

OGUN DIGICLASS

CLASS: SECONDARY SCHOOL

SUBJECT: CHEMISTRY

TOPIC: RATES OF CHEMICAL REACTION



Learning objectives

Meaning of rates of reaction

Collision theory

Factors influencing effective collision

Factors affecting rates of chemical reaction



Definition of rates of reaction

Rates of chemical reaction is the change in the concentration of a reactant or a product per unit time.

It can also be defined as the number of moles of reactant converted or product formed per unit time.



EXAMPLES

- In a certain reaction the concentration of hydrochloric acid changes from 0.03mol dm^{-3} to 0.08mol dm^{-3} after 5 minutes. Calculate the rate of reaction for the hydrochloric acid.
- When 1.2g of magnesium trioxocarbonate (1v) was added to excess dilute hydrochloric acid, carbon (1V) was produced after 30 seconds. What is the rate of the reaction?



SOLUTIONS

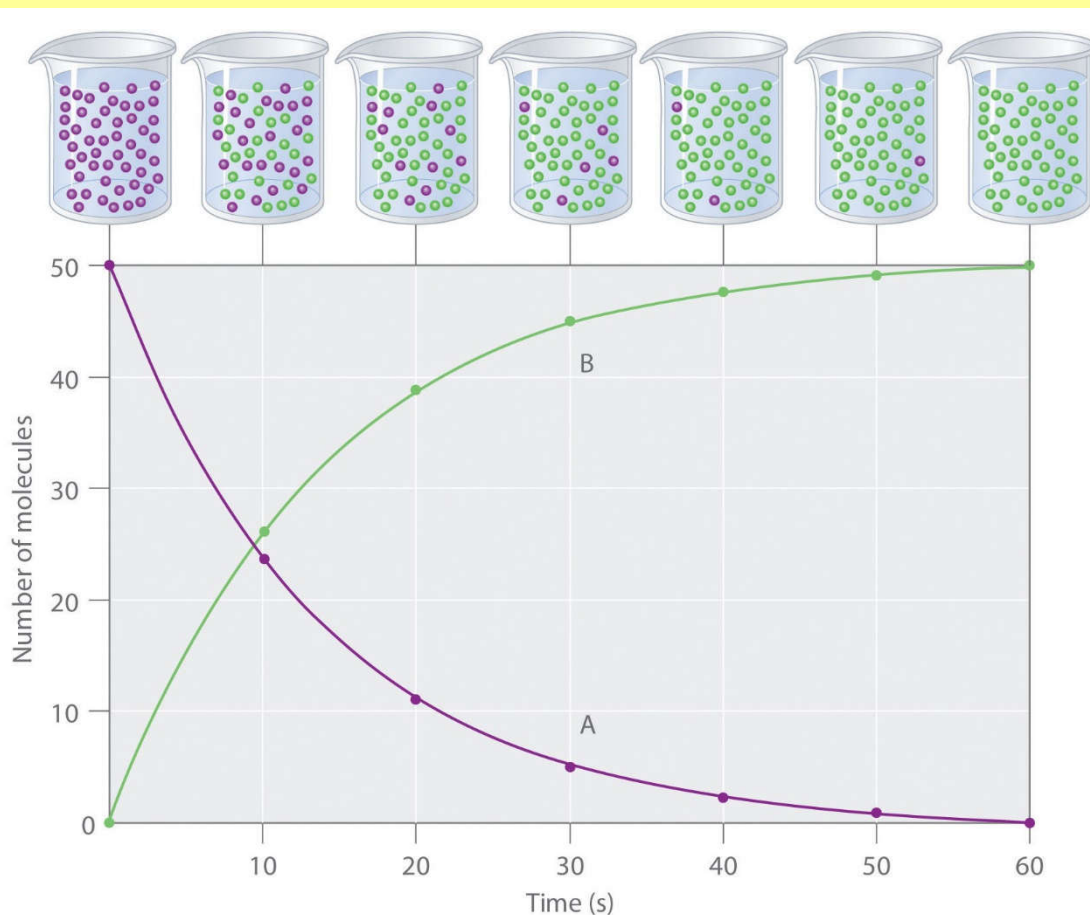
1. Rate of reaction = $\frac{0.08 - 0.03}{5}$
 $= \frac{0.05}{5}$
 $= 0.01 \text{ moldm}^{-3} \text{ min}^{-1}$

2. Rate of reaction = $\frac{1.2}{30}$
 $= 0.04 \text{ g sec}^{-1}$

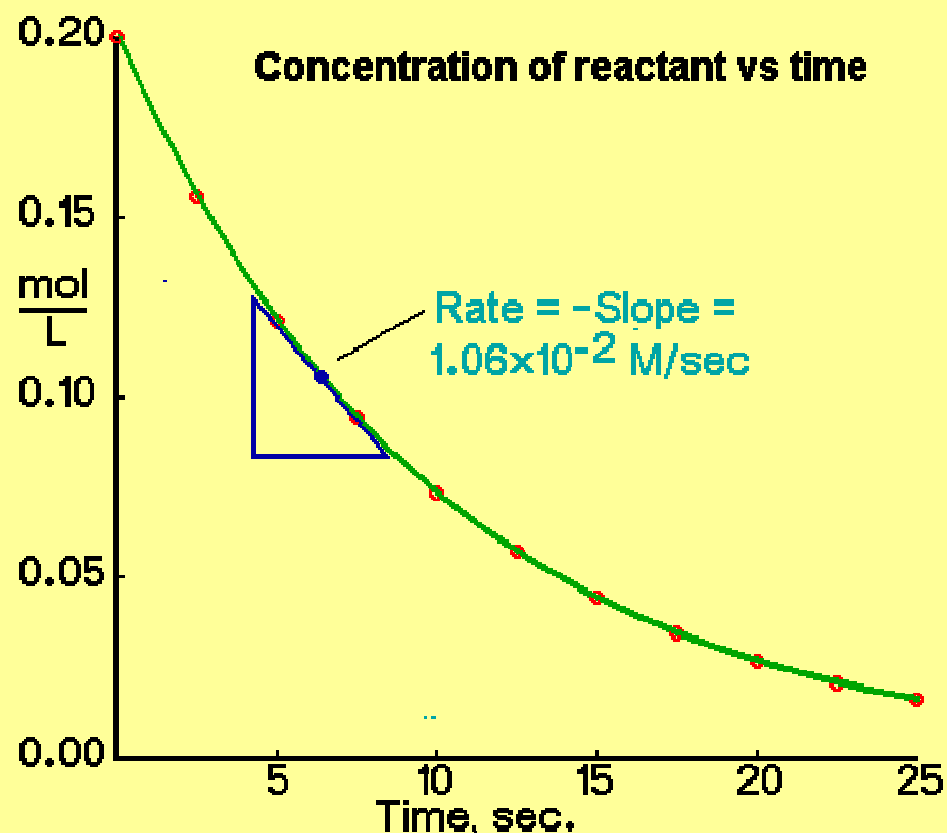
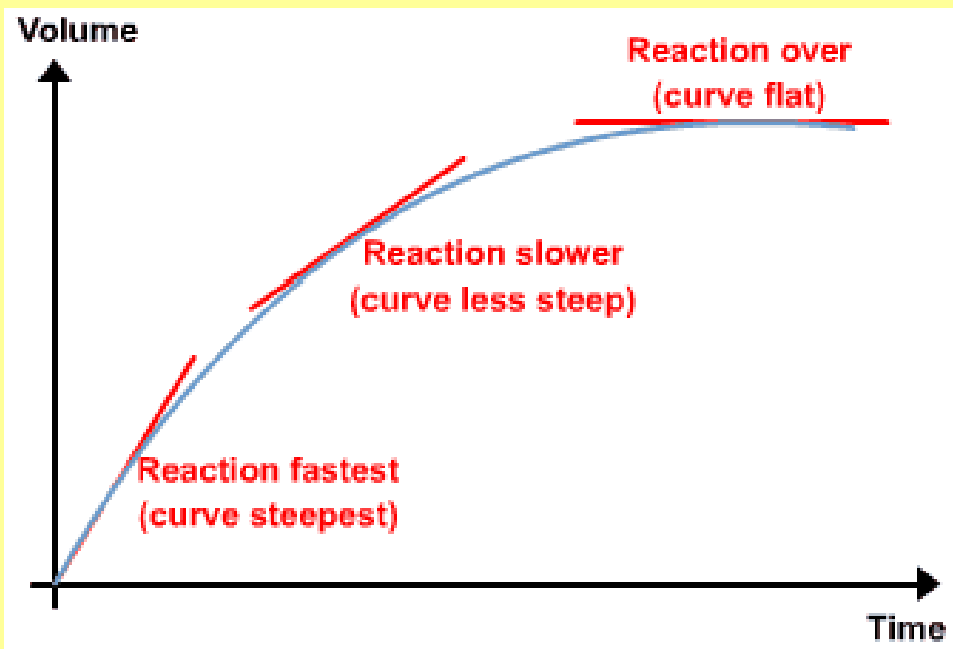


RATE CURVE

The graph which shows the rate of chemical reaction is known as rate curve. The curve passes through origin because there is no loss in mass at the start of the reaction.



EXAMPLES OF RATE CURVE



COLLISION THEORY

Collision theory assumes that there must be effective collision between reactant particles for chemical reaction to occur.

For collision between reactant particles to be effective, the following conditions must be met:

- The energy of the colliding particle must be equal to or greater than activation energy
- The reactants particle must be properly aligned or orientated.



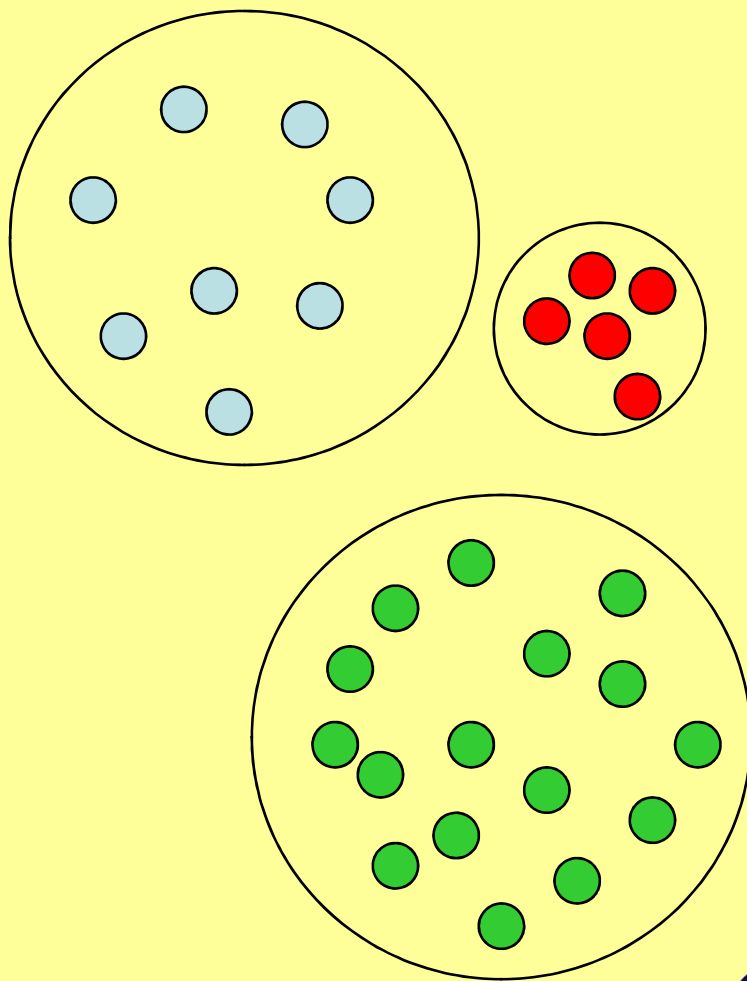
In Contact

Reactions don't happen unless the substances are in contact.

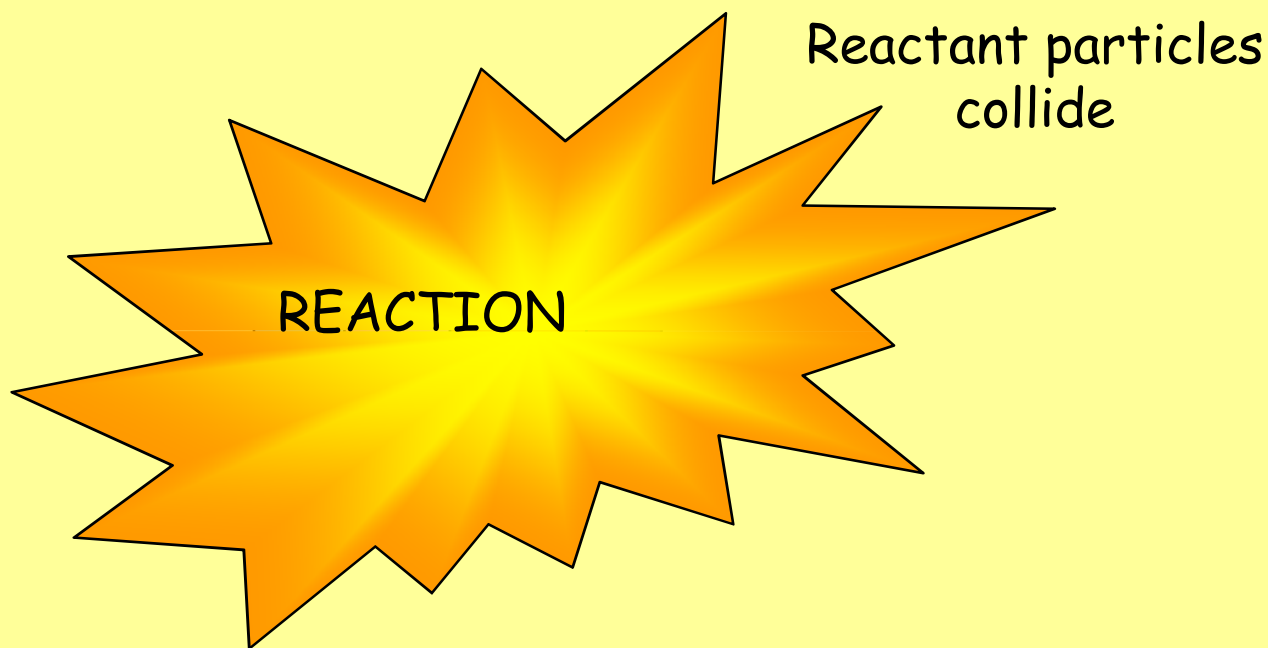


Why?

The particles of the reactants need to get together so that they can react.



How does that work then?



Product particles
formed



Is it *really* that simple?

Yes

Well, sort of.

not really.

OK, not quite!



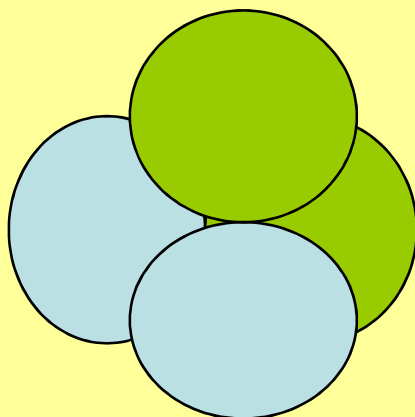
Not all collisions are effective

- Paper burns
- Paper + oxygen \rightarrow carbon dioxide + water + nitrogen
- The paper in this room isn't burning.
- It doesn't have enough energy to burn.
- If we make it hotter it will catch fire.
- Paper burns on its own at 250 °C



A collision but with no effect

Reactant particles
collide



Product particles
not formed as there is no
t enough energy

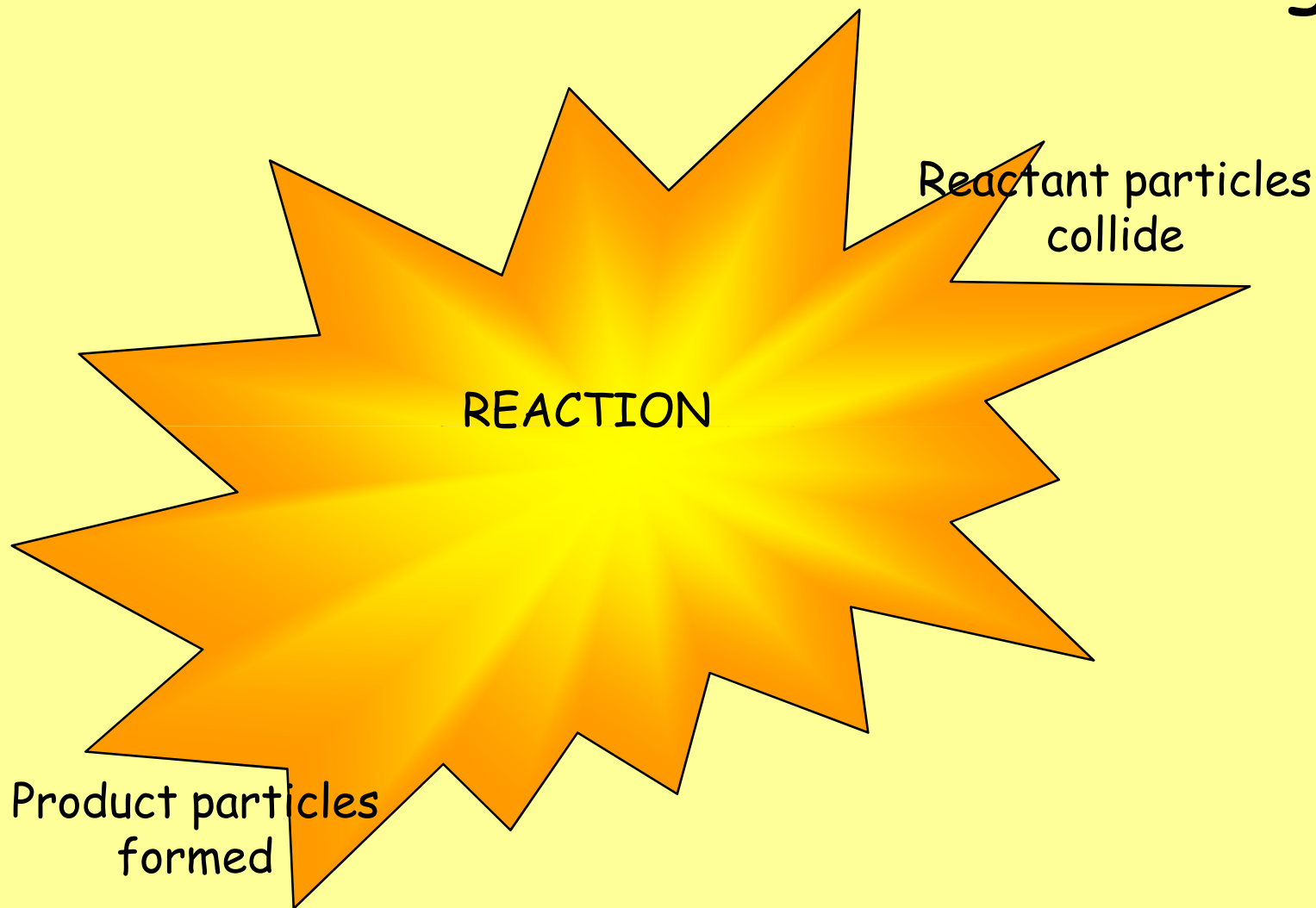


Activation Energy

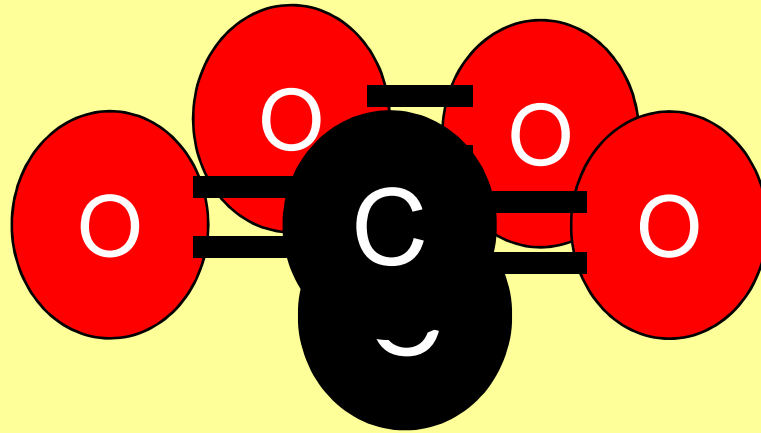
- Reactions only happen if the particles have enough energy.
 - The amount of activation energy needed is different for each reaction.
- The minimum amount of energy needed to start a reaction is called the Activation Energy
 - But
 - Every reaction has activation energy, they all need a little push to get started.



More than the activation energy.



More than the activation energy.



Effective collisions, a reaction.



The Collision Theory

- Particles are constantly moving
- For a chemical reaction to take place the reactant particles must collide first
- For the collision to be effective the particles must have the right amount of energy
- The minimum amount of energy required for an effective collision is called the activation energy

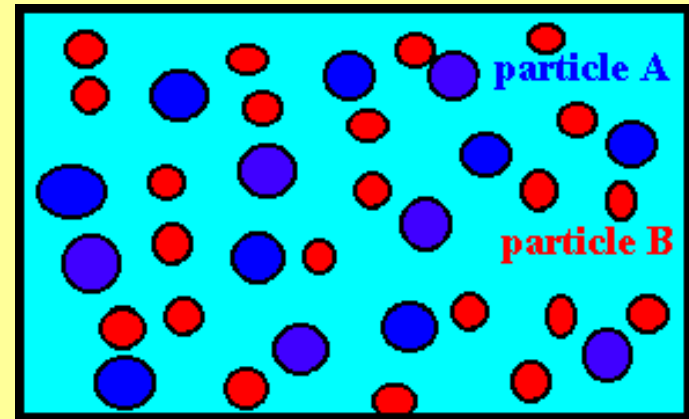
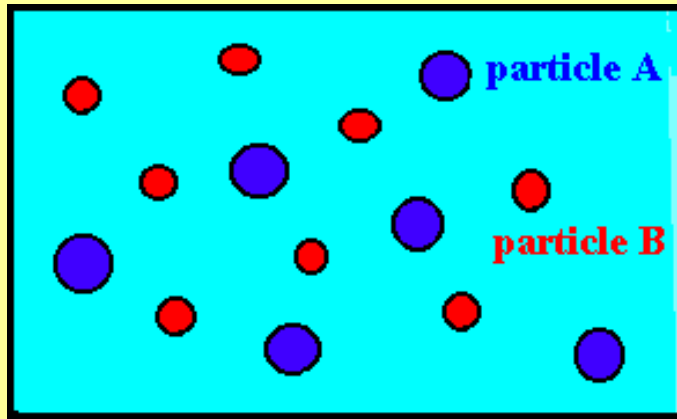


Factors affecting rate of chemical reaction

- Concentration/pressure(gasses)
- Temperature
- Catalysts
- Surface Area
- Nature of the reactants
- Presence of light



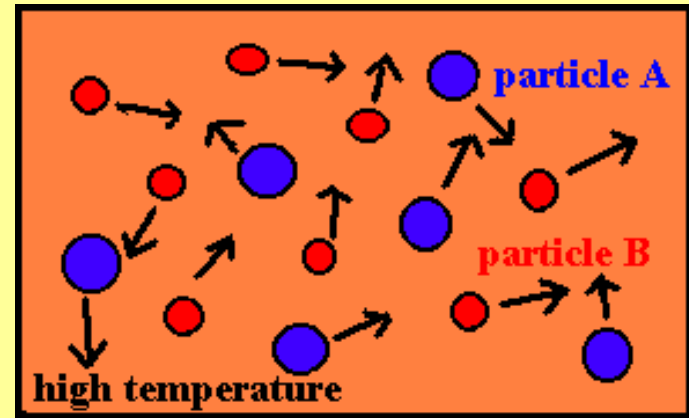
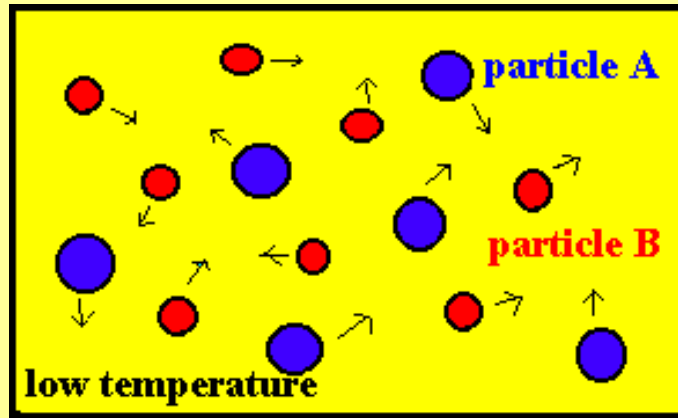
Concentration



- More particles in the same space means more collisions.
- More collisions means more effective collisions
- If we double the concentration
we double the number of collisions



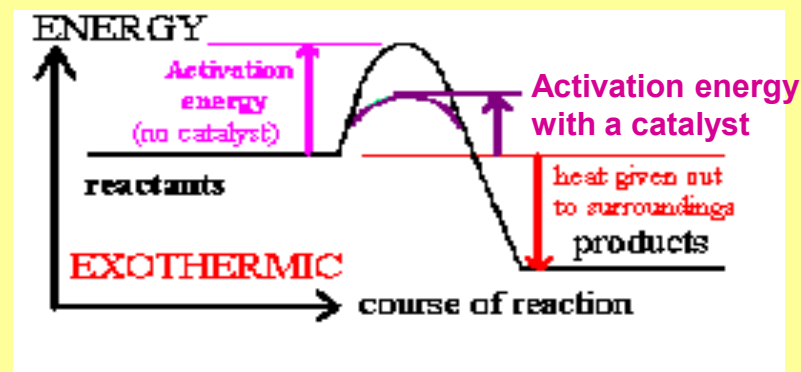
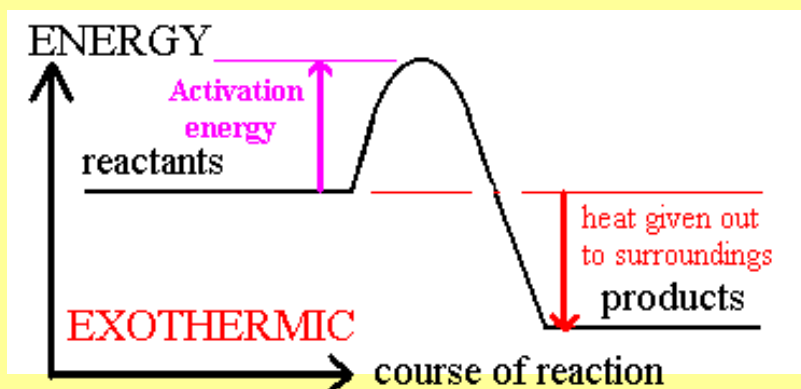
Temperature



- Particles turn heat energy into kinetic energy
- When they get hotter they move faster
- When they move faster they collide more often
- More collisions means more effective collisions



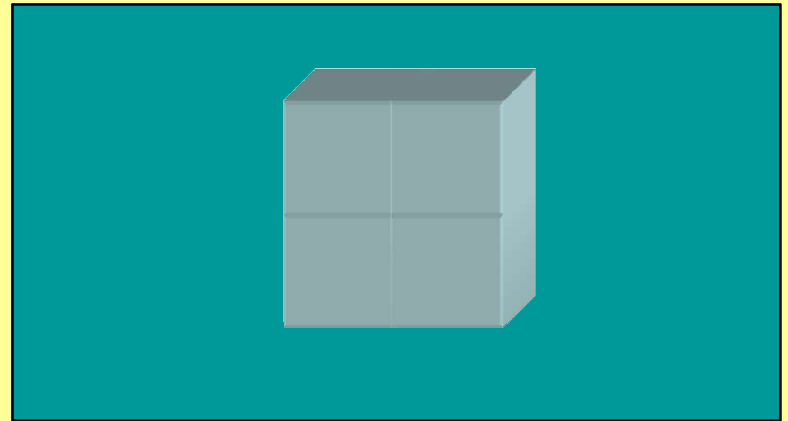
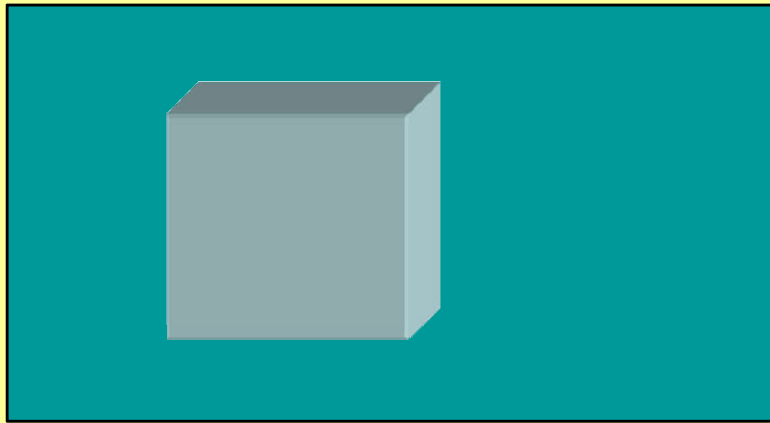
Catalysts



- Catalysts reduce the activation energy needed for a reaction
- They do this by offering an alternate route for the reaction to take
- Less activation energy means more effective collisions
- More effective collisions means faster rate



Surface Area/Particle Size



- Using smaller particles increases rate of reaction
- Increase in surface area allows more collisions at surface
- More collisions means more effective collisions therefore faster rate of reaction.



ASSIGNMENT

1. When dilute solution of hydrogen peroxide was heated, the total volume of oxygen collected was 100cm^3 in 5 minutes. What is the rate of formation of oxygen?

2. Given the reaction:



State three factors which increase the rate of producing hydrogen gas.

