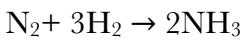
Dynamics and Kinetics. Exercise 1

Problem 1

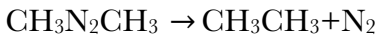
The reaction of 20 mol of hydrogen with 20 mol of nitrogen is stopped when 5 mol of ammonia are produced. What is the extent of the reaction?



$$N_2 + 3H_2 \rightarrow 2NH_3$$

Problem 2

Consider the decomposition of azomethane at 600K:



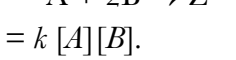
$$CH_3N_2CH_3 \rightarrow CH_3CH_3 + N_2$$

time (s)	0	1000	2000	3000	4000
ρ $CH_3N_2CH_3$ (10^{-2} Torr)	8.20	5.72	3.99	2.78	1.94

Compute the rate constant for this reaction.

Problem 3

Derive the integrated rate law for a second order reaction of the type



$$A + 2B \rightarrow Z$$

if its differential rate law is found to be $v = k\,[A]\,[B]$.

Problem 4

a) Derive the integrated rate equation for a reaction of order 3/2 in a single reactant. Derive the expression for the half-life of such a reaction. Can you think of an example of such a reaction?
b) Obtain these formulae from the general expressions derived in the lecture.