

Physics 451- Fall 2012

Homework #11

Due Tuesday, Oct 9, by 7pm

Please place your assignment in the "Physics 451" slot across from N373 ESC.
We have help sessions twice a week, in N337 ESC (undergraduate lab):

T Th from 3 to 6 pm

List of problems (from the textbook):

2.38

2.39

2.41

A1

A2

A5

A7

Hints:

For problem **2.38**, use $c_n = \int_0^{2a} \Psi(x,0)\psi_n(x)dx$ where ψ_n are the stationary states of the new potential.

For problem **2.41**, the trick is to develop the wave function Ψ in terms of linear combination of the stationary states:

$$\psi_0(x) = \alpha e^{-\xi^2/2}$$

$$\psi_1(x) = \alpha\sqrt{2}\xi e^{-\xi^2/2}$$

$$\psi_2(x) = \frac{\alpha}{\sqrt{2}}(2\xi^2 - 1)e^{-\xi^2/2}$$

$$\text{where } \alpha = \left(\frac{m\omega}{\pi\hbar}\right)^{1/4}; \xi = \sqrt{\frac{m\omega}{\hbar}}x$$

And then to apply the Hamiltonian H on this linear combination.

For problems **A1** and **A2**: check the following 3 properties for a vector space:

- 1) addition
- 2) scalar multiplication
- 3) null vector

For problem **A7**, take the inner product of $|\alpha\rangle + |\beta\rangle$ with itself and use the Schwarz inequality.