*Name*_____
PIXE Homework #3 - Physics 100
Union College Fall 2016

1. Suppose that your x-ray detector had an energy resolution of $\Delta E = 0.5 keV$, would it be able to separate the K_α lines for platinum($^{195}_{78}Pt$) and gold($^{197}_{79}Au$)? An energy resolution means that anything smaller than this value, and I won't be able to distinguish the lines from each other – the lines will overlap. In other words on an x-ray energy spectrum (a graph of the intensity of x-rays versus their energy, as was shown in homework 2) would you be able to tell the K_α line of platinum from the K_α line of gold?

2. What are the two shortest wavelengths for a molybdenum($^{96}_{42}Mo$) atom?

3. An unknown single element target is used in a PIXE experiment and characteristic x-rays are produced with wavelengths of $1.55\times10^{-10}\,m$ and $1.31\times10^{-10}\,m$. What is most likely the elemental make up of the target?

4. Show that the Moseley's law for K_α radiation may be expressed as $\sqrt{f} = \sqrt{\frac{3}{4}\left(\frac{13.6eV}{h}\right)}(Z-1)$ where f is the x-ray frequency.

5. Suppose that you did not have a source of protons in which to perform a PIXE experiment. Rather, you had a source of alpha particles (or helium nuclei.) Describe how you could use the alpha particles to do materials identification of an unknown target material. In particular describe the HIXE (which stands for Helium Induced X-ray Emission spectroscopy) process and what the energy formula for the emitted x-rays might look like.