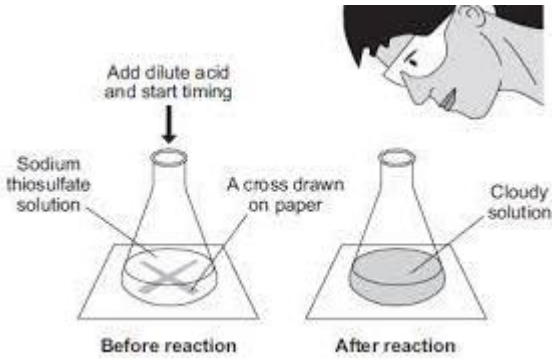
Keywords/ Definitions	
Keyword	Meaning
Rate	A measure of how quickly a reaction occurs
Collision Theory	In order for particles to react, they need to collide with enough energy.
Activation energy	The minimum amount of energy needed for particles to react
Successful collision	Particles collide with enough energy so they will react to form products
Catalyst	A substance that speeds up a chemical reaction without being used up



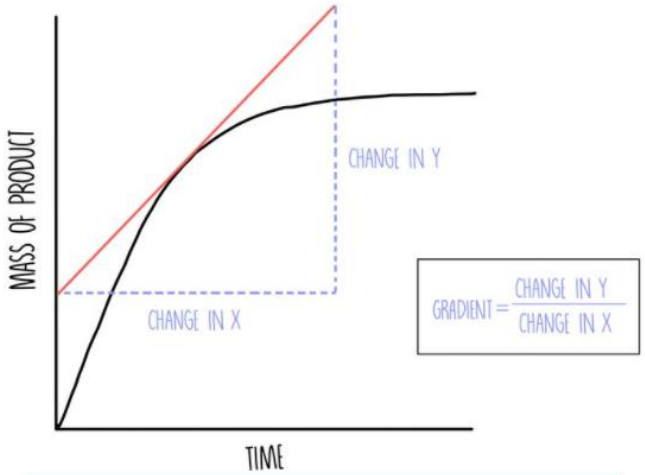
KS4 Chem: Rates of reaction

- **Key Facts**

- A reaction in which the reactants are converted into products very quickly has a high reaction rate.
- The **more successful collisions** there are in a given time, the **faster the rate of reaction**.
- Increasing the **concentration** of a solution or increasing the **pressure** of a gas means that the reacting particles are closer together (there are more particles in the same volume).
  - ➢ **More frequent successful collisions** between reactant particles → increasing reaction rate.
- Increasing the **surface area : volume ratio** of a reacting solid means that **more reacting particles are exposed at the surface**.
  - ➢ **More frequent successful collisions** between reactant particles → increasing reaction rate
- Increasing the **temperature** of the reactants causes them to **move more quickly** and increases the **energy** of the particles.
  - ➢ **More frequent successful collisions** between reactant particles (since more molecules will now have **energy that is greater than the activation energy**). → increasing reaction rate
- Adding a **catalyst** increases the rate of reaction by providing an **alternative pathway with a lower activation energy**. Since the 'energy barrier' for the reaction to happen has been reduced, a larger number of particles will have sufficient energy to react and there will be **more successful collisions**. Catalysts are **chemically unchanged** at the end of the reaction and can be **reused**.

Numeracy

To work out the rate from a graph, draw a tangent.
Take a ruler and draw a line which touches the curve and has the same gradient as the line at that time point.
You can then **calculate the gradient** of the tangent by working out the change in y over the change in x.



$$\text{REACTION RATE} = \frac{\text{CHANGE IN MASS OF REACTANT OR PRODUCT}}{\text{TIME}}$$