What equation in classical physics does

$$i \frac{h}{2\pi} \frac{\partial \psi}{\partial t} = -\left(\frac{h}{2\pi}\right)^2 \frac{1}{2m} \frac{\partial^2 \psi}{\partial x^2}$$

replace?

A) Maxwell's equations (for the propagation of electromagnetic waves)

B) The classical wave equation:

$$\frac{\partial^2 h}{\partial t^2} = v^2 \frac{\partial^2 h}{\partial x^2}$$

C) Newton's Second Law: $\mathbf{F} = m\,\mathbf{a}$

D) Newton's First Law: $m\,\mathbf{a} = 0$ in the absence of forces

Answer: D $\quad m\,\mathbf{a} = 0$

	classical	quantum
description:	$x(t)$	$\psi(x,t)$
free particle equation of motion:	$m\ddot{x} = 0$	$i\frac{h}{2\pi}\frac{\partial\psi}{\partial t} = -\frac{h^2}{(2\pi)^2}\frac{1}{2m}\frac{\partial^2\psi}{\partial x^2}$
free particle solutions:	$x = x_0 + vt$	$\psi(x,t) = \frac{1}{\sqrt{h}}\int dp\,\chi(p)\, e^{i\frac{2\pi}{h}\left(px - \frac{p^2}{2m}t\right)}$

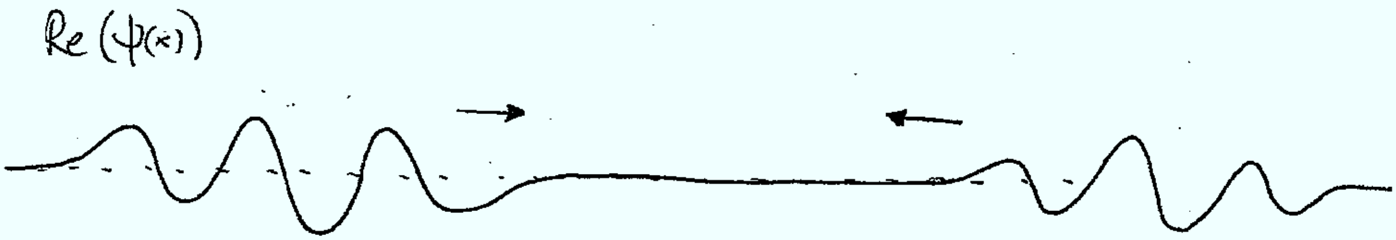
TODAY: what replaces: $m\ddot{x} = F = -V'(x)$?

The wavefunction for an electron involves two wavepackets traveling in opposite directions. When they meet, the wavepackets will

A) Pass right through each other

B) Repel each other and reverse directions

C) Attract each other and form a bound state.



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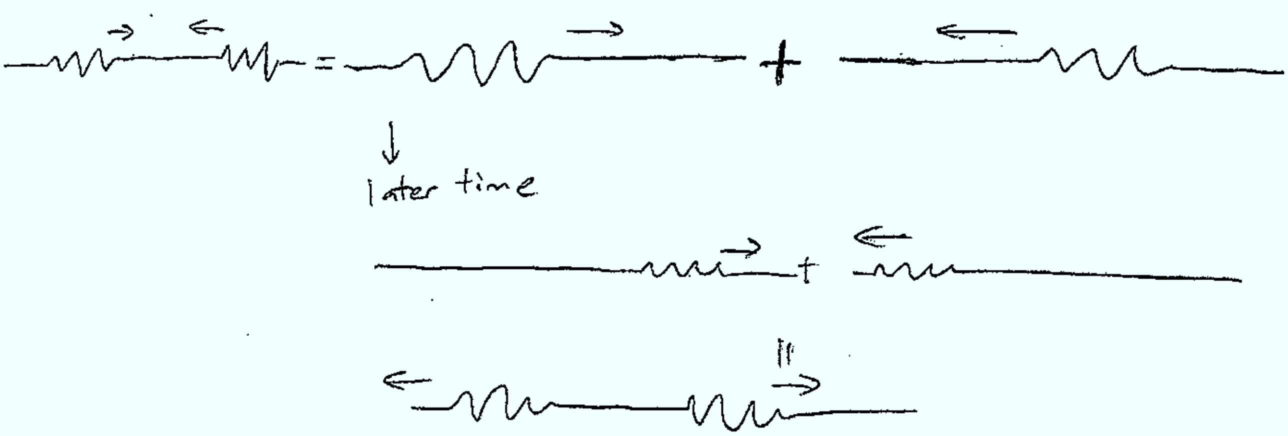
Schrodinger eqn → sum of any 2 solns is a solution.



An electron with momentum p travels in a region where it has a constant positive potential energy V. Compared to an electron with the same momentum p in a region with zero potential energy, we expect that this electron's wavefunction will have

A) a larger wavelength

B) a smaller wavelength

C) a larger frequency

D) a smaller frequency

E) both B and C

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C) a larger frequency *frequency = energy/h =* $(p^2/(2m) + V)/h$

D) a smaller frequency

E) both B and C

Which of the following should be true of an energy eigenstate?

A) The time dependence of the wavefunction should be a simple oscillation of the phase with a definite frequency.

B) There should be zero uncertainty in the quantity $p^2/(2m) + V(x)$.

C) The probability density should be independent of time.

D) All of the above.

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D) All of the above.

energy = h × frequency

∴ definite energy, definite freq

$$\psi(\cancel{x},t) = \psi_E(x)\, e^{-i\frac{2\pi}{h}Et}$$

also: $|\psi(x,t)|^2 = |\psi_E(x)|^2$ indep. of time

also: definite energy

⇒ zero uncertainty in $\frac{p^2}{2m} + V(x)$