

Homework II

- 1.) Derive the Rutherford scattering cross-section formula using the technique from section I.E. of the Notes

instead of
$$V(r) = \begin{cases} 0 & r > a \\ \infty & r \leq a \end{cases}$$

use
$$V(r) = \frac{k}{r} \quad : \quad k = \frac{q_1 q_2}{4\pi\epsilon_0} = \text{constant}$$

integrate $0 \rightarrow \infty \Rightarrow \phi = \sin^{-1}\left(\frac{k}{2Eb}\right) - \sin^{-1}(\infty)$

$$= \underbrace{\sin^{-1}\left(\frac{k}{2Eb}\right)}_{\text{constant}} - \sin^{-1}(\infty)$$

$$\sin\left(\phi + \frac{\pi}{2}\right) = \frac{k/2Eb}{\sqrt{1 + \left(\frac{k}{2Eb}\right)^2}} = \cos(\phi)$$



$$\Rightarrow \tan \phi = \frac{1}{\frac{k}{2Eb}} \Rightarrow b = \frac{k}{2E} \cot\left(\frac{\theta}{2}\right)$$

$$\Rightarrow \sigma(\theta) = \frac{b}{\sin \theta} \frac{db}{d\theta} = \frac{k^2}{16E^2} \frac{1}{\sin^4\left(\frac{\theta}{2}\right)}$$

- 2) Computer:

1.) compile GEANT 4 example/Novice/No2

2.) make your own copy of it.
 Change program name (rename files)

Change target Material
 compile