

Name _____

PIXE Homework #1 - Physics 100

Union College Fall 2023

Due Date: Monday, September 11, 2023, in class

1. Explain the main components of the Pelletron particle accelerator and the significance of each.
2. Explain the charge exchange process that occurs for a helium ion.
3. What is the kinetic energy of the He ion after our machine has accelerated it? The bias voltage applied across the quartz bottle is $+3.8kV$ for Helium. (Hint: the alpha particle (2 protons and 2 neutrons) has a charge of $+2e$ when it leaves the bottle, a $-1e$ charge when it accelerates towards the terminal, and a $+2e$ charge when it accelerates away from the terminal.)
4. From the kinetic energy you calculated in question 3, what is the speed of an alpha particle after it leaves the accelerator?
5. If the radius of the alpha particle's orbit is $34.4cm$ (exactly the same as that of the proton,) what magnitude of magnetic field is required to steer the alpha particle down the 30° beamline?