CHM 152/54 Group Work for Exam 1 Spring 10 Name:_____

ANSWERS AT END

1. The gas phase reaction A + B $\longrightarrow$ C has a reaction rate which is experimentally observed to follow the relationship Rate = k[A]^2[B] . The overall order of the reaction is?_____

2. The units of the rate constant for a second order reaction can be? (use t for time)

_____.

3. A reaction is first order in X and second order in Y. Tripling the initial concentration of X and cutting the initial concentration of Y to three-fourths of its previous concentration at constant temperature causes the initial rate to (increase or decrease)_____ by a factor of _____.

4. Consider the following rate data for the reaction below at a particular temperature.

2A + 3B $\longrightarrow$ Products

Experiment	Initial [A]	Initial [B]	Initial Rate of Loss of A
1	0.10 *M*	0.30 *M*	7.20 x 10^{-5} *M*•s^{-1}
2	0.10 *M*	0.60 *M*	1.44 x 10^{-4} *M*•s^{-1}
3	0.20 *M*	0.90 *M*	8.64 x 10^{-4} *M*•s^{-1}

The reaction is _____ order in A and _____ order in B.

5. Determine the rate-law expression for the reaction below.

2A + B_2 + C $\longrightarrow$ A_2B + BC

Trial	Initial [A]	Initial [B□]	Initial [C]	Initial Rate of Formation of BC
1	0.20 *M*	0.20 *M*	0.20 *M*	2.4 x 10^{-6} *M*•min^{-1}
2	0.40 *M*	0.30 *M*	0.20 *M*	9.6 x 10^{-6} *M*•min^{-1}
3	0.20 *M*	0.30 *M*	0.20 *M*	2.4 x 10^{-6} *M*•min^{-1}
4	0.20 *M*	0.40 *M*	0.40 *M*	4.8 x 10^{-6} *M*•min^{-1}

6. The decomposition of dimethylether at 504°C is first order with a half-life of 1570 seconds. What fraction of an initial amount of dimethylether remains after 4710 seconds?

7. The gas phase reaction 3C + 2D $\longrightarrow$ E + F obeys the rate-law expression Rate = k[D] and has a half-life of 0.860 s^{-1}. If 2.00 mole of D is injected into a 1.00-L container with excess C, what concentration of D remains after 1.50 seconds?

8. The decomposition of dinitrogen pentoxide obeys the rate-law expression Rate = 0.080 min^{-1} [N_2O_5] . If the initial concentration of N_2O_5 is 0.30 *M*, what is the concentration after 2.6 minutes?

9. Consider the following proposed mechanism. If this mechanism for the overall reaction were correct, and if k_1 were much less the k_2, then what would the observed rate law would be?

$$2A \xrightarrow{k_1} C + I$$

$$I + B \xrightarrow{k_{21}} C + D$$

10. Consider the reaction below and its observed rate law expression. Which proposed mechanisms are consistent with the rate law expression?

$2NO_2 \rightarrow 2NO + O_2$ $\quad$ Rate = $k[NO_2]^2$

I.	$NO_2 + NO_2 \rightarrow N_2O_4$	slow
	$N_2O_4 \rightarrow N_2 + 2O_2$	fast
	$N_2 + O_2 \rightarrow 2NO$	fast
II.	$NO_2 \rightarrow N + O_2$	slow
	$NO_2 + N \rightarrow N_2O_2$	fast
	$N_2O_2 \rightarrow 2NO$	fast
III.	$NO_2 \rightarrow NO + O$	slow
	$O + NO_2 \rightarrow NO + O_2$	fast

11. Calculate the activation energy of a reaction if the rate constant is 0.75 s^{-1} at 25°C and 11.5 s^{-1} at 75°C.

12. The specific rate constant, k, for a reaction is 2.64 x 10^{-2} s^{-1} at 25°C, and the activation energy is 74.0 kJ/mol. Calculate k at 50°C.

ANSWERS:

1. is third
2. $M^{-1}s^{-1}$
3. increase, 1.69
4. second, first
5. rate = $k[A]^2[C]$
6. 1/8
7. 0.60 M
8. 0.24 M
9. rate = $k_1[A]^2$
10. I
11. d) 47.1 kJ
12. c) 0.266 s^{-1}