449 HW #7

1) T 4.9

2) T 4.10

3) T 14.11

4) An electron is confined in a spherical box whose radius is such that the lowest p-state in the box has an energy of 1 eV above the ground state. Calculate the radiative lifetime of an electron in the p-state.

Neglect spontaneous emission for the following questions.

5) A 2-level system initially in state g is driven by a π pulse into state e (when tuned on resonance) with a Rabi frequency r and a pulse time of T. Suppose now the oscillating field is detuned from resonance by an amount $\Delta = r$. What is the uncertainty in the measurement of the probability of being in state e? Suppose there are N identical such systems. How many atoms will be in state e and what is the uncertainty in the measurement?

6) A single mode of frequency ω is tuned near the resonance frequency ω_{eg} of an atom. The vacuum Rabi frequency is Ω. At $t = 0$ the atom is in state $|e\rangle$ and there are zero photons in the mode. Find $\langle \hat{n}(t) \rangle$ and $\langle \hat{n}^2(t) \rangle$.