

Kinetics (Reaction Rate) Practice

Name: Key Pd: _____

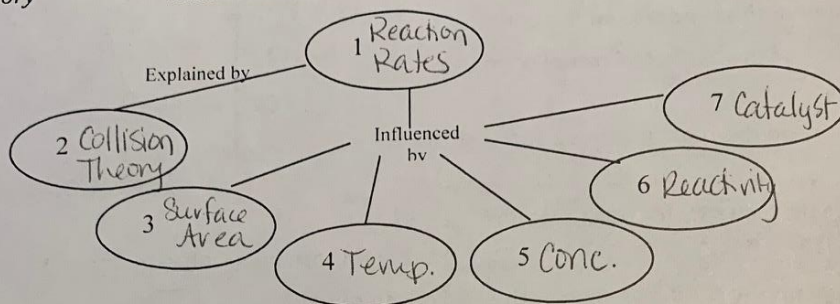
1. Complete the following concept map using the following terms:

Surface area
Collision theory

Temperature
Reaction rates

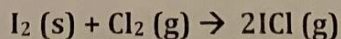
Concentration
Reactivity

Catalyst



2. Define reaction rate. What does the reaction rate indicate about a particular chemical reaction?
Reaction Rate is the change in concentration per unit time. It indicates the speed (how fast) a reaction proceeds.
3. In addition to colliding, what else must happen in order for a reaction to occur?
The particles must have the correct orientation & sufficient (enough) energy.
4. Use the collision theory to discuss how the following factors affect the rate of a chemical reaction:
- Temperature** As temp increases, the particles collide more often and with greater energy, which increases the rate. It is opposite for cooler temps.
 - Concentration** As concentration increases, there are more particles to collide so the number of collisions goes up which increases the rate. The opposite is true for decreasing concentration.
 - Surface area** As surface area increases (as it is crushed or broken) there are more particle collisions and the rate increases. The opposite is true for decreasing surface area.
5. What role does the reactivity of the reactants play in determining the rate of a chemical reaction?
The reactants have an intrinsic (natural) reactivity.
6. Answer the following questions about catalysts:
- What is the difference between a homogeneous and a heterogeneous catalyst?
A homogeneous catalyst is in the same state as the reactants. A heterogeneous catalyst is in a different state.
 - How does a catalyst affect the activation energy for a chemical reaction?
A catalyst lowers the activation energy.
 - What is the result of adding a catalyst to a reaction?
The reaction rate increases (it speeds up).

7. Would the changes listed below increase or decrease the rate of the following reaction:

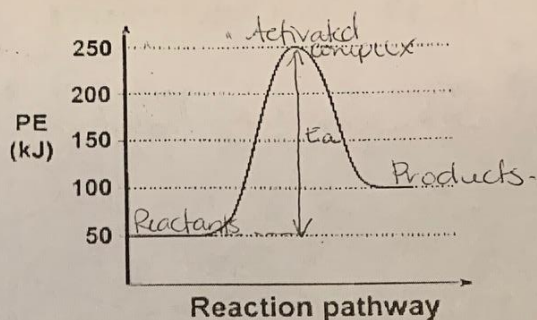


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|----------------------------------|-----------------|----------------------------|-----------------|
| a. decreasing temperature | <u>decrease</u> | c. crushing I ₂ | <u>increase</u> |
| b. Increasing [Cl ₂] | <u>increase</u> | d. adding a catalyst | <u>increase</u> |

Activation Energy Diagrams

Use the graph below to answer questions 1-7: Include labels on any numerical values.

1. Label the position of the **reactants** on the graph.
2. Label the position of the **products** on the graph.
3. Label the position of the **activated complex** on the graph.
4. How much energy do the reactants have at the start of the reaction? 50 kJ

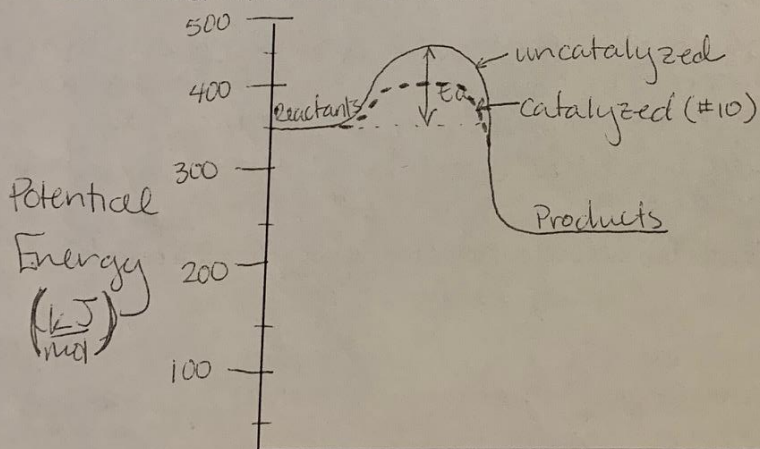


5. What is the activation energy for this reaction?
 $250 \text{ kJ} - 50 \text{ kJ} = 200 \text{ kJ}$ Label this on the graph.
6. How much energy do the products have at the end of the reaction? 100 kJ
7. Is this reaction exothermic or endothermic? Explain your answer using evidence from the graph.
Endothermic because the products have higher energy than the reactants which means energy is gained by the system.
8. Draw an energy diagram on the axes below using the given information. Be sure to include labels and units on both the x-axis and y-axis.

Potential energy of reactants = 350 kJ/mole

Activation energy = 100 kJ/mole

Potential energy of products = 250 kJ/mole



Reaction Pathway

9. Is this reaction exothermic or endothermic? Explain your answer using evidence from the graph.

Exothermic because the products have less energy than the reactants which means that energy is released by the system.

10. You add a catalyst to the reaction you graphed in question 8, which lowers the activation energy of the reaction from 100 kJ/mole to 50 kJ/mole. Draw the energy diagram of the catalyzed reaction on the same set of axes above (use a dashed line or a different color and label the reaction with the catalyst).