Consider a metal whose work function is $2.0 \text{ eV}$. The metal is illuminated by light of wavelength $\lambda$.

(a) If the stopping potential for photoelectrons emitted from the surface is 3 volts, what is the wavelength of the light?

Use photoelectric equation: \[ \frac{hc}{\lambda} = KE_{max} + \Phi \] (1)

Also, from energy conservation: \[ KE_{max} = eV_s \] (2)

\[
\frac{1240 \text{ eV nm}}{1}\cdot\frac{3 \text{ eV}}{2} = \frac{5 \text{ eV}}{1} \Rightarrow \lambda = \frac{1240 \text{ eV nm}}{5 \text{ eV}} \Rightarrow \lambda = 248 \text{ nm}
\]

(b) What is the initial velocity of the electrons as they are emitted from the photocathode? \( v_0 (\equiv v_{max}) \)

From (2) in part (a) we have:

\[ eV_s = \frac{1}{2} m_e v_0^2 \Rightarrow v_0 = \sqrt{\frac{2 e V_s}{m_e}} = \sqrt{\frac{2 (1.6 \cdot 10^{-19} \text{ C}) (3 \text{ Volts})}{9.11 \cdot 10^{-31} \text{ kg}}} \]

\[
\Rightarrow v_0 \approx 1.03 \cdot 10^6 \frac{\text{m}}{\text{s}}
\]

\[ m_e = 9.11 \times 10^{-31} \text{ kg} \]
\[ q_e = -1.6 \times 10^{-19} \text{ C} \]