Exercise 2

Florian Bierlage

30.4.2025

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1 Exercise 1

1.1 a)

The distance between two particles $d = \sqrt{V}$ where V is the volume per particle.

$$pV = N_A RT \to V, \quad d = 3.4nm$$

and for silicon

$$\frac{\rho}{M_{Si}} = 28u \Rightarrow V \quad d = 0.27nm$$

via the lattice constant $d = 0.5nm$.

1.2 b)

$$V_{\text{Tube}} = \pi b^2 \cdot 1cm$$

$$\frac{V_{\text{Tube}}}{V} = \begin{cases} 7.77 \cdot 10^{23} b^2 m^{-2} & \text{ideal gas} 1.6 \cdot 10^{27} b^2 m^{-2} \\ \text{Silicon} \end{cases}$$

1.3 c)

with $b = 0.1nm$; 7700 Air particles, and $1.6 \cdot^{7}$ Silicon particles.

1.4 d)

$$\sigma = \pi b^2 P$$

2 Exercise 2

Reading from the figure, we get

$$\frac{\mathrm{d}E}{\mathrm{d}x} = \begin{cases} 2.1 & \mu \\ 2.0 & \pi \\ 2.8 & p \end{cases}$$

now to get 2σ we multiply all values by $2 \cdot 5\%$.
the Proton is separated from the muon and the pion, but the pion and muon are very close to each other, so they are indistinguishable.

3 Exercise 3

3.1 a)

- in the Order of $10MeV$
- Bremsstrahlung in the Order of
-

3.2 b)

$$\left(\frac{\mathrm{d}E}{\mathrm{d}x}\right)_{\mathrm{rad}} = -\frac{E}{X_0}$$

$$\frac{E}{X_0} = \sum_i \omega_i \frac{E}{X_{0i}}$$

$$\frac{1}{X_0} = \sum_i \omega_i \frac{1}{X_{0i}}$$

where $X_0 = 43.2\frac{g}{cm^2}$, or $X_0 = 32.5\frac{1}{cm}$.

3.3 c)

Al: 3.37%, 8.89cm
Si: 0.21%, 9.36cm