24.33. **Model:** A confined particle can have only discrete values of energy.
Solve: **(a)** Equation 24.14 simplifies to

$$E_n = \frac{h^2}{8mL^2}n^2 = \frac{\left(6.63\times10^{-34}\ \text{Js}\right)^2}{8\left(9.11\times10^{-31}\ \text{kg}\right)\left(0.70\times10^{-9}\ \text{m}\right)^2} = \left(1.231\times10^{-19}\ \text{J}\right)n^2$$

Thus, $E_1 = \left(1.231\times10^{-19}\,\text{J}\right)\left(1^2\right) = 1.23\times10^{-19}\,\text{J}$, $E_2 = \left(1.231\times10^{-19}\,\text{J}\right)\left(2^2\right) = 4.92\times10^{-19}\,\text{J}$, and $E_3 = 1.11\times10^{-18}\,\text{J}$.
(b) The energy is $E_2 - E_1 = 4.92\times10^{-19}\ \text{J} - 1.23\times10^{-19}\ \text{J} = 3.69\times10^{-19}\ \text{J}$.
(c) Because energy is conserved, the photon will carry an energy of $E_2 - E_1 = 3.69\times10^{-19}\ \text{J}$. That is,

$$E_2 - E_1 = E_{\text{photon}} = hf = \frac{hc}{\lambda} \Rightarrow \lambda = \frac{hc}{E_2 - E_1} = \frac{\left(6.63\times10^{-34}\ \text{Js}\right)\left(3.0\times10^{8}\ \text{m/s}\right)}{3.69\times10^{-19}\ \text{J}} = 539\ \text{nm}$$