

23. (a) The kinetic energy K_m of the fastest electron emitted is given by $K_m = hf - \Phi = (hc/\lambda) - \Phi$, where Φ is the work function of aluminum, f is the frequency of the incident radiation, and λ is its wavelength. The relationship $f = c/\lambda$ was used to obtain the second form. Thus,

$$K_m = \frac{1240 \text{ eV} \cdot \text{nm}}{200 \text{ nm}} - 4.20 \text{ eV} = 2.00 \text{ eV}$$

where the result of Exercise 3 is used.

- (b) The slowest electron just breaks free of the surface and so has zero kinetic energy.
- (c) The stopping potential V_0 is given by $K_m = eV_0$, so $V_0 = K_m/e = (2.00 \text{ eV})/e = 2.00 \text{ V}$.
- (d) The value of the cutoff wavelength is such that $K_m = 0$. Thus $hc/\lambda = \Phi$ or $\lambda = hc/\Phi = (1240 \text{ eV} \cdot \text{nm})/(4.2 \text{ eV}) = 295 \text{ nm}$. If the wavelength is longer, the photon energy is less and a photon does not have sufficient energy to knock even the most energetic electron out of the aluminum sample.