# Notes on exercise 2a

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# Exercise 2a

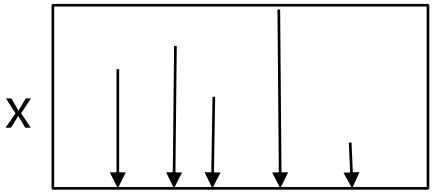
- Calibration standard, water solution
- Sample with unknown composition and density
- Transmission experiment results available
- How to determine self-absorption in the sample?

# Exercise 2a

$$\varepsilon = \varepsilon_0 (F / F_0)$$

ε – efficiency

F – self absorption factor



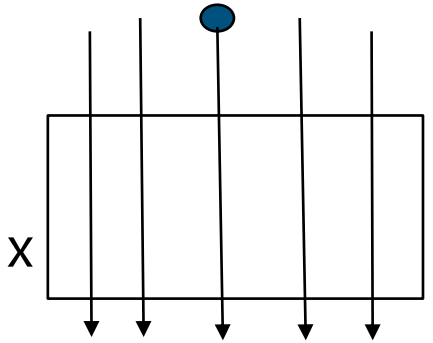

$$F = \frac{1 - e^{-\mu x}}{\mu x}$$

x – sample thickness

μ – absorption coefficient

$$T = e^{-\mu x}$$

T – transmission factor



# Exercise 2a

$$T / T_0 = e^{-(\mu-\mu_0)x}$$

$$\ln(T / T_0) = -(\mu - \mu_0)x$$

$$F / F_0 = \left( \frac{1-e^{-\mu x}}{\mu x} \right) \Big/ \left( \frac{1-e^{-\mu_0 x}}{\mu_0 x} \right)$$

$$\ln(F / F_0) = \ln\left( \frac{1-e^{-\mu x}}{\mu x} \right) - \ln\left( \frac{1-e^{-\mu_0 x}}{\mu_0 x} \right)$$

# Exercise 2a

$$\ln\left(\frac{1-e^{-z}}{z}\right) \xrightarrow{z \to 1} -z/2 + z^2/24 - \ldots$$

$$z = \mu x$$

$$\ln(F/F_0) = -\frac{1}{2}(\mu - \mu_0)x$$

$$\ln(T/T_0) = -(\mu - \mu_0)x$$

$$\ln(F/F_0) = \frac{1}{2}\ln(T/T_0)$$

$$F/F_0 = \sqrt{T/T_0}$$

# Exercise 2a