Problem 4

Modeling this as a harmonic oscillator. We have that

$$E_{n+1} - E_n = \left((n+1)+\frac{1}{2}\right)\hbar\omega_0 - \left(n+\frac{1}{2}\right)\hbar\omega_0$$

$$= \hbar\omega_0.$$

The photon released has energy

$$E_\gamma = \frac{hc}{\lambda} = \frac{1240\cdot nm}{561\,nm} = 2.21eV.$$

This must match the energy lost from the transition. That is

$$2.20V = \hbar\omega_0 \Rightarrow \underline{\omega_0} = \frac{2.21eV}{\hbar} = \boxed{3.36\cdot 10^{15}\,s^{-1}}.$$