PRACTICE QUIZ • 30 MIN

Quantum Chemistry I - Practice Quiz

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Quantum Chemistry I - Practice Quiz

TOTAL POINTS 10

1. If the workfunction of a metal is $2.2\ \text{eV}(1\ \text{eV} = 1.602 \times 10^{-19}\ \text{J})$, the corresponding threshold wavelength is: **1 / 1 point**

- (•) $562\ \text{nm}$
- ( ) $587\ \text{nm}$
- ( ) $464\ \text{nm}$
- ( ) $744\ \text{nm}$
- ( ) $444\ \text{nm}$

Correct
Solution

2. If a photon of energy $4.9 \times 10^{-19}\ \text{J}$ ejects an electron ($m_e = 9.11 \times 10^{-31}\ \text{kg}$) from a metal having a workfunction energy of $2.2\ \text{eV}(1\ \text{eV} = 1.602 \times 10^{-19}\ \text{J})$, the velocity of the emitted electron is: **1 / 1 point**

- ( ) $5.5 \times 10^{3}\ \text{m s}^{-1}$
- (•) $5.5 \times 10^{5}\ \text{m s}^{-1}$
- ( ) $4.5 \times 10^{5}\ \text{m s}^{-1}$
- ( ) $1.5 \times 10^{5}\ \text{m s}^{-1}$
- ( ) $3.2 \times 10^{6}\ \text{m s}^{-1}$

Correct
Solution

3. Using de Broglie's relationship, the velocity of an electron ($m_e = 9.11 \times 10^{-31}\ \text{kg}$) having a wavelength of $700\ \text{nm}$ is: **1 / 1 point**

- ( ) $2.04 \times 10^{3}\ \text{m s}^{-1}$
- ( ) $3.06 \times 10^{3}\ \text{m s}^{-1}$
- ( ) $9.04 \times 10^{3}\ \text{m s}^{-1}$
- (•) $1.04 \times 10^{3}\ \text{m s}^{-1}$
- ( ) $1.04 \times 10^{2}\ \text{m s}^{-1}$

Correct
Solution

4. Heisenberg's uncertainty principle states: **1 / 1 point**

- (•) $\triangle y \times \triangle p_y \geq \hbar/4\pi$
- ( ) $\triangle y \times \triangle p_y \leq \hbar/2\pi$
- ( ) $\triangle x \times \triangle p_y \geq \hbar/2\pi$
- ( ) $\triangle x \times \triangle p_y \geq \hbar/4\pi$
- ( ) $\triangle x \times \triangle p_y \geq 2\hbar/4\pi$
- ( ) $\triangle x \times \triangle p_y \leq \hbar/4\pi$

Correct
Solution

5. The minimum uncertainty in the velocity of an electron ($m_e = 9.11 \times 10^{-31}\ \text{kg}$) in a He atom whose position is known to within $58\ \text{m}$ is: **1 / 1 point**

- ( ) $0.5 \times 10^{-4}\ \text{m s}^{-1}$
- (•) $1.0 \times 10^{-4}\ \text{m s}^{-1}$
- ( ) $1.0 \times 10^{-9}\ \text{m s}^{-1}$
- ( ) $1.5 \times 10^{-4}\ \text{m s}^{-1}$
- ( ) $0.8 \times 10^{-7}\ \text{m s}^{-1}$

Correct
Solution

6. Using the particle in a box model, the energy of the highest occupied energy level for a linear polyene of length 14 angstroms and containing 10 π-electrons is ($m_e = 9.11 \times 10^{-31}\ \text{kg}$): **1 / 1 point**

[Correct answer to be indicated.]

- ( ) $7.32 \times 10^{-17}\ J$
- (•) $7.68 \times 10^{-19}\ J$
- ( ) $5.68 \times 10^{-19}\ J$
- ( ) $1.45 \times 10^{-34}\ J$
- ( ) $4.52 \times 10^{-5}\ J$

Correct
Solution

7. Using the particle in a box model, the wavelength of electromagnetic radiation, in nm, needed to excite electronically to the first excited state, a linear polyene of length 14 angstroms and containing 10 π-electrons ($m_e = 9.11 \times 10^{-31}\ \text{kg}$), is: [Correct answer to be indicated] **1 / 1 point**

- ( ) $4564\ \text{nm}$
- ( ) $444\ \text{nm}$
- (•) $587\ \text{nm}$
- ( ) $844\ \text{nm}$
- ( ) $744\ \text{nm}$

Correct
Solution

8. For the particle in a box, in the first excited state, only one of the following answers could be correct for the the probability of finding a particle in the leftmost 20% of the box. Choose which one. **0 / 1 point**

- ( ) 0.253
- ( ) 0.800
- ( ) 0.353
- (•) 0.200
- ( ) 0.153

Incorrect

9. A particle in a one-dimensional box of length L can be excited from the ground state to the first excited state by light of frequency, ν. If the box length is trebled, the frequency needed to produce the transition is: **1 / 1 point**

- (•) $\nu/9$
- ( ) 9ν
- ( ) $\nu/3$
- ( ) 6ν
- ( ) 3ν
- ( ) $\nu/6$

Correct
Solution

10. Born's interpretation of the wavefunction, Ψ, states that: **1 / 1 point**

- (•) The probability of finding particle in a volume element dv equals $\Psi^2 dv$.
- ( ) $\Psi^2 dv$ equals 1.
- ( ) The probability of finding particle in a volume element dv equals Ψ^2.
- ( ) Ψ is continuous everywhere.

Correct
Solution

Close