

Notes on exercise 2a

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

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

ε – efficiency

F – self absorption factor

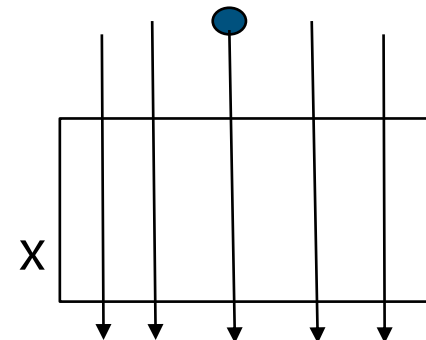
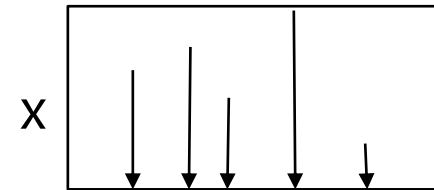
$$F = \frac{1 - e^{-\mu x}}{\mu x}$$

x – sample thickness

μ – absorption coefficient

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

T – transmission factor



Exercise 2a

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

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

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

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

Exercise 2a

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

$$z = \mu x$$

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

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

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

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

Exercise 2a

ln((1-exp(-z))/z) Series

WolframAlpha[™] computational knowledge engine.

ln((1-exp(-z))/z) Series

series $\log\left(\frac{1 - \exp(-z)}{z}\right)$

log(x) is the natural logarithm

Series expansion at z=0:

$$-\frac{z}{2} + \frac{z^2}{24} - \frac{z^4}{2880} + \frac{z^6}{181440} + O(z^7)$$

(Taylor series)

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Approximations about z=0 up to order 4:

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