

Ch 8

$$35) 1.496 \times 10^8 \text{ Km} \times \frac{1000 \text{ m}}{1 \text{ Km}} \times \frac{1 \text{ sec}}{3.00 \times 10^8 \text{ m}} = 499 \text{ s} \times \frac{1 \text{ min}}{60 \text{ s}} = 8.32 \text{ min}$$

$$39c) 0.052 \text{ nm} \times \frac{1 \text{ m}}{1 \times 10^9 \text{ nm}} = 5.2 \times 10^{-11} \text{ m} \quad v = \frac{c}{\lambda} = \frac{3.00 \times 10^8 \text{ m/s}}{5.2 \times 10^{-11} \text{ m}} = 5.8 \times 10^{18} \text{ s}^{-1}$$

$$41c) E = h\nu = 6.626 \times 10^{-34} \text{ J}\cdot\text{s} \times \frac{5.8 \times 10^{18}}{\text{s}} = 3.8 \times 10^{-15} \text{ J}$$

$$43) E = \frac{hc}{\lambda} = \frac{(6.626 \times 10^{-34} \text{ J}\cdot\text{s})(3.00 \times 10^8 \text{ m/s})}{(532 \times 10^{-9} \text{ m})} = 3.7365 \times 10^{-19} \text{ J/photon}$$

$$3.85 \text{ m J} \times \frac{1 \text{ J}}{1000 \text{ m J}} \times \frac{1 \text{ photon}}{3.7365 \times 10^{-19} \text{ J}} = 1.03 \times 10^{16} \text{ photons}$$

$$44) E = \frac{hc}{\lambda} = \frac{(6.626 \times 10^{-34} \text{ J}\cdot\text{s})(3.00 \times 10^8 \text{ m/s})}{6.5 \times 10^{-6} \text{ m}} = 3.058 \times 10^{-20} \text{ J/photon}$$

6.5  $\mu\text{m}$   $\rightarrow 6.5 \times 10^{-6} \text{ m}$

$$1 \text{ sec} \times \frac{32.8 \text{ J}}{\text{Sec}} \times \frac{1 \text{ photon}}{3.058 \times 10^{-20} \text{ J}} = 1.1 \times 10^{21} \text{ photons}$$

electron  $\lambda = \frac{h}{mv} = \frac{6.626 \times 10^{-34} \text{ Kg}\cdot\text{m}^2\cdot\text{s}}{\text{s}^2} = 5.39 \times 10^{-9} \text{ m} \rightarrow 539 \text{ nm}$

$(9.109 \times 10^{-31} \text{ Kg})(1.35 \times 10^5 \text{ m/s})$

baseball  $\lambda = \frac{6.626 \times 10^{-34} \text{ Kg}\cdot\text{m}^2\cdot\text{s}}{\text{s}^2} = 1.1 \times 10^{-34} \text{ m}$

$(0.143 \text{ Kg}) \left( \frac{95 \text{ mi}}{\text{hr}} \right) \left( \frac{1.609 \text{ Km}}{\text{mi}} \right) \left( \frac{1000 \text{ m}}{\text{Km}} \right) \left( \frac{1 \text{ hr}}{3600 \text{ s}} \right)$  Wavelength is so small

$$73) 1 \text{ C-C bond} \times \frac{1 \text{ mol C-C}}{6.02 \times 10^{23} \text{ C-C bonds}} \times \frac{348 \text{ KJ}}{1 \text{ mol}} \times \frac{1000 \text{ J}}{1 \text{ KJ}} = 5.779 \times 10^{-19} \text{ J}$$

$$\lambda = \frac{hc}{E} = \frac{hc}{5.779 \times 10^{-19} \text{ J}} = 3.44 \times 10^{-7} \text{ m} = 344 \text{ nm UV}$$

74) cis-retinal  $1 \text{ molecule} \times \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ molecs}} \times \frac{164 \text{ KJ}}{1 \text{ mol}} \times \frac{1000 \text{ J}}{1 \text{ KJ}} = 2.723 \times 10^{-19} \text{ J}$

$$\lambda = \frac{hc}{E} = \frac{hc}{2.723 \times 10^{-19}} = 7.30 \times 10^{-7} \text{ m} \rightarrow 730 \text{ nm red (visible)}$$

7a)  $\Delta E = E_{\infty} - E_1 = 0 - \left[ -2.18 \times 10^{-18} \text{ J} \left( \frac{1}{1^2} \right) \right] = +2.18 \times 10^{-18} \text{ J}$

$$\lambda = \frac{hc}{E} = \frac{hc}{2.18 \times 10^{-18} \text{ J}} = 9.12 \times 10^{-8} \text{ m} = 91.2 \text{ nm UV}$$