Physics 448 **HOMEWORK SET 6** **Fall 2008**

Due Monday November 3

29) In class we derived a formula for the probability of transmission through a rectangular barrier. Use the formula (or equivalently Eq. (4.35) from the text) to find the transmission probability for

    (a) a 2 eV electron incident on a 3 eV high, 10 nm wide barrier;

    (b) a 2 MeV α-particle incident on a 3 MeV high, 10 fm wide barrier (use $m_\alpha = 3730\ \mathrm{MeV/c^2}$).

30) Gasiorowicz problem 4.8.

31) Consider a conventional square well potential

$$V(x) = \begin{cases} 0 & \text{for } -a < x < a \\ V_0 & \text{elsewhere} \end{cases}$$

with $V_0 = 1\,\mathrm{eV}$ and $a = 0.5\,\mathrm{nm}$. The particle bound in the well is an electron. Find the energies of the two lowest states.

32) Determine the number of bound states of an electron in a square well potential with $V_0 = 100\,\mathrm{eV}$ and $a = 0.5\,\mathrm{nm}$.

33) A particle of mass m is confined in a potential

$$V(x) = \begin{cases} \infty & \text{for } x < 0 \\ -V_0 & \text{for } 0 < x < a \\ 0 & \text{for } x > a. \end{cases}$$

where V_0 has the value $32\hbar^2/ma^2$.

    (a) How many bound states are there?

    (b) In the highest-energy bound state, what is the probability that the particle would be found outside the well (beyond $x = a$)?

34) Without doing any math, sketch, as carefully as you can, the wave functions for the ground state and first two excited states of the potential well

$$V(x) = \begin{cases} ax & \text{for } x > 0 \\ \infty & \text{for } x < 0. \end{cases}$$