A 5 MeVα-particle source is used in Rutherford backscattering analysis. Calculate the energies of backscattered αparticles from nuclei with ***A*** = 20, 50 and 100. What detector energy resolution (in keV) for α particles would be needed to resolve ΔA = 1 for each of the above mass regions?

In an AMS measurement of a carbon sample, 1000 counts due to transmitted 14C ions are recorded in 5 min. A beam of 10 μA is measured when the system is set to transmit 12C3+on s. Calculate the atomic ratio of l4C/12C in the sample assuming that the transmissions of 14C and 12C ions through the system are the same. What mass of 12C was in the sample if it is totally consumed in half an hour? Assume a constant rate of consumption during this period and a system efficiency εof 2%.

In a PIXE measurement, a thin target containing 10-11 gcm-2 of an element of mass number 120 is bombarded with a proton beam of intensity 0.5 μA in a direction perpendicular to the target. The X-ray detection efficiency of the system ***ε*** = 1%. If the count rate is 0.6 s-1' and the background is negligible, calculate the cross section in barns for the production of X-rays and its accuracy (to one standard deviation) in a measurement lasting 25 min.