Kinetics/ HW **Name:**_____

1) Suggest experimental means by which the following reactions can be monitored for rate. *(B)*

a) $C_2H_6\,(g) \longrightarrow C_2H_4\,(g) + H_2\,(g)$

b) $C_2H_5I(g) + H_2O(l) \longrightarrow C_2H_5OH(l) + H^+\,(aq) + I^-(aq)$

2) The initial concentration of H_2O_2 is 0.1108 M and 12 s later the concentration is 0.1060 M. what is the initial rate of this reaction expressed in M s^{-1}. (ans: 4.0 x 10^{-4} M/s)

3) The rate of the following reation in aqueous solution si monitored by measuring the number of moles of Hg_2Cl_2 that precipitate per liter per minute. The data obtained are listed in the table.

$2HgCl_2 + C_2O_4^{2-} \longrightarrow 2Cl^- + 2CO_2 + Hg_2Cl_2$

Exp	$[HgCl_2]$, M	$[C_2O_4^{2-}]$, M	Initial rate M min^{-1}
1	0.105	0.15	1.8 x 10^{-5}
2	0.105	0.30	7.1 x 10^{-5}
3	0.052	0.30	3.5 x 10^{-5}
4	0.052	0.15	8.9 x 10^{-6}

a) Determine the order of reaction with respect to $HgCl_2$ and $C_2O_4^{2-}$ and overall. (ans: 1,2,3)
b) What is the value of the rate constant, k? (ans: 7.6 x 10^{-3} M^{-2} min^{-1})
c) What would be the intital rate of reaction if $[HgCl_2]$ = 0.094 M and $[C_2O_4^{2-}]$ = 0.19 M? (ans: 2.6 x 10^{-5} M/min)
d) Are all four experiments necessary to answer parts a through c?

4) A first order reaction A $\longrightarrow$ products, has a rate of reaction of 0.0025 M s^{-1}, when [A] = 0.484 M.

a) What is the rate constant, k, for this reaction? (ans: 5.17 x 10^{-3}/s)

b) Does $t_{3/4}$ depend on the initial concentration? Does $t_{4/5}$? Explain?

5) The rate constant for the second order reaction is 0.80 $M^{-1}s^{-1}$ at 10°C.

$$2NOBr \longrightarrow 2NO + Br_2$$

a) Starting with a concentration of 0.086 M, calculate the concentration of NOBr after 22 s. (ans: 0.034M)

b) Calculate the half lifes when [NOBr] = 0.072 M and $[NOBr]_0$ = 0.054 M. (ans: 17s, 23s)

6) The second order rate constant of the dimerization of protein P is 6.2 x 10^{-3} $M^{-1}s^{-1}$ at 25°C.

$P + P \longrightarrow P_2$

If the concentration of the protein is 2.7 x 10^{-4} M, calculate the initial rate (M/s) of the formation of P_2. How long in seconds, will it take to decrease the concentration of P to 2.7 x 10^{-5} M? ((*B*)ans: 4.5 x 10^{-10} M/s)

7) For the reaction given below the frequency factor A is 8.7 x 10^{12} s^{-1} and the activation energy is 63 KJ/mol. What is the rate constant for the reaction at 75°C? ((*B*)ans: 3.0 x 10^3/s)

$NO(g) + O_3(g) \longrightarrow NO_2 + O_2(g)$