Name(s) _____

Worksheet: Rate Law Data and Rate Expressions

1. State the order with respect to each reactant and the overall order of the reaction for the following rate expressions:

	A	B	Overall
(a) rate = k [A] [B]			
(b) rate = k $[A]^2$ [B]			
(c) rate = k [A] $[B]^{1/2}$			

2. If a first-order reaction has a rate constant of 10 s^{-1}, what is its half-life? The half-life for a reaction is the time needed to reduce the initial concentration by half.

3. Consider the following rate expression, and then answer the following questions.

The reaction $2\ NO(g) + O_2(g) \rightarrow 2\ NO_2(g)$

Obeys the following rate law: rate = k $[NO]^2$ $[O_2]$

In each case, explain how the rate of the reaction will change when the following concentration changes are made.

(a) $[O_2]$ is doubled	
(b) [NO] is doubled	
(c) [NO] is halved	
(d) $[O_2]$ is halved and [NO] is doubled	
(e) [NO] is halved and $[O_2]$ is doubled	

4. Consider the reaction

$2\ I^-(aq) + S_2O_8^{2-}(aq) \rightarrow I_2(aq) + 2\ SO_4^{2-}(aq)$

The following initial rates were found from a series of three experiments:

Experiment Number	$[I^-]$ (M)	$[S_2O_8^{2-}]$ (M)	Rate (mol/L · s)
1	0.07500	0.9000	2.61×10^{-4}
2	0.07500	0.4500	1.29×10^{-4}
3	0.1500	0.4500	2.60×10^{-4}

Provide the rate law for the reaction, including the value and units for the rate constant.

5. For the reaction A ➔ B, the following concentrations of A were measured:

[A] (M)	time (s)
0.100	0
0.091	1.00
0.082	2.00
0.073	3.00
0.068	4.00
0.061	5.00
0.055	6.00
0.049	7.00
0.045	8.00

(a) Determine the initial rate.

(b) Assume the reaction is first order. Calculate the rate constant.

(c) Assume the reaction is second order. Calculate the rate constant.

(d) Generate and plot 3 curves below:

(i) Plot concentration (y-axis) vs. time (x-axis) for the given experimental data above, use a solid —— line for the curve.

(ii) Calculate the predicted concentrations based on the initial concentration and rate constant from (b) for a first order reaction @ t=3s, t=5s, and t=8s. Plot vs. time using a dashed line ------.

(iii) Calculate the predicted concentrations based on the initial concentration and rate constant from (c) for a second order reaction @ t=3s, t=5s, and t=8s. Plot vs. time, using a dotted line ·····