

## Factors that affect the rate of reaction

- I. (#4-4) What factors affect the rate a reaction proceeds?
  - a. (#4-4a) Students will be able to integrate the ideas of Kinetic molecular theory and collision theory to determine how a fast a reaction will proceed.
  - b. (#4-4b) Students should be able to indicate the factors that affect rate.
  - c. (#4- 4c) Students will be able to identify and explain how a reaction can be affected by a catalyst.

<https://www.youtube.com/watch?v=OttRV5ykP7A>

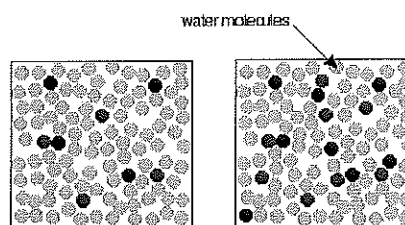
or Google: How to speed up chemical reactions (and get a date) - Aaron Sams

Reaction rates are controlled by the collision of particles

**1. Concentration:**

More particles = more collisions.  
Does not increase effectiveness of collisions

THE EFFECT OF CONCENTRATION ON REACTION RATES

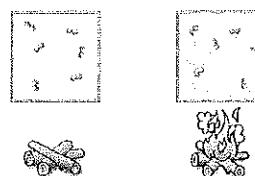


Both reactants in solution  
↑ conc. = faster rate of reaction

**2. Temperature:**

-Particles move faster  
so increased number of collisions  
and collisions have more energy  
when they collide.  
-increases the effectiveness of a collision.

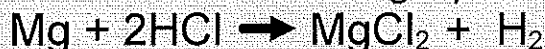
Effects of a Temperature Change  
Rate of reaction increases with increased temperature.



More kinetic energy, more particles with  $E_a$ ,  
higher chances of successful collisions.

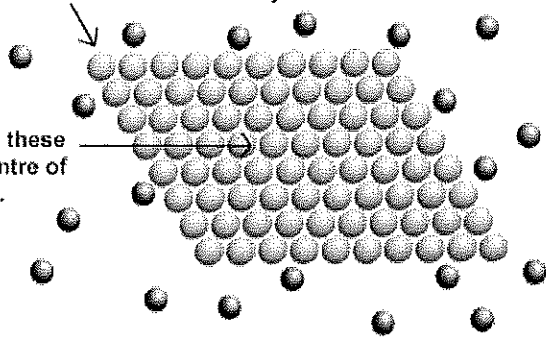
**3. Surface area:**

Really only applies to solids and sometimes liquids.  
(Hard to increase the surface area of a gas.)

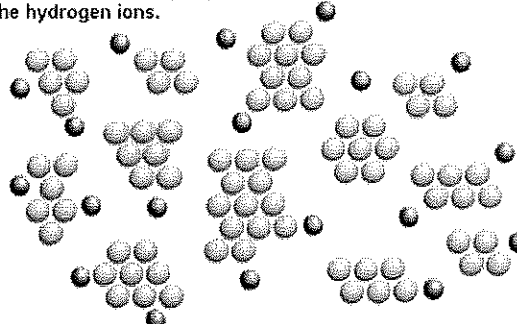


Hydrogen ions can hit the outer layer of atoms...

...but not these in the centre of the lump.



With the same number of atoms now split into lots of smaller bits, there are hardly any magnesium atoms inaccessible to the hydrogen ions.



more surface area = more reactions  
faster rate of reaction

4. All other factors are just variations of concentration/temperature.

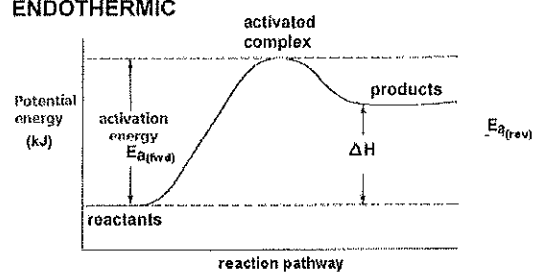
### Nature of reactants/products

1. Bonds broken requires energy to be invested.
2. Bonds formed gives energy to surroundings.
3. Large reactant bond energy makes it hard to run a reaction.

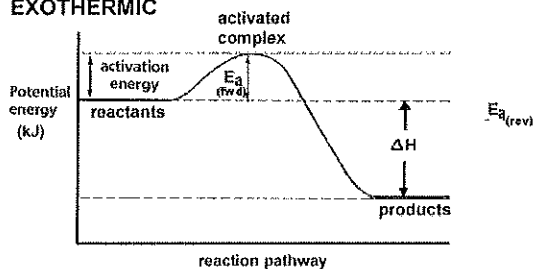


### POTENTIAL ENERGY DIAGRAMS FOR REACTIONS

#### ENDOTHERMIC



#### EXOTHERMIC

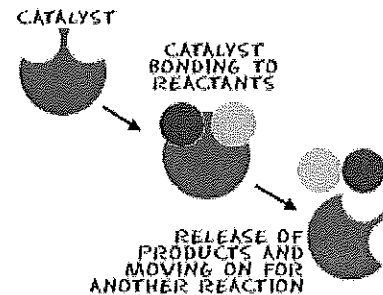


### Catalyst (matchmaker)

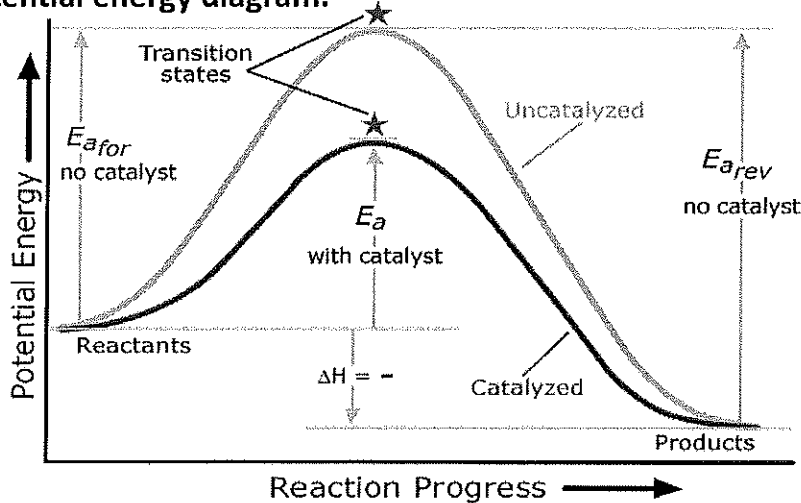
- Speeds up rxn
- Not consumed
- Does not make impossible possible
- Uses a different pathway  
 same start  $\rightarrow$  same end.

Driving a car vs. walking vs. running.  
 Note running and walking is the same means. Just more energy.  
 Driving is a different means.

Dating: meet someone at school, on-line, friends mom sets you up.  
 Same start same end. (does not make impossible possible)



Potential energy diagram.



difference in activation energy

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