1. The basis for the creation of the latent image on a photographic negative is the dissociation of molecules of silver bromide, AgBr. The energy of dissociation of AgBr is 24kcal/mole. Find the longest wavelength of light that is just able to expose the negative, that is, dissociate AgBr.

2. (a) If you were to measure the intensity on the ground parking lot lights on 15.0 meter poles and discover that the intensity was 9 times too small for pedestrian safety, how many times brighter would you need the light bulb to be in order to maintain the appropriate brightness? (b) If you decided to shorten the lamp poles instead of buying more expensive (higher power) lamps, what height would the poles be?

3. A hydrogen atom is in the \( n = 4 \) excited state. Calculate and show on an energy-level diagram the different possible photon energies that may be emitted as the atom returns to the \( n = 1 \) ground state. For each photon energy, also give the corresponding wavelength.

4. (a) What energy does an incoming photon of wavelength 110 nm have? [11.3 eV] (b) For an electron that starts in the ground state, where will it end up if it interacts with this photon? Is this possible? Draw this on your diagram for #3. If necessary, add energy levels above \( n=4 \). [photon not absorbed, stays at same energy ... WHY?] (c) Suppose the electron began in the \( n=2 \) (the first excited) state. Where will it end up if it interacts with this photon? Is this possible? Draw this on the diagram. Clearly label which is which on diagram. [yes, absorbed ... where does the electron end up?] (d) What wavelength must an incoming photon have in order for it to cause an electron in the ground state to move to the \( n=2 \) state? Draw this on the diagram. Clearly label which is which on diagram. [121 nm]

5. The energy gap for cadmium selenate [CdSe] at room temperature is 1.74 eV. (a) If we made an LED from this material, what wavelength photon would you expect? [713 nm] (b) Is your calculated wavelength a minimum value or a maximum value? Explain. (c) What “color” would the emitted light be? (d) Suppose we used GaP with an energy gap of 2.25 eV instead. What wavelength would be emitted and what color would it be?

6. From Pedrotti & Pedrotti: Ch. 3 # 3

7. From Pedrotti & Pedrotti: Ch. 3 # 4
   Note: follow the ray inside the cube until it emerges.

8. A penny is placed at the bottom of a glass of water. The water is 4.00 cm deep. What is the apparent distance from the surface of the water to the penny if you look directly down on the water?
   Hint: Look at Fig. 3-8(b), p. 46, and use the small angle approximation as described on pp 45-46.