FACTORS AFFECTING RATES OF REACTION

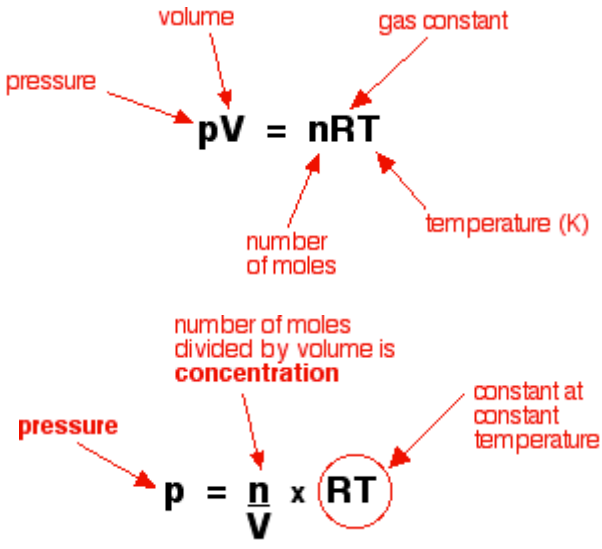
1. The reaction takes place on the surface of the metal. Aluminium powder will have a huge surface area compared with the foil, and so there will be far more hydrogen ions hitting the aluminium every second, and therefore a much faster reaction with the powder.

2. a) If you double the concentration of the organic compound, you will double the chance of a collision between it and a hydroxide ion, and so double the rate of the reaction. If you also double the concentration of the hydroxide ions, that will double the chance of a collision again. The overall effect will be to speed up the reaction rate four times.

   b) (i) If you double the concentration of the organic compound, you will double the number of ions being formed from it in a given time. Those ions can then go on to take part in the second stage of the reaction, and so the rate will double.

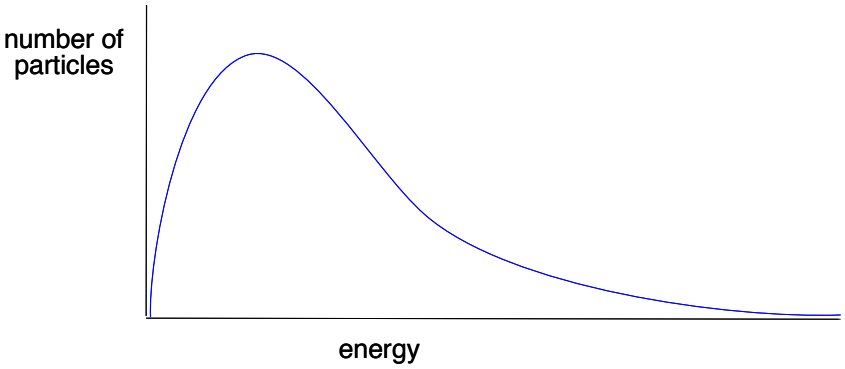
   (ii) Doubling the concentration of the hydroxide ions will have no effect on the rate of reaction (or at best a completely negligible effect). As soon as an organic ion is formed, it will react with a hydroxide ion. This second stage is already going as fast as it can - limited by the availability of the organic ions.

3. Using diagrams from the pressure page:

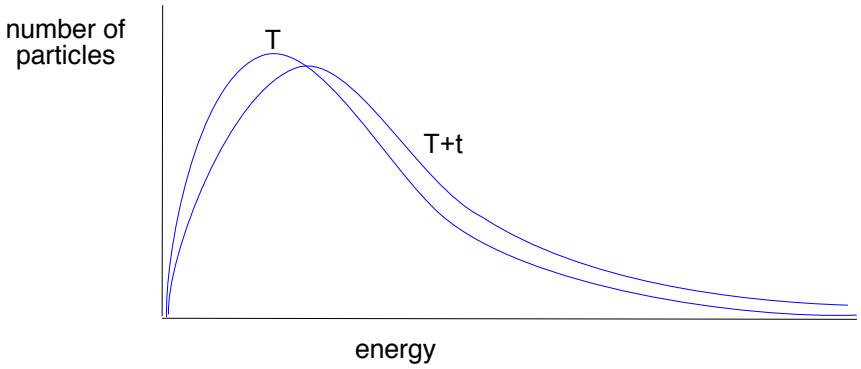


   Because RT is a constant at constant temperature, pressure is directly proportional to concentration.

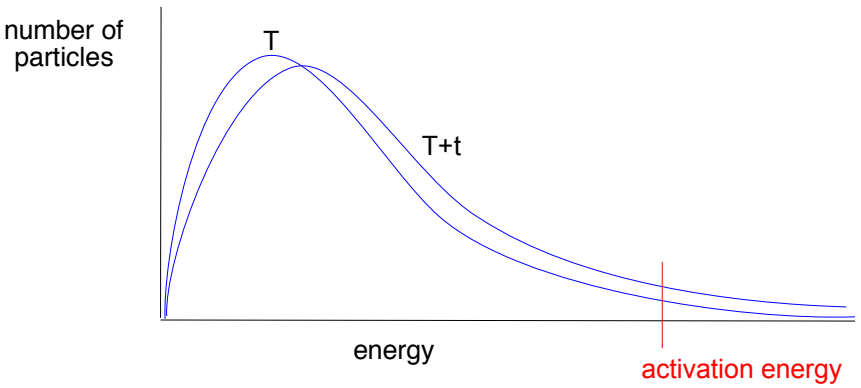
4. a)



b)



c)

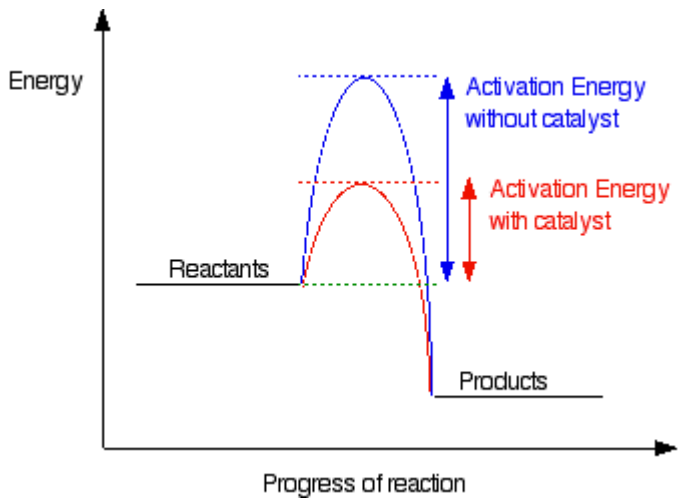


Only those particles which collide with energies greater than activation energy will actually react. The number of these is given by the area under the curves to the right of the activation energy. A small increase in temperature produces a much larger increase in the number of these more energetic particles.

d) Increasing temperature means that the particles are moving faster and so hit each other more often.

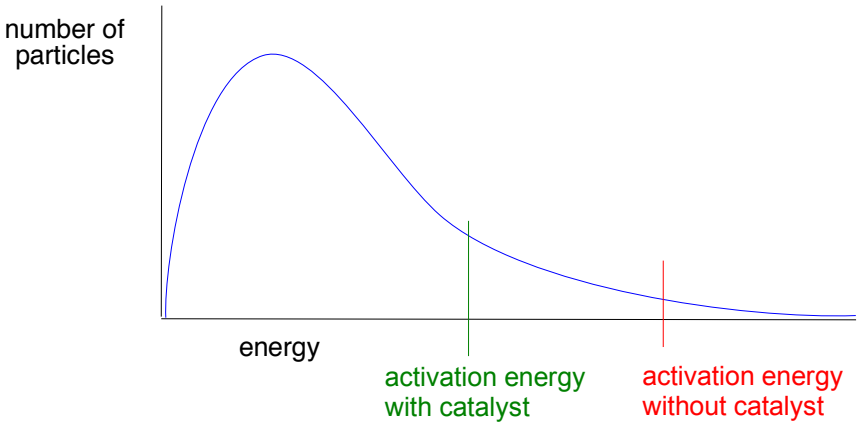
5. a) A catalyst is a substance which speeds up a reaction, but is chemically unchanged at the end of the reaction.

b)



A catalyst provides an alternative route with a lower activation energy. (Important! If you have said "A catalyst lowers the activation energy", punish yourself severely, and don't do it again!)

c)



With the catalyst present, there are many more particles which have energies greater than the activation energy for the alternative route - the area under the curve to the right of the catalytic activation energy is much larger. Therefore the reaction is much faster.