

**Homework Assignment #1**  
**PS405**  
**Atomic & Nuclear Physics**

Due: Fri. September 2, 2016

August 29, 2016

1. Griffiths 5.2

Use the following constants:

$$m_p = 1836 m_e \quad (\text{proton})$$

$$m_D = 3670.5 m_e \quad (\text{deuteron})$$

$$E_R = \frac{1}{2} m_e c^2 \alpha^2 = 13.6 \text{ eV}$$

2. An ensemble of quantum harmonic oscillators are described by the following wave function:

$$\psi(x) = 8|0\rangle + 6|1\rangle + 3|2\rangle$$

a. Normalize this wave function.

$$\psi_n = \underline{\hspace{10cm}}$$

b. Calculate the mean energy of this ensemble of quantum-mechanical harmonic oscillators.

$$\langle E \rangle = \underline{\hspace{2cm}} E_0$$

Where  $E_0 = \frac{1}{2} \hbar \omega_0$