



Reaction Rates

Factors that Influence Reaction Rates

- Some factors that can influence reaction rates are:

- **The nature of the reactants;**
- **The concentration of the reactants;**
- **The surface area of solid reactants;**
- **The temperature; and**
- **Catalysts.**



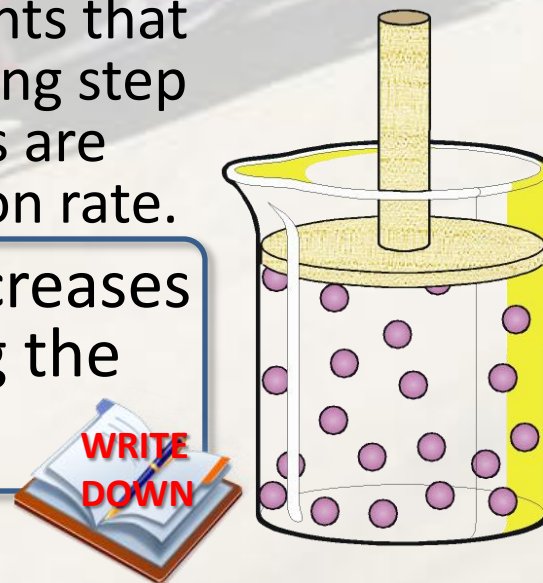
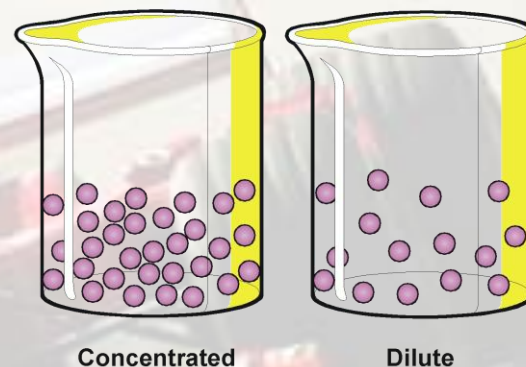
The Nature of the Reactants

- Chemical reactions occur by breaking and rearranging existing bonds.
- The fewer electrons that need to be rearranged, the faster the reaction is.
 - Reactions between ionic substances in aqueous solution are rapid.
 - Example: double replacement reactions
 - Reactions in which covalent bonds are broken occur slowly at room temperature.
 - Example: decomposition of hydrogen peroxide



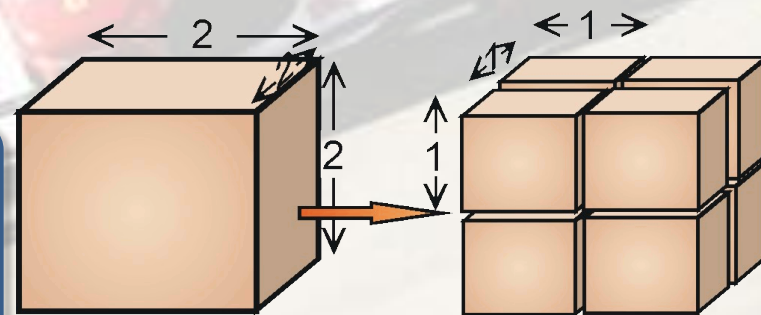
The Concentration of the Reactants

- An increase in concentration results in an increase in the frequency of collisions.
- Usually as the concentration increases, the reaction rate increases.
 - If the concentration of only the reactants that are NOT involved in the rate determining step are increased, the number of collisions are increased without effecting the reaction rate.
- Gas reactant - increasing pressure increases the concentration of a gas, increasing the reaction rate.



The Surface Area of the Reactants

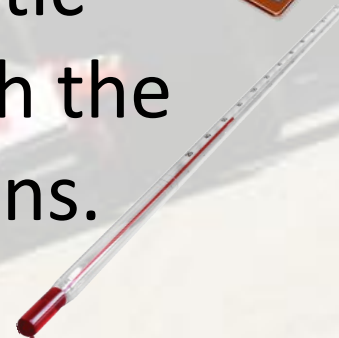
- The only part of a solid that is exposed to other reactants is the surface.
- Increasing the surface area of solid reactants increases the opportunity for collisions, speeding up the reaction.
- Crushing solids increases the surface area, speeding up the reaction.



<u>Volume</u>	
$2 \times 2 \times 2 = 8$	$8 \times (1 \times 1 \times 1) = 8$
<u>Surface Area</u>	
$6 \times (2 \times 2) = 24$	$6 \times (8 \times (1 \times 1)) = 48$

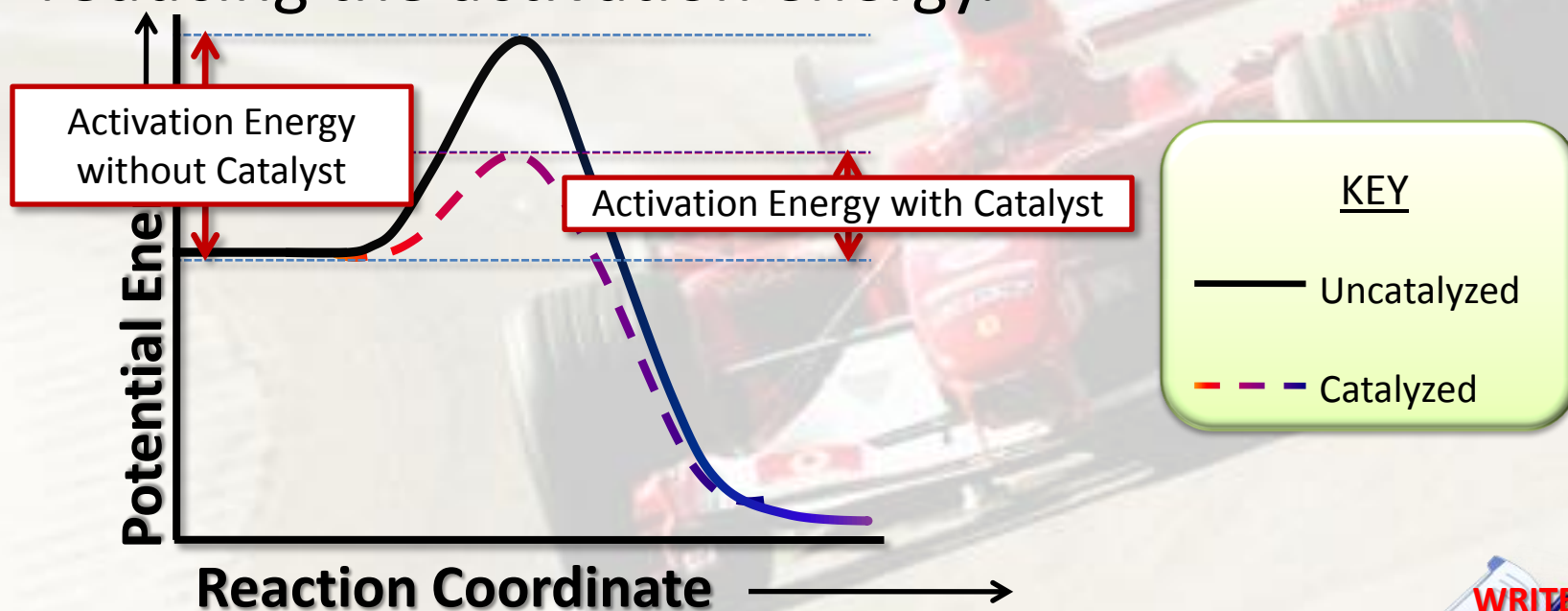
Temperature

- As temperature increases so does the reaction rate.
- Increasing temperature increases kinetic energy of the particles, increasing both the frequency and effectiveness of collisions.
- An increase in temperature of 10°C approximately doubles the speed of many reactions.



Catalysts

- Catalysts change the reaction mechanism, reducing the activation energy.



- Reducing activation energy with catalysts increases the probability of effective collisions, speeding up the reaction.

