

35. (a) Since energy is conserved, the energy E of the photon is given by $E = E_i - E_f$, where E_i is the initial energy of the hydrogen atom and E_f is the final energy. The electron energy is given by $(-13.6 \text{ eV})/n^2$, where n is the principal quantum number. Thus,

$$E = E_i - E_f = \frac{-13.6 \text{ eV}}{(3)^2} - \frac{-13.6 \text{ eV}}{(1)^2} = 12.1 \text{ eV} .$$

- (b) The photon momentum is given by

$$p = \frac{E}{c} = \frac{(12.1 \text{ eV})(1.60 \times 10^{-19} \text{ J/eV})}{3.00 \times 10^8 \text{ m/s}} = 6.45 \times 10^{-27} \text{ kg}\cdot\text{m/s} .$$

- (c) Using the result of problem 3 in Chapter 39, the wavelength is

$$\lambda = \frac{1240 \text{ eV}\cdot\text{nm}}{12.1 \text{ eV}} = 102 \text{ nm} .$$