Quiz 7.4 – Translational Motion

Name: _____

Particle in a Box

Consider a H atom confined in a box with $L = 1.5\ nm$. Model this system as a particle in a box. For each of the first three energy levels, draw the wavefunction and give the energy. Point out any nodes on your drawn wavefunctions.

Find an expression for the spacing between energy levels for a particle in a box ($E_{n+1} - E_n$), and describe its trend, if any.

Quantum Well

Consider a particle confined to a 2-dimensional box. This system is commonly called a *quantum well*. If the two sides are equal in length, give the energies and degeneracies to the first four energy levels of this quantum system

Tunneling

Consider an electron approaching a potential energy barrier. The barrier is $5.0\ nm$ wide, and $4.0 \times 10^{-23}\ J$ high, while the electron has kinetic energy of $1.0 \times 10^{-23}\ J$

What will be the probability that the electron is transmitted through the barrier?

Sketch this system below, showing both the potential energy and the electron wavefunction in qualitative terms.

Ozymandius

By Percy Bysshe Shelley

I met a traveller from an antique land,
Who said—"Two vast and trunkless legs of stone
Stand in the desert. . . . Near them, on the sand,
Half sunk a shattered visage lies, whose frown,
And wrinkled lip, and sneer of cold command,
Tell that its sculptor well those passions read
Which yet survive, stamped on these lifeless things,
The hand that mocked them, and the heart that fed;
And on the pedestal, these words appear:
My name is Ozymandias, King of Kings;
Look on my Works, ye Mighty, and despair!
Nothing beside remains. Round the decay
Of that colossal Wreck, boundless and bare
The lone and level sands stretch far away."