Unit 9 Kinetics & Equilibria (Paper 2 & 3)

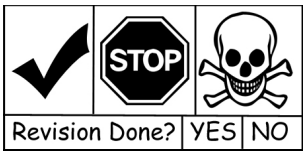
9.1 Kinetics

Collision Theory

Reactions can only occur when collisions take place between particles having sufficient energy. This energy is called the activation energy.

You should be able to:

- define the term activation energy
- explain why most collisions do not lead to a reaction.



Maxwell–Boltzmann distribution

Maxwell–Boltzmann distribution of molecular energies in gases.

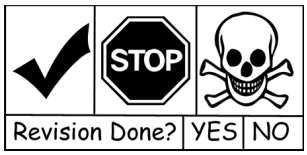
You should be able to draw and interpret distribution curves for different temperatures.

Effect of temperature on reaction rate

Meaning of the term rate of reaction.

The qualitative effect of temperature changes on the rate of reaction.

You should be able to use the Maxwell–Boltzmann distribution to explain why a small temperature increase can lead to a large increase in rate.



Effect of concentration and pressure

The qualitative effect of changes in concentration on collision frequency.

The qualitative effect of a change in the pressure of a gas on collision frequency.

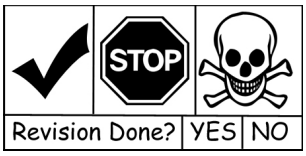
You should be able to explain how a change in concentration or a change in pressure influences the rate of a reaction.

Catalysts

A catalyst is a substance that increases the rate of a chemical reaction without being changed in chemical composition or amount.

Catalysts work by providing an alternative reaction route of lower activation energy.

You should be able to use a Maxwell–Boltzmann distribution to help explain how a catalyst increases the rate of a reaction involving a gas.



9.2 Chemical equilibria, Le Chatelier's principle and K_c

Chemical equilibria and Le Chatelier's principle

Many chemical reactions are reversible.

In a reversible reaction at equilibrium:

- forward and reverse reactions proceed at equal rates
- the concentrations of reactants and products remain constant.

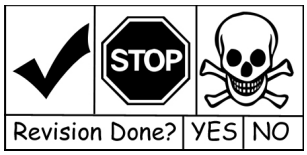
Le Chatelier's principle.

Le Chatelier's principle can be used to predict the effects of changes in temperature, pressure and concentration on the position of equilibrium in homogeneous reactions.

A catalyst does not affect the position of equilibrium.

You should be able to:

- use Le Chatelier's principle to predict qualitatively the effect of changes in temperature, pressure and concentration on the position of equilibrium
- explain why, for a reversible reaction used in an industrial process, a compromise temperature and pressure may be used.



Equilibrium constant K_c for homogeneous systems

The equilibrium constant K_c is deduced from the equation for a reversible reaction.

The concentration, in mol dm $^{-3}$, of a species X involved in the expression for K_c is represented by [X]

The value of the equilibrium constant is not affected either by changes in concentration or addition of a catalyst.

You should be able to:

- construct an expression for K_c for a homogeneous system in equilibrium
- calculate a value for K_c from the equilibrium concentrations for a homogeneous system at constant temperature
- perform calculations involving K_c
- predict the qualitative effects of changes of temperature on the value of K_c