

Chapter 36 Problem 32 †

Solution

Find the energy difference between the 4f and 3p levels in sodium.

The spectral line associated with the $4f \rightarrow 3p$ transition has a wavelength of $\lambda = 567.0 \text{ nm}$. The relationship between wavelength and energy for a photon is

$$E = \frac{hc}{\lambda}$$

Since the energy of the photon matches the energy of the transition, the energy between the 4f and 3p levels is

$$E = \frac{(6.626 \times 10^{-34} \text{ J} \cdot \text{s})(2.998 \times 10^8 \text{ m/s})}{567.0 \times 10^{-9} \text{ m}} = 3.503 \times 10^{-19} \text{ J}$$

Converting this to electron volts gives

$$E = 2.187 \text{ eV}$$

(All calculations were done with four significant digits.)

†Problem from Essential University Physics, Wolfson