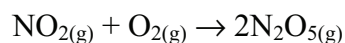


**Reinforcement****Chapter 6****BLM 6-2****Rate Law Equations****Goal****Practise determining and interpreting rate law equations.****Procedure**

Answer the following questions about the rate law.

**Questions**

1. A chemist carries out three trials to determine the rate of the reaction of nitrogen dioxide and oxygen at a fixed temperature. The chemist's results are shown in the chart below.



Experiment	Initial [NO <sub>2</sub> ] (mol/L)	Initial [O <sub>2</sub> ] (mol/L)	Initial rate of formation of N <sub>2</sub> O <sub>5</sub> (mol/(L ÷ s))
1	0.025	0.011	$3.1 \times 10^{-4}$
2	0.025	0.022	$6.2 \times 10^{-4}$
3	0.050	0.011	$6.2 \times 10^{-4}$

- (a) Write the rate law expression for the reaction. Explain your logic or show your calculations.

- (b) Calculate the rate constant.

(c) A chemist runs a trial of the reaction (at the same temperature) in which the initial concentration of  $[\text{NO}_2]$  is 0.0323 mol/L and the initial concentration of  $[\text{O}_2]$  is 0.0157 mol/L. Predict the initial rate.

2. A reaction has the following rate law:

$$\text{Rate} = k[\text{A}][\text{B}]^2$$

Assuming a constant temperature, by what factor does the reaction rate change when the following changes are made to initial reactant concentration?

(a)  $[\text{A}]$  is tripled and  $[\text{B}]$  is doubled. How does the rate change?

(b)  $[\text{B}]$  is halved and  $[\text{A}]$  remains the same. How does the rate change?

(c)  $[\text{A}]$  is quadrupled and  $[\text{B}]$  is halved. How does the rate change?

(d)  $[\text{A}]$  and  $[\text{B}]$  are halved. How does the rate change?

3. Consider the following reaction and its corresponding rate law:



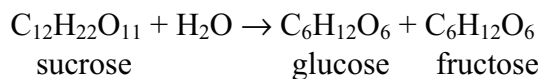
$$\text{Rate} = k[\text{BrO}_3^-][\text{Br}^-][\text{H}^+]^2$$

(a) What is the reaction order with respect to each reactant?

(b) What is the overall order of the reaction?

**(c)** Suggest two different ways to track the rate of this reaction experimentally.

- 4.** Sucrose (table sugar) reacts with water to form glucose and fructose (structural isomers).



At temperature  $T_1$ , the reaction has the rate law  $k[\text{C}_{12}\text{H}_{22}\text{O}_{11}]$  with  $k = 6.17 \times 10^{-4} \text{s}^{-1}$ .

**(a)** Calculate the half-life of the reaction in seconds.

**(b)** How long, in minutes, does it take for three quarters of the sucrose to react when  $T = T_1$ ?