Outline for Day 12

Office hours: 2 - 4

In which we learn how to solve the Schrödinger Equation for some more situations that all employ similar math.

Schrodinger equation solutions for:

- free particle with constant potential
- Worksheet – One Dimensional S.E.
- free particle with variable potential
- particles in variable shaped boxes
- particles in classically forbidden regions and tunneling

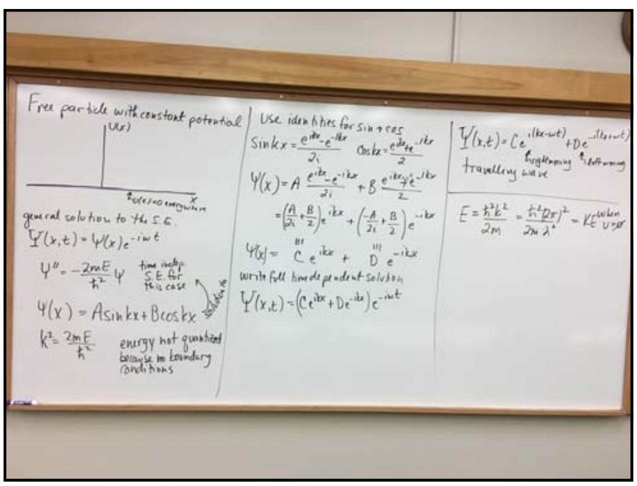
Outline for Day 12

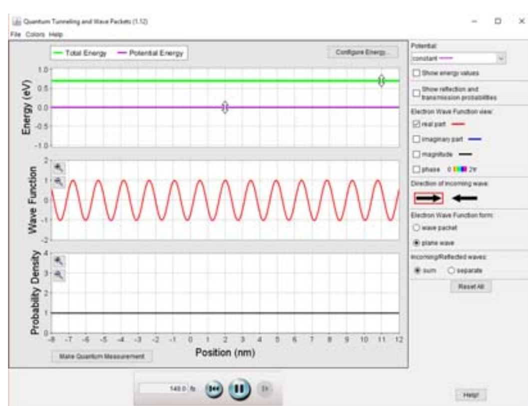
Office hours: 2 - 4

In which we learn how to solve the Schrödinger Equation for some more situations that all employ similar math.

Schrodinger equation solutions for:

- free particle with constant potential
- Worksheet – One Dimensional S.E.
- free particle with variable potential
- particles in variable shaped boxes
- particles in classically forbidden regions and tunneling





Drag green line up and down

Plane Waves

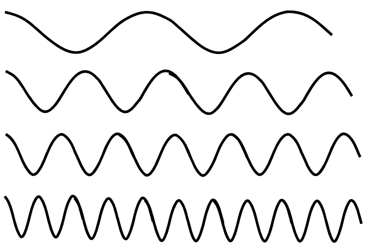
Plane waves (sines, cosines, complex exponentials) extend forever in space:

$\Psi_1(x,t) = \exp\left[i\left(k_1 x - \omega_1 t\right)\right]$

$\Psi_2(x,t) = \exp\left[i\left(k_2 x - \omega_2 t\right)\right]$

$\Psi_3(x,t) = \exp\left[i\left(k_3 x - \omega_3 t\right)\right]$

$\Psi_4(x,t) = \exp\left[i\left(k_4 x - \omega_4 t\right)\right]$

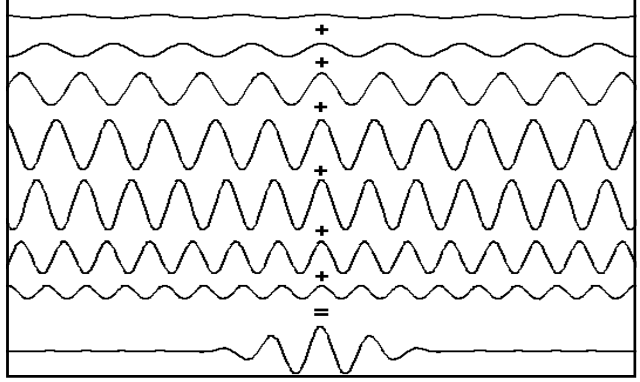


Different *k*'s correspond to different energies, since

$$E = \frac{1}{2}mv^2 = \frac{p^2}{2m} = \frac{h^2}{2m\lambda^2} = \frac{\hbar^2 k^2}{2m}$$

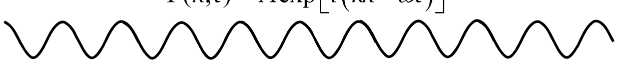
Superposition

$$\Psi(x,t) = \sum_n A_n \exp\left[i\left(k_n x - \omega_n t\right)\right]$$



Plane Waves vs. Wave Packets

$$\Psi(x,t) = A\exp\left[i\left(kx - \omega t\right)\right]$$



$$\Psi(x,t) = \sum_n A_n \exp\left[i\left(k_n x - \omega_n t\right)\right]$$

Which one looks more like a particle?

Outline for Day 12

Office hours: 2 - 4

In which we learn how to solve the Schrödinger Equation for some more situations that all employ similar math.

Schrodinger equation solutions for:

- free particle with constant potential
- Worksheet – One Dimensional S.E.
- free particle with variable potential
- particles in variable shaped boxes
- particles in classically forbidden regions and tunneling

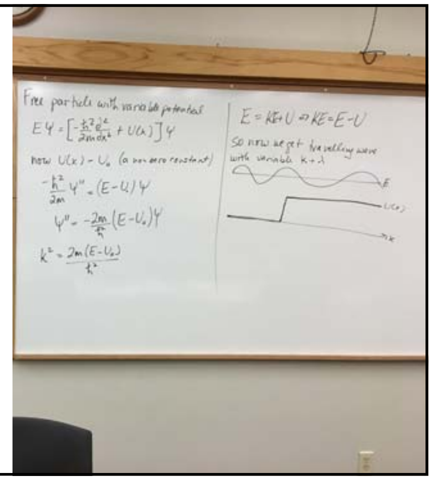
Outline for Day 12

Office hours: 2 - 4

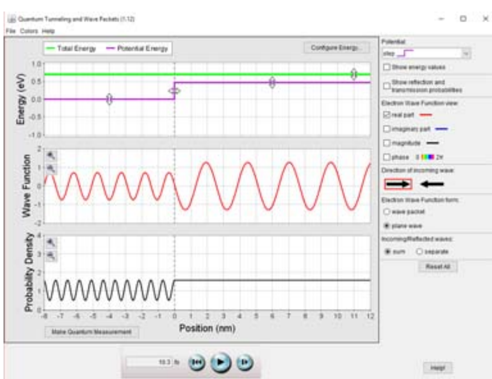
In which we learn how to solve the Schrödinger Equation for some more situations that all employ similar math.

Schrodinger equation solutions for:

- free particle with constant potential
- Worksheet – One Dimensional S.E.
- free particle with variable potential
- particles in variable shaped boxes
- particles in classically forbidden regions and tunneling



Variable Potential



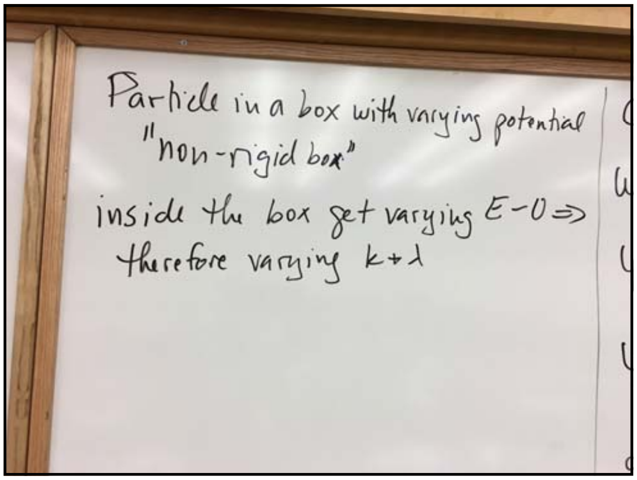
Outline for Day 12

Office hours: 2 - 4

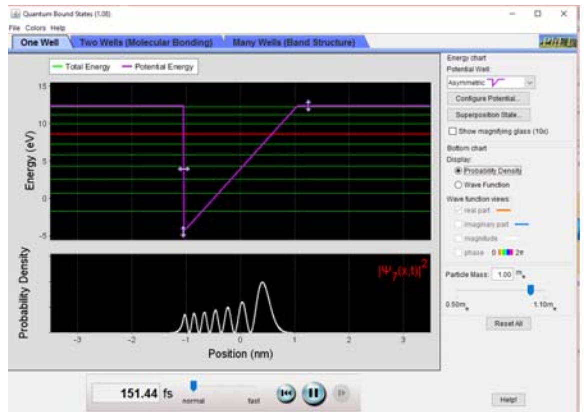
In which we learn how to solve the Schrödinger Equation for some more situations that all employ similar math.

Schrodinger equation solutions for:

- free particle with constant potential
- Worksheet – One Dimensional S.E.
- free particle with variable potential
- particles in variable shaped boxes
- particles in classically forbidden regions and tunneling



Variable Shaped Boxes



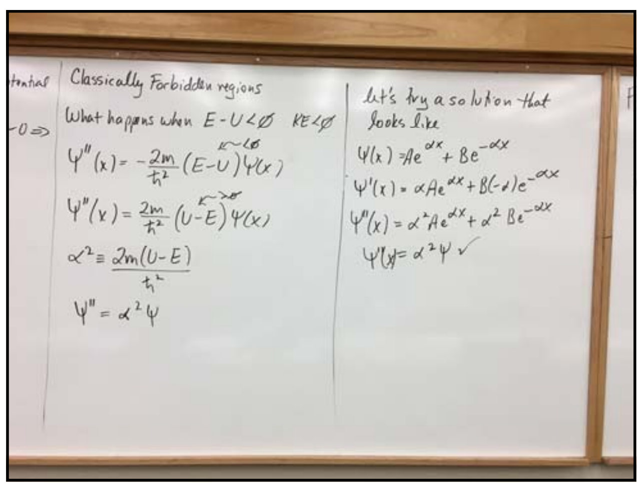
Outline for Day 12

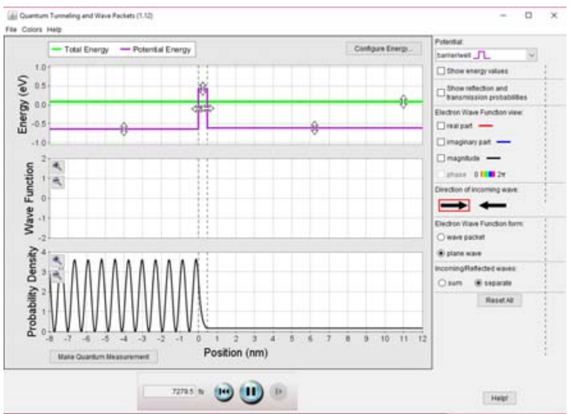
Office hours: 2 - 4

In which we learn how to solve the Schrödinger Equation for some more situations that all employ similar math.

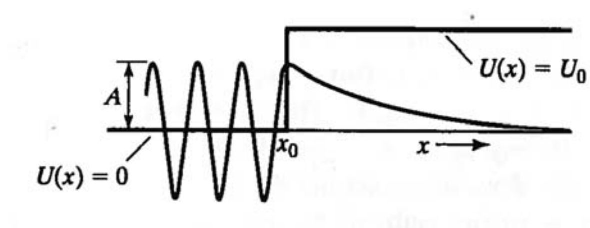
Schrodinger equation solutions for:

- free particle with constant potential
- Worksheet – One Dimensional S.E.
- free particle with variable potential
- particles in variable shaped boxes
- particles in classically forbidden regions and tunneling



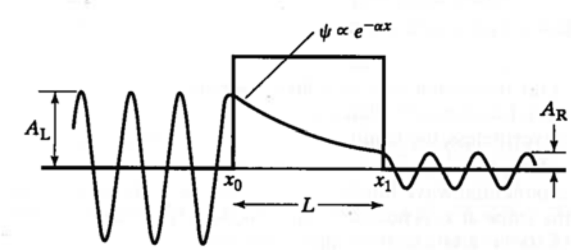


Classically Forbidden Region



PHET Quantum Tunneling. Step potential.
See incoming and reflected wave make standing wave.
Vary the energy and see how far wave function extends into forbidden region.

Tunneling



PHET Quantum Tunneling. Barrier potential.
Probability density not zero on other side of barrier. Probability varies with energy and width of barrier.