Assignment 1: Kinetics Calculations

PART I

1. When heated above $500° C$, potassium nitrate decomposes according to the equation:

$$4KNO_{3(s)} \rightarrow 2K_2O_{(s)} + 2N_{2(g)} + 5O_{2(g)}$$

   If oxygen is being formed at a rate of 0.30 mol/Ls, what are the rates of formation of the other products? What is the rate at which the KNO_3 is decomposing? (1) 0.12 mol/Ls (2) 0.24 mol/Ls)

2. In the combustion of hexane:

$$2C_6H_{11(g)} + 19O_{2(g)} \rightarrow 12CO_{2(g)} + 14H_2O_{(g)}$$

   It was found that rate of reaction of C_6H_{14} was -1.2 mol/Ls.
   a. What was the rate of reaction of O_2? (-11.4 mol/Ls)
   b. What is the rate of formation of CO_2? (+7.2 mol/Ls)
   c. What is the rate of formation of H_2O? (+8.4 mol/Ls)

3. For the reaction $2A + B \rightarrow 3C$, it was found that the rate of disappearance of B was -0.3 mol/Ls. What was the rate of disappearance of A and the rate of appearance of C? (A= -0.6 mol/Ls C= +0.9 mol/Ls)

   At a certain temperature, the rate of decomposition of N_2O_5, in the following equation is 2.5×10^{-6} mol/Ls. How fast are NO_2 and O_2 being formed?

4. What units are used to express reaction rate?

5. In the reaction $3H_2 + N_2 \rightarrow 2NH_3$, how does the rate of disappearance of hydrogen compare to the rate of disappearance of nitrogen? How does the rate of appearance of NH_3 compare to the rate of disappearance of nitrogen?

PART II

1. The following data were collected for the reaction $CH_3CHO \rightarrow CH_4 + CO$

$[CH_3CHO]$ (mol/L)	Time (s)
0.200	0
0.153	20
0.124	40
0.104	60
0.090	80
0.079	100
0.070	120
0.063	140
0.058	160
0.053	180
0.049	200

Make a graph of concentration versus time and determine the reaction rate at 60 s and at 120 s. What can you conclude about the values obtained at 60 s and at 120 s?

2. The following data were collected for the reaction $SO_2Cl_2 \rightarrow SO_2 + Cl_2$ at a certain temperature.

$[SO_2Cl_2]$ (mol/L)	Time (s)
0.100	0
0.082	100
0.067	200
0.055	300
0.045	400
0.037	500
0.030	600
0.025	700
0.020	800

Make a graph of concentration versus time and determine the rate of the reaction at t = 250 s and t= 625 s.