49. (a) An electron must be removed from the K-shell, so that an electron from a higher energy shell can drop. This requires an energy of 69.5 keV. The accelerating potential must be at least 69.5 kV.

(b) After it is accelerated, the kinetic energy of the bombarding electron is 69.5 keV. The energy of a photon associated with the minimum wavelength is 69.5 keV, so its wavelength is

$$\lambda_{\min} = \frac{1240\,\mathrm{eV \cdot nm}}{69.5 \times 10^3\,\mathrm{eV}} = 1.78 \times 10^{-2}\,\mathrm{nm} = 17.8\,\mathrm{pm}\ .$$

(c) The energy of a photon associated with the K_α line is $69.5\,\mathrm{keV} - 11.3\,\mathrm{keV} = 58.2\,\mathrm{keV}$ and its wavelength is $\lambda_{\mathrm{K}\alpha} = (1240\,\mathrm{eV \cdot nm})/(58.2 \times 10^3\,\mathrm{eV}) = 2.13 \times 10^{-2}\,\mathrm{nm} = 21.3\,\mathrm{pm}$. The energy of a photon associated with the K_β line is $69.5\,\mathrm{keV} - 2.30\,\mathrm{keV} = 67.2\,\mathrm{keV}$ and its wavelength is $\lambda_{\mathrm{K}\beta} = (1240\,\mathrm{eV \cdot nm})/(67.2 \times 10^3\,\mathrm{eV}) = 1.85 \times 10^{-2}\,\mathrm{nm} = 18.5\,\mathrm{pm}$. The result of Exercise 3 of Chapter 39 is used.