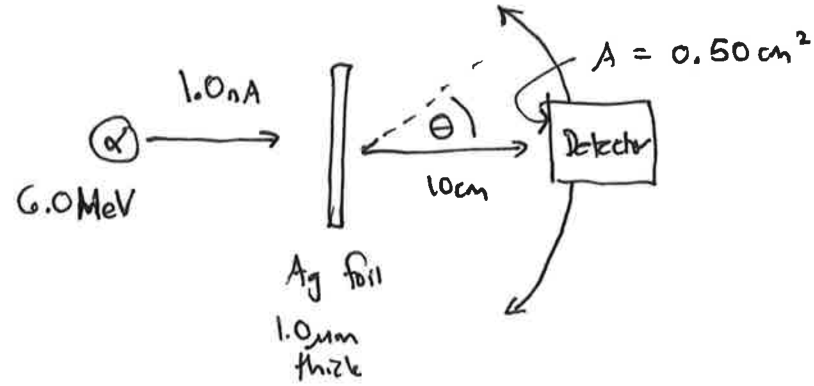
TL 4-48



How many α-particles will be scattered per second into the detector at (a) θ = 60°? (b) θ = 120°

Use
$$\Delta N = \left(\frac{I_0 A_{sc} n t}{r^2}\right)\left(\frac{k Z e^2}{2 E_\alpha}\right)^2 \frac{1}{\sin^4\left(\frac{\theta}{2}\right)}$$

- I_0: ptcls/second / unit area of incident beam
- A_{sc}: detector area
- t: thickness of foil
- r: distance to detector
- n: # nuclei per unit volume
- E_α: α ptcl KE

- There are a few as-yet-undetermined values in this formula.
- So: for silver: $Z = 47$

$$n = \frac{\rho N_A}{M} = \frac{(10.49\ g/cc)(6.02\times10^{23}\ atoms/mol)}{(107.9\ g/mol)} = 5.85\times10^{28}\ \frac{atoms}{m^3}$$

$$I_0 = \frac{\text{current}}{\text{charge/ptcl}}\frac{1}{\text{area}} = \frac{1.0e{-9}\ coul/sec}{2(1.6e{-19}\ coul)}\frac{1}{\text{area}} = \frac{3.1\times10^9}{sec\cdot area}$$

- Plugging in numbers gives

$\Delta N_{60°}$ = 465 α-ptcls/second at 60°
$\Delta N_{120°}$ = 52 α-ptcls/second at 120°