

Name(s) _____

<i>Worksheet: Rate Law Data and Rate Expressions</i>

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

(a) $\text{rate} = k [\text{A}] [\text{B}]$

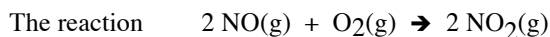
(b) $\text{rate} = k [\text{A}]^2 [\text{B}]$

(c) $\text{rate} = k [\text{A}] [\text{B}]^{1/2}$

A	B	Overall

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.

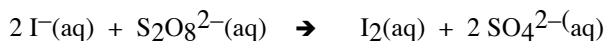


Obeys the following rate law: $\text{rate} = k [\text{NO}]^2 [\text{O}_2]$

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

(a) $[\text{O}_2]$ is doubled	
(b) $[\text{NO}]$ is doubled	
(c) $[\text{NO}]$ is halved	
(d) $[\text{O}_2]$ is halved and $[\text{NO}]$ is doubled	
(e) $[\text{NO}]$ is halved and $[\text{O}_2]$ is doubled	

4. Consider the reaction



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

<u>Experiment Number</u>	<u>$[\text{I}^-]$ (M)</u>	<u>$[\text{S}_2\text{O}_8^{2-}]$ (M)</u>	<u>Rate (mol/L · s)</u>
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.

Rate Data and Rate Equations

5. For the reaction $A \rightarrow B$, the following concentrations of A were measured:

<u>[A] (M)</u>	<u>time (s)</u>
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

