PHY 3063 NAME: _____

"Honors Modern Physics" Spring 2008

Quiz 10 (5 points) 03 April 2008

Professor Mark W. Meisel

PLEASE PRINT and box final results. Show all work for full credit.
Work must be clear and unambiguous for credit.

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Verify that the eigenfunction ψ_{211} and the associated eigenvalue E_2 satisy the time-independent Schrödinger equation for a one-electron atom with $Z = 1$.

$$\psi_{211} \;=\; \frac{1}{8\sqrt{\pi}} \left(\frac{Z}{a_o}\right)^{3/2} \frac{Zr}{a_o}\, e^{-Zr/2a_o}\, \sin\theta\, e^{i\phi}$$

$$E_n \;=\; -\left(\frac{kZe^2}{\hbar}\right)^2 \frac{\mu}{2n^2} \qquad \text{and} \qquad a_o \;=\; \frac{\hbar^2}{(ke^2\mu)}$$

$$\nabla^2 \;=\; \frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2\frac{\partial}{\partial r}\right) \;+\; \frac{1}{r^2\,\sin\theta}\frac{\partial}{\partial\theta}\left(\sin\theta\frac{\partial}{\partial\theta}\right) \;+\; \frac{1}{r^2\,\sin^2\theta}\frac{\partial^2}{\partial\phi^2}$$