

PHY 6646 - Quantum Mechanics II - Spring 2020
Homework set # 7, due February 26

1. A particle of mass μ is in linear motion in the potential

$$\begin{aligned} V(x) &= 5kx && \text{for } x > 0 \\ &= -kx && \text{for } x < 0 \end{aligned} \tag{0.1}$$

with k positive. Use the WKB approximation to estimate the energies of the states of the particle.

2. Problems 16.2.7, 17.2.1, 17.2.2, 17.2.3 in Shankar's book.

3. Consider a particle of mass μ in the central force potential

$$\begin{aligned} V(r) &= -\frac{e^2}{r} && \text{for } 0 < r < R \\ &= -\frac{e^2}{r} \exp(-\lambda(r - R)) && \text{for } R < r < \infty \quad . \end{aligned} \tag{0.2}$$

This potential differs from the Coulomb potential only in the region $r > R$, where the Coulomb force is screened. The difference becomes negligible when $\lambda \rightarrow 0$. Consider this difference as a perturbation and calculate the first-order correction to the energy of the ground state of the hydrogen atom.