

Übungsaufgaben I, von 24.10.2001

Musterlösungen

1. 1. Ordnung Reaktion:

$$\frac{d[A(t)]}{dt} = -k[A(t)]$$

Umformung der differential Gleichung:

$$\frac{d[A(t)]}{[A(t)]} = -k dt$$

Integration:

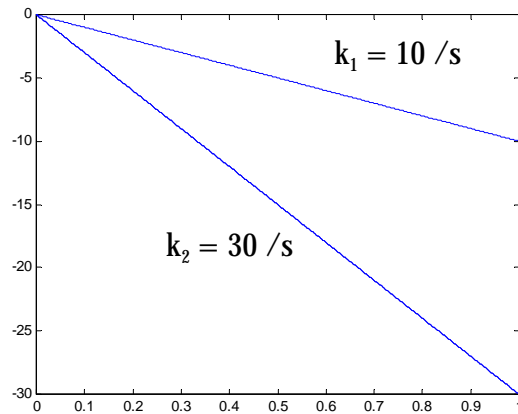
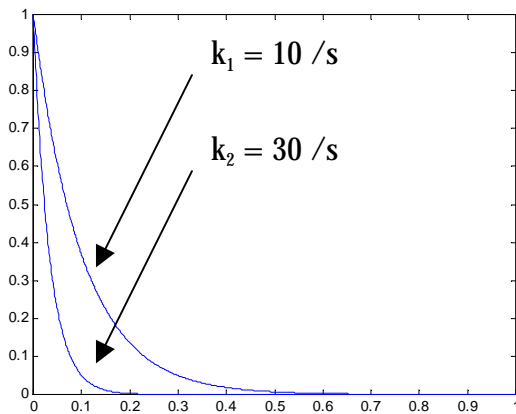
$$\int_{[A]_0}^{[A]} \frac{d[A(t)]}{[A(t)]} = - \int_0^t k \cdot dt$$

bei $t_0=0$ A(t) ist $[A]_0$

$$\ln\left(\frac{[A(t)]}{[A]_0}\right) = -kt$$

Die analytische Lösung lautet:

$$[A(t)] = [A]_0 e^{-kt}$$



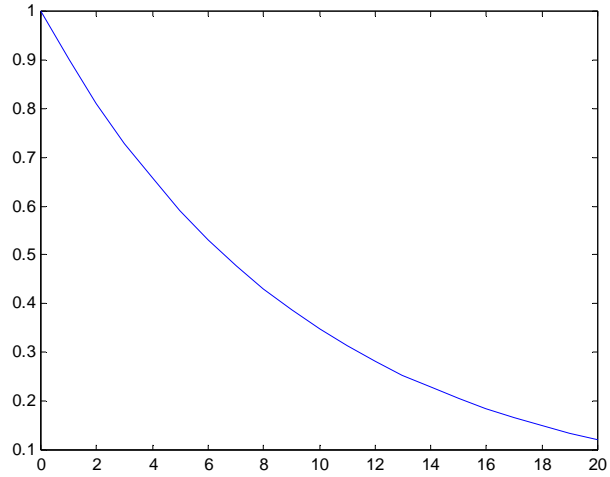
2.

$$c(t_{i+1}) = c(t_i) - kc(t_i)\Delta t$$

$$c(t_{i+1}) = c(t_i) \underbrace{(1 - k\Delta t)}_{\text{const}=0.9}$$

t [s]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Cmol/l	0.9	0.81	0.73	0.66	0.59	0.53	0.48	0.43	0.39	0.35	0.32	0.28	0.26	0.23	0.21	0.19	0.17	0.15	0.14	0.12

Graphische Darstellung:
C(t)



3. $t_{1/2} = 1.4 \cdot 10^{10} \text{ a} = \ln(2)/k$
 $k = 4.95 \cdot 10^{-11} \text{ a}^{-1}$
 $N = N_0 \cdot e^{-kt}$
 $N = N_0 \cdot 0.75$ (25% Zerfall !)

$t = 5.8 \cdot 10^9 \text{ a}$

4. *2. Ordnung Reaktion:*

$$\frac{d[A]}{dt} = -k[A]^2 \qquad \frac{d[A]}{[A]^2} = -kdt$$

$$\int_{[A]}^{\frac{[A]}{[A]^2}} d[A] = - \int_0^t kdt \qquad \frac{1}{[A]} - \frac{1}{[A]_0} = kt \qquad \frac{1}{[A]} - \frac{1}{[A]_0} = kt$$

$$[A] = \frac{[A]_0}{1 + kt[A]_0}$$

