

Unit 3 - Week 1 - Introduction

Course outline

How to access the portal

Week - 0

Week 1 - Introduction

- Lecture 01 - Introduction : Motivation & Overview
- Lecture 02 - Introduction : Technical Details
- Lecture 03 - Introduction : Basic tools

Quiz : Assignment - 1

Assignment - 1 Solution

Week 1 - Feedback Form

Week 2 - Glimpse of Quantum Informatics

Week 3 - Quantum Algorithms

Week 4 - NMR Quantum Computing

Week 5 - Critical optical tool for QC " LASERS "

Week 6 - Linear Optical approach towards Quantum Computing

Week 7 - Approaches other than Linear approaches to " QIQC "

Week - 8 Implementing QC using Ion Traps and revisiting concepts

Week 9 - Various Aspects of Qubits in Action

Week 10 - Justifying Implementation Aspects from the Basics

Week 11 - Importance of Density Matrix in Quantum Computing Implementation

Week - 12 - An Overview of the Implementation of Quantum Computing

Assignment - 1

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2019-08-14, 23:59 IST.

1) Let a ball of mass 1g confined to a one-dimensional box of length 0.1m moves with a velocity of 0.01 m/s. If we calculate its quantum number n and the separation of consecutive energy levels (ΔE), we find: 1 point

- $n = 3 \times 10^{27}, \Delta E = 3.3 \times 10^{-35} \text{J}$
 $n = 3 \times 10^{-35}, \Delta E = 3.3 \times 10^{27} \text{J}$
 $n = 3, \Delta E = 3.3$
 $n = 3 \times 10^{27}, \Delta E = 0.3 \times 10^{27} \text{J}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$n = 3 \times 10^{27}, \Delta E = 3.3 \times 10^{-35} \text{J}$$

2) For a helium atom in a one dimensional box of length 1 nm , the value of the quantum numbers of the energy level corresponding to the energy of 450 K (Assuming $E = K_B T$) is: 1 point

- 19
 27
 33
 47

No, the answer is incorrect.

Score: 0

Accepted Answers:

27

3) For a particle in one dimensional box, the spacing between successive energy levels : 1 point

- increase as energy (E) increase
 decrease as energy (E) increase
 remains constant with energy (E)
 does not follow a particular pattern

No, the answer is incorrect.

Score: 0

Accepted Answers:

increase as energy (E) increase

4) For two Hermitian operators, A and B , if there exist two unitary operators: e^{iA} and $\frac{1+iB}{1-iB}$, 1 point

then the two Hermitian operators, A and B , are related to each other as follows:

- $A = \tan\left(\frac{B}{2}\right)$
 $B = 1 + \cos^2\left(\frac{A}{2}\right)$
 $B = \tan\left(\frac{A}{2}\right)$
 $A = B^2$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$B = \tan\left(\frac{A}{2}\right)$$

5) We measure $|\psi\rangle = \alpha|0\rangle + \beta|1\rangle$ in the $|v\rangle, |v^*\rangle$ basis, where $|v\rangle = \frac{1}{\sqrt{2}}|0\rangle + \frac{1}{\sqrt{2}}|1\rangle$. What is the probability of measuring $|v\rangle$? 1 point

- $\frac{\alpha + \beta}{2}$
 $\frac{\alpha^2}{2} + \frac{\beta^2}{2}$
 $\frac{\alpha + \beta}{\sqrt{2}}$
 $\frac{(\alpha + \beta)^2}{2}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$\frac{(\alpha + \beta)^2}{2}$$

6) Considering a harmonic oscillator model for H_2 and HD , and assuming the same force constants for both the molecules, the lowest energy state for H_2 is (tick the correct choice): 1 point

- Lower than that of HD
 Higher than that of HD
 Equal to that of HD
 Not related to that of HD

No, the answer is incorrect.

Score: 0

Accepted Answers:

Higher than that of HD

7) How many variables do the Schrodinger wave functions of He atom depends on ? 1 point

- 2
 9
 6
 3

No, the answer is incorrect.

Score: 0

Accepted Answers:

9

8) The electronic Hamiltonian for He atom in *atomic units* is: 1 point

- $H = -\frac{1}{2}\nabla^2 - \frac{1}{r}$
 $H = -\frac{1}{2}(\nabla_1^2 + \nabla_2^2) - \frac{2}{r_1} - \frac{2}{r_2} + \frac{1}{r_{12}}$
 $H = -\frac{1}{2}(\nabla_1^2 + \nabla_2^2) + \frac{2}{r_1} + \frac{2}{r_2} - \frac{1}{r_{12}}$
 $H = -\frac{1}{2}(\nabla_1^2 + \nabla_2^2) - \frac{2}{r_1} - \frac{2}{r_2}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$H = -\frac{1}{2}(\nabla_1^2 + \nabla_2^2) - \frac{2}{r_1} - \frac{2}{r_2} + \frac{1}{r_{12}}$$

9) A node in an orbital represents 1 point

- an anti-bonding orbital
 barrier to electron motion at nuclear location
 a point or a plane wherein the wave function changes sign
 a plane of symmetry

No, the answer is incorrect.

Score: 0

Accepted Answers:

a point or a plane wherein the wave function changes sign

10) Consider an excited state of He^+ ion having energy of -13.6 eV. If the z-component of orbital angular momentum of its electron in this state is $-\hbar$, logically the state is: 1 point

- $2p_{+1}$ state
 $2s$ state
 $2p_z$ state
 $2p_{-1}$ state

No, the answer is incorrect.

Score: 0

Accepted Answers:

$2p_{-1}$ state