

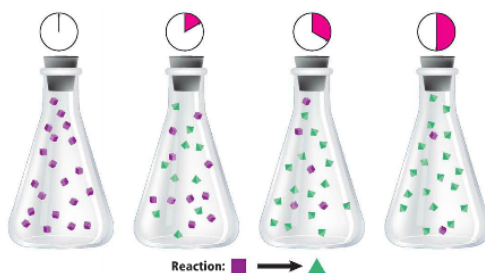
Expressing Reaction Rates

- Some chemical reactions are fast and others are slow, but chemists need to be more specific.
- What is a rate?
- How do we use rates in everyday life?
- How would we measure the rate of a reaction?

$$\frac{\Delta \text{quantity}}{\Delta \text{time}}$$

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Expressing Reaction Rates



- What happens to the amount of reactants over time?
- What happens to the amount of products over time?
- Do you think you would observe the same changes for any reaction?

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Reaction Rates

- Reaction Rate for chemistry is defined as the change in concentration of reactant or product in a period of time
- What is concentration?
 - > amount of solute in a given amount of solvent
 - solute: what's being dissolved
 - solvent: doing the dissolving
 - ex: salt in water -- salt is _____, water is _____
 - unit we typically use is molarity (M) -- moles/liter

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Reaction Rates

- Reaction Rates are determined experimentally by measuring the concentration of reactants and/or products in a chemical reaction.
- Reaction rates CANNOT be calculated from balanced chemical reactions.
- Reaction rates must always be positive.

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Collision Theory

In order for a reaction to occur

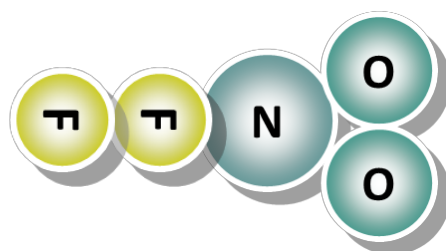
- reactants must collide
- collisions must be in the correct orientation
- collision must have minimum amount of energy for bonds to break

Only a small number of collisions actually meet the requirements and result in a reaction.

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Collision Theory

Activated Complex: a temporary, unstable arrangement of atoms in which old bonds are breaking and new bonds are forming



Transition state is another name for activated complex.

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Collision Theory

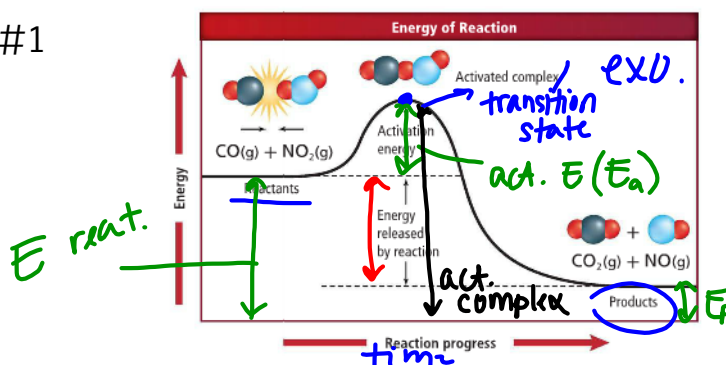
- Collisions with correct orientation must also have sufficient amount of _____.
- This amount of energy is called the activation energy.
- Symbol: E_a

QUESTION: How would a high vs low activation energy affect the speed of a reaction?

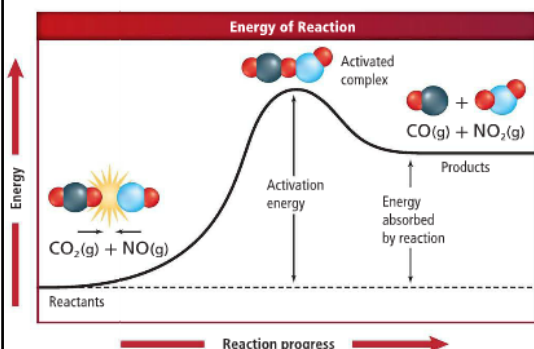
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Activation Energy

Reaction #1



Reaction #2



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Factors Affecting Reaction Rate

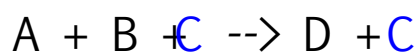
1. Nature of Reactant
2. Concentration
3. Surface Area
4. Temperature
5. Catalysts

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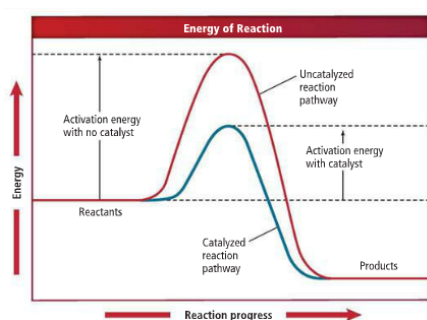
Catalysts

Catalyst: substance that increases the rate of reaction without being used up.

> creates a lower energy reaction pathway



"C" is the catalyst it is present in the beginning and the end.



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How to speed up a reaction and
get a date.



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