$$-\frac{\hbar^2}{2m}\frac{\partial^2\Psi(x,t)}{\partial x^2}+V(x,t)\Psi(x,t)=i\hbar\frac{\partial\Psi(x,t)}{\partial t}$$

What is V(x,t) for electron interacting with proton?

(A) $-ke^2/x$, where x is distance electron is from origin.

(B) $-ke^2/x$ where x is distance between + and - .

(C) Impossible to tell unless know how electron is moving, because that determines the time dependence .

(D) $(-ke^2/x)$ $(\sin\omega t)$.

(E) Can't figure out what time dependence should be.

$$-\frac{\hbar^2}{2m}\frac{d^2\psi(x)}{dx^2}+V(x)\psi(x)=E\psi(x)$$

Step 1: Analyze situation and determine V(x)

Often needed: simplifying assumptions

Step 2: Establish boundary conditions

General – ψ has to be continuous

Specific – depends on situation

Step 3: Solve Schrödinger equation

mathematically or on computer

make physically informed guess and check

Step 4: Fulfill boundary conditions + normalization

Step 5: Multiply with exp(-iEt/ħ)

Step 1: Analyze situation and determine V(x)

Often needed: simplifying assumptions

Short copper wire, length L.

What is V(x)?

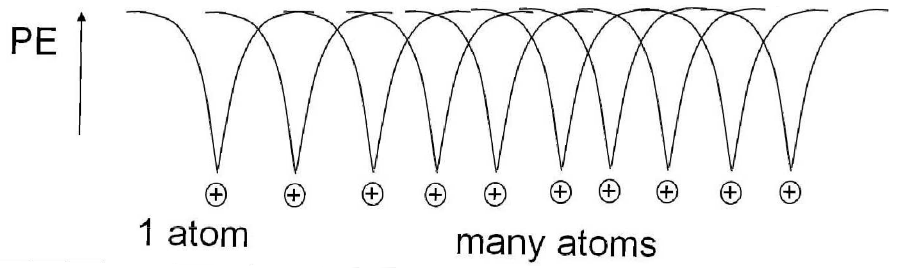
Remember photoelectric effect:

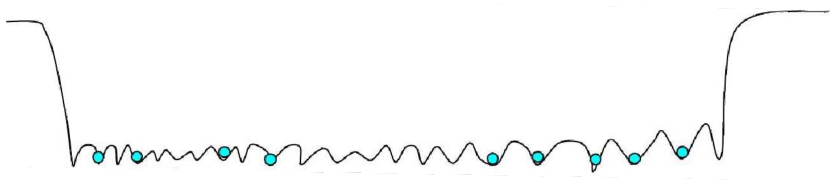
- Needed energy to kick out electron.

  Is V(x) inside smaller/larger than outside?
- Is it everywhere the same inside the wire?.

Step 1: Analyze situation and determine V(x)

Often needed: simplifying assumptions





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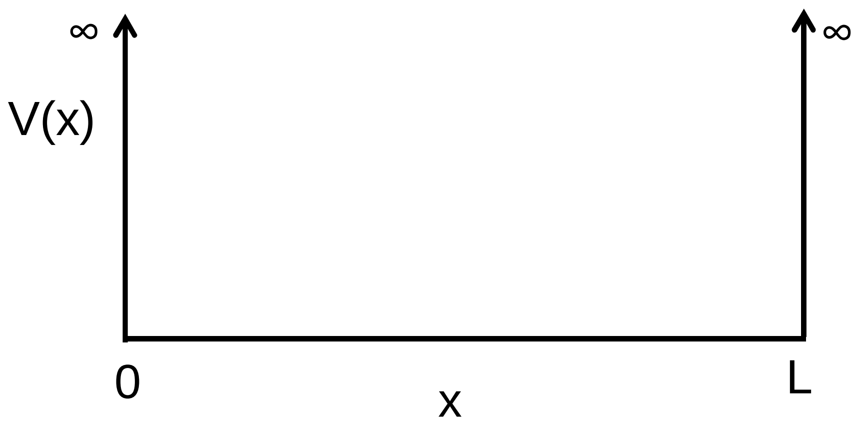

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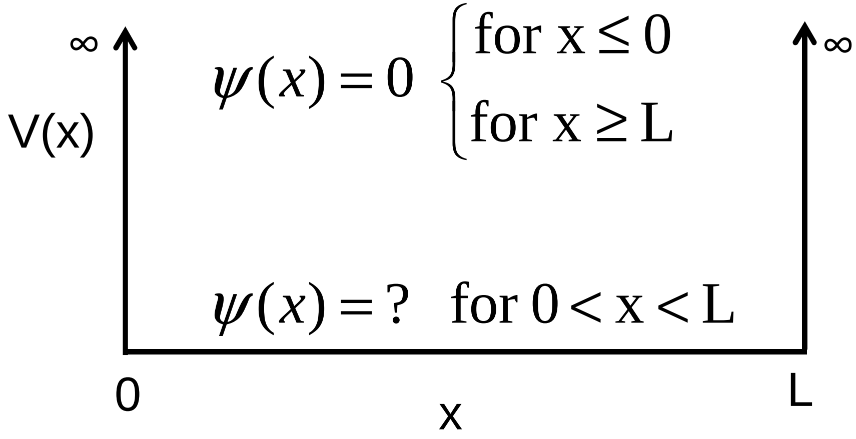
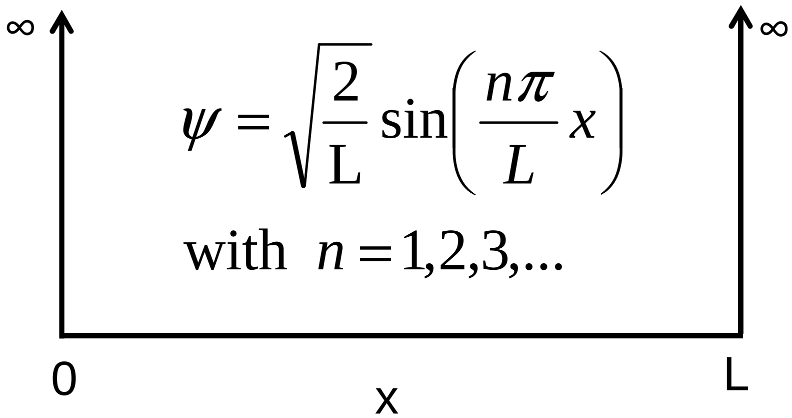


$$\psi(x) = 0 \begin{cases} \text{for } x \leq 0 \\ \text{for } x \geq L \end{cases}$$

$$\psi(x) = ? \quad \text{for } 0 < x < L$$

Step 4: Fulfill boundary conditions + normalization



$$\psi = 0$$

$$\psi = \sqrt{\frac{2}{\mathrm{L}}}\,\sin\left(\frac{n\pi}{L}x\right)$$

with $n = 1,2,3,\ldots$

$$\psi = 0$$