma_y])$$

is

(A) $2i$

(B) i

(C) $4i$

(D) $\frac{i}{2}$

Q.No:44 GATE-2026

Consider two particles with angular momenta

$$j_1 = 2\hbar \quad \text{and} \quad j_2 = \frac{\hbar}{2}.$$

If the expression

$$|j = 5/2, m = 3/2\rangle = \begin{cases} c_1|j_1 = 2,\ m_1 = 1\rangle|j_2 = 1/2,\ m_2 = 1/2\rangle + \\ c_2|j_1 = 2,\ m_1 = 2\rangle|j_2 = 1/2,\ m_2 = -1/2\rangle \end{cases}$$

gives an eigenstate of the total angular momentum of the two particles, using standard notation.

Hint: $\hat{J}_\pm|j, m\rangle = \sqrt{j(j+1) - m(m\pm 1)}|j, m\pm 1\rangle$

Which of the following is true?

(A) $c_1 = \frac{2}{\sqrt{5}}, \quad c_2 = \frac{1}{\sqrt{5}}$

(B) $c_1 = \frac{1}{\sqrt{5}}, \quad c_2 = \frac{2}{\sqrt{5}}$

(C) $c_1 = \frac{1}{\sqrt{2}}, \quad c_2 = \frac{1}{\sqrt{2}}$

(D) $c_1 = 0, \quad c_2 = 1$

Q.No:45 GATE-2026

The energy E and degeneracy d of the second excited state of a three-dimensional, isotropic quantum harmonic oscillator with angular frequency ω are

(A) $E = \frac{7}{2}\hbar\omega, \quad d = 6$

(B) $E = \frac{7}{2}\hbar\omega, \quad d = 3$

(C) $E = \frac{5}{2}\hbar\omega, \quad d = 3$

(D) $E = \frac{5}{2}\hbar\omega, \quad d = 6$

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Question No.	Entrance with year	Answer
1	GATE-2012	-
2	GATE-2012	Option D
3	GATE-2013	Option D
4	GATE-2013	Option C
5	GATE-2013	7.6
6	GATE-2013	0.25
7	GATE-2014	Option D
8	GATE-2014	3.99-4.01
9	GATE-2014	1.99-2.01
10	GATE-2014	1.99-2.01
11	GATE-2015	Option D
12	GATE-2015	Option B
13	GATE-2016	Option C
14	GATE-2016	Option C
15	GATE-2017	Option C
16	GATE-2017	Option C
17	GATE-2017	Option A
18	GATE-2018	Option B
19	GATE-2019	2.5
20	GATE-2019	0.75
21	GATE-2020	Option D
22	GATE-2020	4
23	GATE-2020	6
24	GATE-2020	1
25	GATE-2021	Option D
26	GATE-2021	4
27	GATE-2022	Option a,b,d
28	GATE-2022	Option b,d
29	GATE-2022	Option c
30	GATE-2022	Option a,b,d
31	GATE-2023	Option A
32	GATE-2023	Option B
33	GATE-2023	45
34	GATE-2023	Option C
35	GATE-2023	Option D
36	GATE-2023	Option B
37	GATE-2024	9
38	GATE-2025	Option B
39	GATE-2025	Option B
40	GATE-2025	Option A
41	GATE-2026	Option A
42	GATE-2026	4
43	GATE-2026	Option C
44	GATE-2026	Option A
45	GATE-2026	Option A

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