

11. The total energy emitted by the bulb is  $E = 0.93Pt$ , where  $P = 60 \text{ W}$  and  $t = 730 \text{ h} = (730 \text{ h})(3600 \text{ s/h}) = 2.628 \times 10^6 \text{ s}$ . The energy of each photon emitted is  $E_{\text{ph}} = hc/\lambda$ . Therefore, the number of photons emitted is

$$N = \frac{E}{E_{\text{ph}}} = \frac{0.93Pt}{hc/\lambda} = \frac{(0.93)(60 \text{ W})(2.628 \times 10^6 \text{ s})}{(6.63 \times 10^{-34} \text{ J}\cdot\text{s})(2.998 \times 10^8 \text{ m/s})/(630 \times 10^{-9} \text{ m})} = 4.7 \times 10^{26} .$$