

1. a. Describe collision theory using complete sentences.

b. In complete sentences, describe two reasons why a collision might be ineffective.

2. a. Define *reaction rate*.

b. What units are most commonly used to describe reaction rate? _____

c. Write a generalized equation that describes reaction rate:

3. For the following reaction, indicate how relative concentrations of molecules will change as the reaction progresses. Mark the statements true or false with respect to this reaction.



a. _____ As the reaction progresses, the concentration of N_2 will increase at the same rate as the concentration of NH_3 increases.

b. _____ As the reaction progresses, the concentration of H_2 will decrease at the same rate as the concentration of NH_3 increases.

c. _____ As the reaction progresses, the concentration of H_2 will decrease 1.5 times as fast as the concentration of NH_3 increases.

d. _____ As the reaction proceeds, the concentration of hydrogen gas decreases.

e. _____ The concentration of H_2 decreases three times as fast as the concentration of N_2 does.

4. One way that a balanced overall equation differs from a reaction mechanism is that the overall equation does not include _____, while the reaction mechanism does.

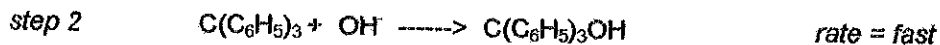
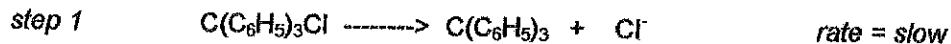
5. Reactions which proceed in a one-step mechanism _____ involve an intermediate product.

a. always

c. sometimes

b. never

6. The following reactions represent a proposed mechanism for the formation of triphenyl methanol ($C_6H_5)_3OH$) from triphenyl chloride ($C_6H_5)_3Cl$.



- A. Write the equation for the net reaction.
- B. Identify the intermediate product(s) _____
- C. Which step(s) is(are) the rate determining step(s)?
- Step 1 only
 - Step 2 only
 - both Step 1 and Step 2
 - neither Step 1 nor Step 2
- D. Which step(s) is(are) the elementary step(s)?
- Step 1 only
 - Step 2 only
 - both Step 1 and Step 2
 - neither Step 1 nor Step 2
7. The decomposition of nitrogen dioxide into oxygen gas and nitrogen monoxide takes place in one step. Propose a mechanism for the reaction, showing cancellation of any intermediate product and a summation of the reaction.
8. The balanced equation for the reaction of nitrogen monoxide gas and fluorine gas is:
- $$2 NO + F_2 \longrightarrow 2 NOF$$
- with NOF_2 as an intermediate product. Propose a two-step mechanism for the reaction, showing cancellation of any intermediate product and a summation of the reaction.

9. The rate law for the reaction of H_2O_2 and I^- is $\text{rate} = k [H_2O_2] [I^-]$.
- What will happen to the reaction rate if $[H_2O_2]$ is halved? _____
 - What will happen to the reaction rate if $[I^-]$ is four times greater? _____
10. A reaction has the rate law, $\text{rate} = k [A]^3 [B]$.
- What will happen to the reaction rate if the concentration of A is halved? _____
 - What will happen to the reaction rate if the concentration of B is tripled? _____

11. In your job at the Acme Nitrogen Dioxide Company, you are in charge of the production of nitrogen dioxide from nitrogen monoxide and oxygen gas which has been shown to proceed according to this rate law: $\text{rate} = k[\text{NO}]^2 [\text{O}_2]$.
- The two reactants in this process are kept in containers that hold the same number of molecules of each reactant. As the reaction proceeds, which container of reactant will empty first?
The container that holds _____
 - The initial concentration of nitrogen monoxide used at the factory is 4.00 M. In your haste, you mistakenly order 0.40 M nitrogen monoxide from your supplier. What will happen to the rate of the reaction if you use the new concentration?
 - A national emergency requires you to speed up the production of nitrogen dioxide. The engineers report that your factory can only change the concentration of one or the other reactant. Which reactant concentration should be changed? Explain why.

12. Name five general factors that affect reaction rates and explain how each could account for a change in reaction rate according to the Collision Theory.

	<u>Factor</u>	<u>Affects rate by...</u>
A.		
B.		
C.		
D.		
E.		

12. Draw an energy diagram graph for an exothermic reaction. Include the following in your diagram (check list for your convenience):

labels for x and y axes activated complex reactants
 activation energy reaction pathway products transition state

