Problem 1

(a) When α particles with kinetic energy of 5.00 MeV are scattered at 90°by gold nuclei, what is the impact parameter?

(b) If the thickness of a gold foil is 1.0 μm, in what percentage of cases will the incident α particles be scattered at angles larger than 90°(this is called back-scattering)

Problem 2

A narrow beam of protons with a kinetic energy of 1.0 MeV impinge perpendicularly on a gold foil of mass-thickness 1.5 mg/cm^2. A counter counts the protons scattered at an angle of 60°. The window of the counter has an area of 1.5 cm^2, and the distance from the scattering region in the foil is 10 cm. The window faces and is at right angles to the protons that fall on it. What is the ratio between the numbers of protons that enter the window and that impinge on the foil?

Problem 3

Assume Thomson's model is right: that the positive charge in an atom is uniformly distributed over the entire atom. If an α particle has an energy of 5.0 MeV and the radius of a gold atom is 1 Å, show that the largest angle of deflection of the α particle scattered from a gold atom would be about 10^{-4} rad (electrons are neglected).

Problem 4

If α particles with kinetic energy up to 7.7 MeV energy are scattered by a gold foil and the Rutherford scattering formula is still correct, estimate the size of the gold nucleus.