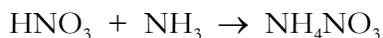


Extra Problems for Chapter 15

1. During a kinetics study, a student measures the rate of a chemical reaction to be 1.7 M/s. To get this value, he measured the concentration of a reactant at $t = 0.0$ seconds and found that it was 8.01 M. Later, he measured the concentration to be 2.15 M. At what time did he make that measurement?

2. The kinetics of the following chemical reaction are studied:

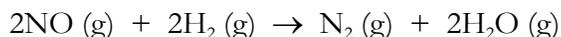


The rate equation is determined to be $\text{Rate} = k[\text{HNO}_3][\text{NH}_3]$

- What is the order of the reaction with respect to reactant HNO_3 ?
- What is the order with respect to reactant NH_3 ?
- What is the overall order of the reaction?
- What is the unit of the rate constant?

3. The rate constant for a reaction is $0.781 \frac{1}{\text{M}^2 \cdot \text{s}}$. What is the overall order of the reaction?

4. A chemist is doing a rate study on the following reaction:



The following data are obtained:

Trial	[NO]	[H ₂]	Instantaneous Rate
1	0.050 M	0.020 M	0.134 M/s
2	0.050 M	0.040 M	0.268 M/s
3	0.100 M	0.020 M	1.072 M/s

What is the rate equation for the reaction, including the rate constant?

5. Use the data in the table below to determine the rate equation (including the rate constant) for the following reaction:



Trial	[Xe]	[F ₂]	Instantaneous Rate
1	0.150 M	0.150 M	0.0056 M/s
2	0.300 M	0.150 M	0.0224 M/s
3	0.150 M	0.300 M	0.0112 M/s

6. A student is given two reactions to study. He is told that at room temperature, the first reaction has a rate constant of $1.34 \text{ 1/M}\cdot\text{s}$, while the second has a rate constant of $0.145 \text{ 1/M}\cdot\text{s}$. He is asked to measure the activation energy of each reaction at room temperature and use that to determine which rate constant belongs to which reaction. Once he measures the activation energies, how will he determine which rate constant belongs to which reaction?

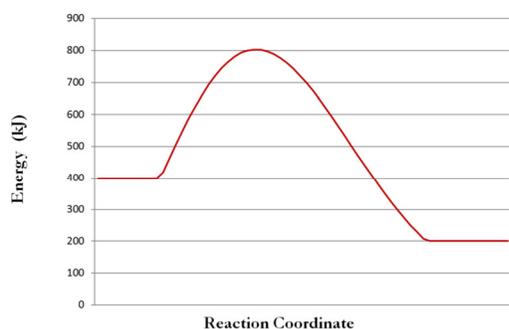
7. Given the following reaction mechanism:



What is the catalyst and the overall reaction?

8. Is the catalyst in #7 a heterogeneous or homogeneous catalyst?

9. Consider the coordinate diagram given below:



Draw the reaction coordinate diagram for the same reaction being run under the influence of a catalyst.

10. A chemical reaction has both gases and liquids as reactants. If a heterogeneous catalyst is used to speed up the reaction, what phase is the catalyst in?