Assignment 4

The due date for submitting this assignment has passed. As per our records you have not submitted this assignment. Due on 2018-09-05, 23:59 IST.

1) A particle of mass $m$ moving in a circle of radius $r$ and having an angular velocity $\omega$ has the kinetic energy given by:

- $\frac{1}{2} mr^2$
- $\frac{1}{2} mr^2 \omega$
- $\frac{1}{2} mr^2 \omega^2$
- $\frac{1}{2mr^2} \omega^2$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{1}{2} mr^2 \omega^2$

2) The angular momentum operator used to define the rotational kinetic energy Hamiltonian is given by

- $i \hbar \frac{\partial}{\partial \phi}$
- $- i \hbar \frac{\partial}{\partial \phi}$
- $- \hbar^2 \frac{\partial^2}{\partial \phi^2}$
- $- \hbar^2 \frac{\partial^2}{\partial \phi^2}$

No, the answer is incorrect.
3) For the polar coordinate system employed to solve the Schrödinger equation for a particle on a ring, the polar coordinate \( \phi \) has the following range:

- \( 0 \leq \phi \leq \pi \)
- \( 0 \leq \phi \leq 4\pi \)
- \( 0 \leq \phi \leq 2\pi \)
- \( 0 \leq \phi \leq \infty \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
- \( 0 \leq \phi \leq 2\pi \)

4) The integral \( \int_{0}^{2\pi} e^\frac{i}{\pi} d\phi \) for has the value

- \( \pi \)
- \( 2\pi \)
- \( i \)
- \( 4i \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
- \( 4i \)

5) The eigenfunction of the rotational kinetic energy operator \( \frac{\hbar^2}{2I} \frac{\partial^2}{\partial \phi^2} \) among the following

- \( \cos^3 \phi \)
- \( \sin^2 \phi \)
- \( \sin \phi \cos \phi \)
- \( \cos^3 \phi + \sin^3 \phi \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
- \( \sin \phi \cos \phi \)

6) The expectation value for the angular momentum operator for the wave function

\[ \psi(\phi) = \frac{1}{\sqrt{2\pi}} (e^{im\phi} + e^{-im\phi}) \]

is
7) The expectation value for the angular momentum operator for the wave function $\psi(\phi) = \frac{1}{2\sqrt{\beta}} \left( e^{im\phi} - e^{-im\phi} \right)$ is

- $0$
- $2m$
- $-2m$
- $2im\hbar$

No, the answer is incorrect.
Score: 0
Accepted Answers: 0

8) The normalization constant $N$ for the wave function $\psi(\phi) = N(Xe^{2i\phi} + Ye^{-2i\phi})$ is

- $X + Y$
- $X - Y$
- $\frac{1}{\sqrt{2\pi\left(|Y|^2 + |X|^2\right)}}$
- $\frac{1}{\sqrt{2\pi\left(|X|^2 - |Y|^2\right)}}$

No, the answer is incorrect.
Score: 0
Accepted Answers:

9) The expectation value for the angle $\phi$ for the wave function $\psi(\phi) = (Ae^{im\phi})$, where $A$ the normalization constant, is

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No, the answer is incorrect.
Score: 0
Accepted Answers: 0
10) The expectation value for the energy operator $-\frac{\hbar^2}{2I} \frac{\partial^2}{\partial \phi^2}$ for a particle on a ring with the wave function $\psi(\phi) = \frac{1}{\sqrt{2\pi}} (e^{i m \phi} - e^{-i m \phi})$ is

$$\frac{m \hbar}{2\pi}$$

$$2|A|^2 \pi^2$$

$$\pi$$

$$4\pi$$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$2|A|^2 \pi^2$

11) The moment of inertia of a rotating disc is $3 \times 10^5 \text{ kg.m}^2$. At room temperature $T=300 \text{ K}$, the rotational quantum number associated with the disc assuming one dimensional motion is

$$\frac{\hbar^2 m^2}{2I}$$

$m\hbar$

$-m\hbar$

$0$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\frac{\hbar^2 m^2}{2I}$

12) In polar coordinates $(r, \theta)$, the derivative $\frac{\partial}{\partial x}$ of a function $x^4y^2$ is

$r^4 \cos^4 \theta$
\[ r^2 \sin^2 \theta \]

\[ r^4 \cos^4 \theta \sin^2 \theta \]

\[ 4r^5 \cos^3 \theta \sin^2 \theta \]

No, the answer is incorrect.
Score: 0
Accepted Answers:

The coordinate system \((x', y')\) is expressed in terms of another Cartesian system \((x, y)\) and a rotation angle \(\theta\) as
\[ x' = x \cos \theta + y \sin \theta \]
\[ y' = -x \sin \theta + y \cos \theta \]
The area element \(dA\) is given by
\[ \sin \theta \cos \theta \, dx \, dy \]
\[ \sin \theta \, \cos \theta \, dx \, dy \]
\[ dx \, dy \]
\[ \left( \cos^2 \theta - \sin^2 \theta \right) dx \, dy \]

No, the answer is incorrect.
Score: 0
Accepted Answers:

The area element \(dA\) is given by
\[ dx \, dy \]

No, the answer is incorrect.
Score: 0
Accepted Answers: