Rates of reaction – Collision theory

Rates of chemical reactions vary considerably

- Combustion reactions have very high rates
- Rusting of iron has very slow rate

Rate of reaction = change in concentration ÷ time units moldm3s-1

The rate of a reaction is the change in concentration of a reactant or product in a given time

Factors that alter the rate of reaction:

- Temperature
- Pressure
- Concentration
- Surface area
- Adding a catalyst

We explain how theses factors effect rate using collision theory

- When two molecules collide the reaction will take places if the molecules have sufficient energy to overcome the activation energy and they collide in the correct orientation

Effect of concentration

If the concentrations of reactants are increased then the rate will increase!

- More molecules per unit volume
- Molecules will be closer together so there is greater chance of the molecules colliding
- Collisions will be more frequent

More collisions will take place and there will be more collisions with an energy greater than the activation energy, so there will be more successful collisions and the rate will increase

Effect of Pressure

When the pressure of a gas is increased molecules are pushed closer together

- The same number of molecules occupy a smaller volume
- For a gaseous reaction increasing pressure is the same as increasing concentration

So more collisions will take place and there will be more collisions with the energy greater than the activation energy, there will be more frequent collisions and the rate will increase .

The Ozone Layer

The ozone layer is continuously being reformed and broken down.

How ozone if formed

$O_2 + UV \longrightarrow 2O$
$O + O_2 \longrightarrow O_3$

How ozone is broken down

$O_3 + UV \longrightarrow O_2 + O$

Overall

$O_2 + O \longleftrightarrow O_3$

Removal of ozone

$O_3 + 0 \longrightarrow 2O_2$

Ozone depletion

Initiation
$CFCL_3 \longrightarrow Cl + CFCl_2$

Propagation
$Cl + O_3 \longrightarrow ClO + O_2$
$ClO + O \longrightarrow Cl + O_2$

Overall $O_3 + O \longrightarrow O_2$

$NO + O_3 \longrightarrow NO_2 + O_2$
$NO_2 + O \longrightarrow NO + O_2$