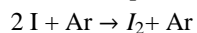


CHEM 113C, Spring 2009, Problem Set 3. DUE Friday May 24 in class.

Problem 1. (100 points) For the reaction



you have the following data.

Ar	$2 \cdot 10^3 \text{ sec}$	$4 \cdot 10^3 \text{ sec}$	$6 \cdot 10^3 \text{ sec}$	$8 \cdot 10^3 \text{ sec}$	$10 \cdot 10^3 \text{ sec}$
0.002	8.45×10^{-6}	8.7×10^{-6}	8.9×10^{-6}	9.05×10^{-6}	9.15×10^{-6}
0.004	8.53×10^{-6}	8.96×10^{-6}	9.19×10^{-6}	9.34×10^{-6}	9.44×10^{-6}
0.006	8.77×10^{-6}	9.19×10^{-6}	9.39×10^{-6}	9.52×10^{-6}	9.6×10^{-6}

The table gives the I_2 concentrations in mol/liter at the time listed in the headings. The first row is for an Ar concentration of 0.002 mol/liter, the second for 0.004 mol/liter Ar etc.

The initial concentration

$$I(0) = 2 \cdot 10^{-5} \text{ mol/liter}$$

$$I_2(0) = 0$$

1a. Assume that the reaction is pseudo second order and write the rate equation and the mass balance.

$$\frac{dI}{dt} = -k \text{ Ar } I^2$$

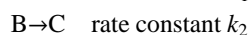
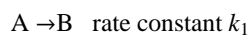
Denote

$$k_p = \text{Ar } k$$

and determine k_p by fitting the data in the table. Test the fit by calculating the percentage deviation of the fit to the data.

1b. Calculate k_p for all three Ar concentrations and test whether it satisfies Eq. 1. Calculate k .

Problem 2: Consider the reactions

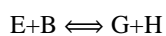
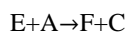
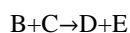


2a. (30 points) Prove that $B(t)$ has a maximum.

2b. (30 points) Find the formula for the time the maximum is reached.

Problem 3: (50 points)

Write the rate equations and the mass balance for the following reactions:



For problem 1: If you do not use *Mathematica* explain how you would do the calculations. Give the equation and explain the procedure.