

19. The energy of an incident photon is $E = hf = hc/\lambda$, where h is the Planck constant, f is the frequency of the electromagnetic radiation, and λ is its wavelength. The kinetic energy of the most energetic electron emitted is $K_m = E - \Phi = (hc/\lambda) - \Phi$, where Φ is the work function for sodium. The stopping potential V_0 is related to the maximum kinetic energy by $eV_0 = K_m$, so $eV_0 = (hc/\lambda) - \Phi$ and

$$\lambda = \frac{hc}{eV_0 + \Phi} = \frac{1240 \text{ eV} \cdot \text{nm}}{5.0 \text{ eV} + 2.2 \text{ eV}} = 170 \text{ nm} .$$

Here $eV_0 = 5.0 \text{ eV}$ and $hc = 1240 \text{ eV} \cdot \text{nm}$ are used. See problem 3.