UNIVERSITY OF CALIFORNIA, SANTA BARBARA
Department of Physics

Physics 115A
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Winter 1996

Midterm

$$\text{Information}: \hbar = 1 \times 10^{-34} \text{ joules/sec}$$
$$m_e = 9 \times 10^{-31} \text{ kg}$$
$$e = 1.6 \times 10^{-19} \text{ coulombs}$$

1. (20 points) An electron is bound in a region of space about the size of an atom, 10^{-10} m. Make a very rough estimate of the minimum kinetic energy which the electron must have.

2. (30 points) A particle of mass m is bound in an infinite one-dimensional square well where $v = \infty$ for $V < 0$ and $x > a$, and $V = 0$ for $0 < x < a$. The energy eigenfunctions for this square well are $\phi_n(x) = \sqrt{\frac{2}{a}} \sin\left(\frac{n\pi}{a}x\right)$, corresponding to the energies $E_n = \frac{\left(\hbar\frac{n\pi}{a}\right)^2}{2m}$. Consider the state at $t = 0$, $|\psi(0)\rangle = \frac{1}{\sqrt{2}}|\phi_1\rangle + \frac{1}{\sqrt{2}}|\phi_2\rangle$.

   (a) Is this a stationary state?