

Quantum Mechanics, Physics 531
Homework Assignment 5, due April 14, 2008

Problem 1. Problem 4.17.

Problem 2. Problem 4.38.

Problem 3. Problem 4.39.

Problem 4. Calculate energies E_n of stationary states of a two-dimensional particle moving in a potential

$$U(\mathbf{r}) = \frac{\hbar^2}{2m} \left[\alpha^2 |\mathbf{r}|^2 + \frac{\beta^2}{|\mathbf{r}|^2} \right].$$

Use the cylindrical coordinates and look for the wave function in the form

$$\psi_n(|\mathbf{r}|, \varphi) = e^{im_z \varphi} e^{-\alpha |\mathbf{r}|^2 / 2} |\mathbf{r}|^{\sqrt{\beta^2 + m_z^2}} w(|\mathbf{r}|),$$

where $w(|\mathbf{r}|)$ is a finite order polynomial, $w(0) \neq 0$. Explain the choice of the above equation for the wave function $\psi_n(|\mathbf{r}|, \varphi)$.

Problem 5. Problem 7.1.

Problem 6. Problem 7.7.

Problem 7. Problem 8.3.

Problem 8. Problem 8.16.