

PHY 6646 - Quantum Mechanics II - Spring 2018
Homework #6, due February 21

1. Derive Eq. (17.3.22) from Eqs. (17.3.12) and (17.3.21) in Shankar's book.

2. A particle of mass μ and charge q moves in a given electromagnetic field $\vec{E}(\vec{x}, t) = -\vec{\nabla}\Phi(\vec{x}, t) - \frac{1}{c}\partial_t\vec{A}(\vec{x}, t)$ and $\vec{B}(\vec{x}, t) = \vec{\nabla} \times \vec{A}(\vec{x}, t)$.

a. Show that the classical motion of the particle extremizes the action

$$S = \int_{t_1}^{t_2} \left[\frac{\mu}{2} \vec{v} \cdot \vec{v} - q(\Phi(\vec{x}, t) - \vec{v} \cdot \vec{A}(\vec{x}, t)) \right] dt \quad . \quad (0.1)$$

b. What is the canonical momentum \vec{p} conjugate to \vec{x} ?

c. Derive the Hamiltonian $H(\vec{x}, \vec{p}, t)$ for the particle's motion.

3. Problem 18.2.1

4. Problem 18.2.3

5. Problem 18.2.4

6. Problem 18.2.6