PS #3

1. Atmospheric Pressure...

$$P \simeq \rho g h = (\rho h)\cdot g$$

$$10^5\,\text{Pa} = (\rho h)\cdot 10\ \text{m/s}^2$$

$$\rho h = 10^4\,\frac{\text{kg}}{\text{m}^2} = 10^4\cdot\frac{10^3\ \text{gm}}{10^4\ \text{cm}^2}$$

$$\boxed{\rho h \cong 10^3\ \frac{\text{gm}}{\text{cm}^2}}$$

<u>Nitrogen</u>: $A = 14\ \text{gm/mole}$.

$$S = \frac{\#\ \text{atoms}}{\text{cm}^2} = \frac{10^3}{14}\cdot N_A$$

$$\boxed{S = 4.3\cdot 10^{25}\ \text{atoms/cm}^2}$$

$$\sigma = 4\,\frac{z^2 Z^2 \alpha^2}{\beta^2}\,\pi a^2 \qquad \rightarrow z = 1,\ \beta \simeq 1$$

$$Z = 7$$

$$a = \frac{a_0}{Z^{1/3}}$$

$$\sigma \cong 4\cdot\frac{Z^2\alpha^2}{\beta^2}\,\pi\,\frac{a_0^2}{Z^{2/3}}$$

$$\simeq 4\cdot\frac{Z^{4/3}\alpha^2}{\beta^2}\,\pi a_0^2 \simeq 4\cdot\frac{7^{4/3}}{(137)^2}\,\pi\cdot\frac{1}{2^2}\cdot 10^{-16}\ \text{cm}^2$$

$\sigma_{tot} \simeq 2.2 \cdot 10^{-19}\ cm^2$

$$\boxed{\begin{aligned} S\sigma &= \#\ \text{interactions} \\ &\simeq 4.3 \cdot 10^{25} \cdot 2.2 \cdot 10^{-19} \\ &= 9.6 \cdot 10^{6} \simeq 10^{7} \quad (\text{a lot!}) \end{aligned}}$$