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Courses » Chemistry - II Announcements **Course** Ask a Question Progress Mentor

Unit 3 - Week 2

Course outline

How to access the portal

Week 1

Week 2

- Lecture 6 : Introduction to quantum mechanics I
- Lecture 7 : Introduction to quantum mechanics II
- Lecture 8 : Born-Oppenheimer approximation
- Lecture 9 : Beer-Lambert law
- Quiz : Assessment 3
- Quiz : Assessment 4

Week 3

Week 4

Week 5

Week 6

Week 7

Week 8

Assessment 4

The due date for submitting this assignment has passed. **Due on 2016-03-18, 23:59 IST.**

Submitted assignment

1) The degeneracy of the energy level $E = \frac{65h^2}{8mL^2}$ for a particle in a two dimensional square box is ***1 point***

- 1
- 2
- 3
- 4

No, the answer is incorrect.
Score: 0

Accepted Answers:
4

2) The correct energy level expression for a particle in a two dimensional potential-free rectangular box with sides L_1 and L_2 is ***1 point***

- $E_{n_1 n_2} = \frac{h^2}{8mL^2}(n_1^2 + n_2^2); L = \frac{1}{2}(L_1 + L_2)$
- $E_{n_1 n_2} = \frac{h^2}{8mL_1L_2}(n_1^2 + n_2^2)$
- $E_{n_1 n_2} = \frac{h^2}{8m(L_1^2+L_2^2)}(n_1^2 + n_2^2)$
- $E_{n_1 n_2} = \frac{h^2}{8m}(\frac{n_1^2}{L_1^2} + \frac{n_2^2}{L_2^2})$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$E_{n_1 n_2} = \frac{h^2}{8m}(\frac{n_1^2}{L_1^2} + \frac{n_2^2}{L_2^2})$

3) The probability that a particle in a two dimensional square box of length L be found in the area enclosed by x=0 and L/2 and y=0 and L is ***1 point***

- 1/4
- 1/2
- 1/8
- 1

No, the answer is incorrect.
Score: 0

Accepted Answers:
1/2

4) A rectangular box has sides L_1 and L_4 designated as x and y directions respectively. The total energy of the particle is $\frac{5h^2}{8mL_1^2}$. The degeneracy of the state is *1 point*

- 1
- 2
- 3
- 4

No, the answer is incorrect.
Score: 0

Accepted Answers:
2

5) The number of nodal lines for a particle in a two dimensional box with the energy $E_{n_1 n_2}(i.e.\,\psi_{n_1 n_2}(x, y) = 0)$ is *1 point*

- n_1
- n_2
- $n_1 + n_2$
- $n_1 + n_2 - 2$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$n_1 + n_2 - 2$

6) For a particle of mass m in a three dimensional cubic box of side L, the energy level expression requires specification of three quantum n_1, n_2, and n_3. Also the expression for the quantized energy is $E_{n_1 n_2 n_3} = \frac{h^2}{8mL^2}\,(n_1^2 + n_2^2 + n_3^2)$. The lowest energy is thus $\frac{3h^2}{8mL^2}$. The number of distinct quantum states available for $E \leq \frac{6h^2}{8mL^2}$ is *1 point*

- 1
- 2
- 3
- 4

No, the answer is incorrect.
Score: 0

Accepted Answers:
4

7) The thermal de Broglie wavelength associated with a particle of mass m is given by $\sqrt{\frac{h^2}{2\pi m k_B T}}$. At thermal energy corresponding room temperature for an electron $(k_B T \simeq 4 \times 10^{-17} J)$ whose mass is about 9.31×10^{-31} kg, the wavelength is of the order of *1 point*

- An Angstrom (10^{-10} m)
- A micrometer
- A milimeter
- A meter

No, the answer is incorrect.
Score: 0

Accepted Answers:
An Angstrom (10^{-10} m)

8) Assume one hydrogen molecule to be present in a cubic three dimensional box of side 1 micron at a temperature of 300K. Its thermal energy is $\frac{5}{2}\,k_B T$. The approximate value for the quantum number $n = \sqrt{n_1^2 + n_2^2 + n_3^2}$ is found to be (mass of the hydrogen molecule is 3.4 x 10^{-27} kg, k_B = 1.38 x 10^{-23} J.K^{-1}) **1 point**

- 25000
- 2500
- 250
- 25

No, the answer is incorrect.
Score: 0

Accepted Answers:
25000

9) An arbitrary state of a particle in a two dimensional square box of length L is given by $\psi(x, y) = cxy(L - x)(L - y)$. The normalization constant c is given by (dimensional argument is helpful) **1 point**

- $\frac{30}{L^2}$
- $\frac{30}{L^4}$
- $\frac{30}{L^{9/2}}$
- $\frac{30}{L^{5/2}}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{30}{L^{9/2}}$

10) A wave function of a particle in a two dimensional box is given as $\psi(x, y) = c(L - x)(L - y)$. This wave function is not acceptable as correct because **1 point**

- It can not be normalized.
- The normalization constant is zero.
- The wave function does not go to zero inside the box.
- The wave function does not satisfy the boundary conditions.

No, the answer is incorrect.
Score: 0

Accepted Answers:
The wave function does not satisfy the boundary conditions.

Previous Page End