HW5-1 Soln)

 V_S = 2.14 volts when λ = 200 nm.

$$V_{S} = \frac{h}{q}f - \frac{\varphi}{q} = \frac{hc}{q}\frac{1}{\lambda} - \frac{\varphi}{q}$$

$$\phi = \frac{hc}{\lambda} - qV_{\rm S} = \frac{4.136 \times 10^{-15} (3 \times 10^8)}{200 \times 10^{-9}} - (1e)(2.14) = \frac{4.06 \, \text{eV}}{4.06 \, \text{eV}}$$

The cut-off wavelength is found by setting V_s to zero. That is, if no voltage is required to stop the electrons from reaching the anode, then they probably aren't actually leaving the cathode.

$$\lambda_{\text{cut-off}} = \frac{\text{hc}}{\Phi} = \frac{4.136 \times 10^{-15} (3 \times 10^8)}{4.06} = \frac{3.06 \times 10^{-7} \text{m}}{3.06 \times 10^{-7} \text{m}} = 306 \text{ nm}$$