Problem set #14; do not turn in.

1. XPS systems typically use Al or Mg targets to produce soft x-rays. Calculate the wavelengths of the $K_{\alpha 1}$ and $K_{\alpha 2}$ x-ray lines of Al and Mg starting from the binding energies of the K and L core electrons.

2. We use Cu x-ray tubes in our lab experiments but sometimes harder x-rays are desirable and then Ag is better choice. (a) What are the wavelengths of the two Ag K_α x-ray lines? (b) Calculate the x-ray absorption coefficient for Pd due to the photoelectric effect for Ag K_α and Ag K_β x-ray lines using the equation for σ_{ph} included below. Include only the L and K shells of Pd in your calculation. (c) How thick of a Pd metal foil would you recommend for use as a filter to reduce the K_β intensity from a Ag x-ray source?

x-ray properties of the elements

$$\sigma_{ph} = \frac{128\pi}{3} \frac{e^2 \hbar}{mc} \left(\frac{E_B}{E}\right)^{5/2} \frac{1}{E} \tag{1}$$

$$\frac{e^2 \hbar}{mc} = 0.056 \text{ eV\AA}^2 \tag{2}$$