


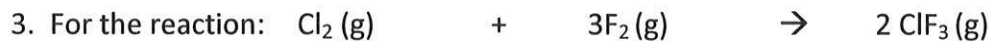
Problem Set # 3

1. The decomposition of X is second order in X and has a rate constant of $7.02 \times 10^{-3} \text{ M}^{-1}\text{s}^{-1}$ at a certain temperature.

- a. Write the rate law. $\text{Rate} = 7.02 \times 10^{-3} \text{ M}^{-1}\text{s}^{-1} [\text{X}]^2$
- b. What is the half-life for this reaction if the initial concentration is 0.500 M? 285 s
- c. How long will it take for the concentration of X to decrease to 0.285 M when the initial concentration is 0.677 M? $t = 289 \text{ sec}$
- d. Draw the straight line plot of the reaction. 

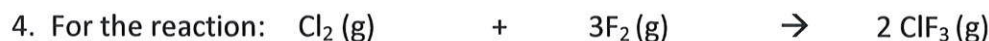
2. The half-life for the radioactive decay of U-238 is 4.5 billion years and is independent of initial concentration. How long will it take for 10% of the initial concentration of a U-238 to decay?

$k = 1.54 \times 10^{-10} \text{ yr}^{-1}$ $t = 684,159,193 \text{ yrs}$



Complete the table by adding the calculated rates for F_2 and ClF_3 :

$\Delta[\text{Cl}_2]/\Delta t$	$\Delta[\text{F}_2]/\Delta t$	$\Delta[\text{ClF}_3]/\Delta t$
-0.048 M/s	-0.144 M/s	0.096 M/s



- a. Write the rate expression for all reactants and products. $-\frac{\Delta[\text{Cl}_2]}{\Delta t} = -\frac{1}{3} \frac{\Delta[\text{F}_2]}{\Delta t} = \frac{1}{2} \frac{\Delta[\text{ClF}_3]}{\Delta t}$
- b. What is the relationship between the rate of consumption of F_2 and the rate of production of ClF_3 ?

$-\frac{\Delta[\text{F}_2]}{\Delta t} = \frac{3}{2} \frac{\Delta[\text{ClF}_3]}{\Delta t}$

5. The following data were obtained for the reaction of NO with O_2 . Concentrations are in molecules/ cm^3 and rates are in molecules/ $\text{cm}^3\cdot\text{s}$. Find the orders with respect to NO and O_2 . Find the value of the rate constant.

[NO] (molecules/ cm^3)	[O_2] (molecules/ cm^3)	Initial Rate (molecules/ $\text{cm}^3\cdot\text{s}$)
1×10^{18}	1×10^{18}	2.0×10^{16}
2×10^{18}	1×10^{18}	2.0×10^{16}
3×10^{18}	1×10^{18}	18.0×10^{16}
1×10^{18}	3×10^{18}	6.0×10^{16}

$n = 0$

$n = 1$