

# AQA GCSE Chemistry

## Topic 6: The rate and extent of chemical change

### Rate of reaction

#### Notes

(Content in bold is for Higher Tier only)





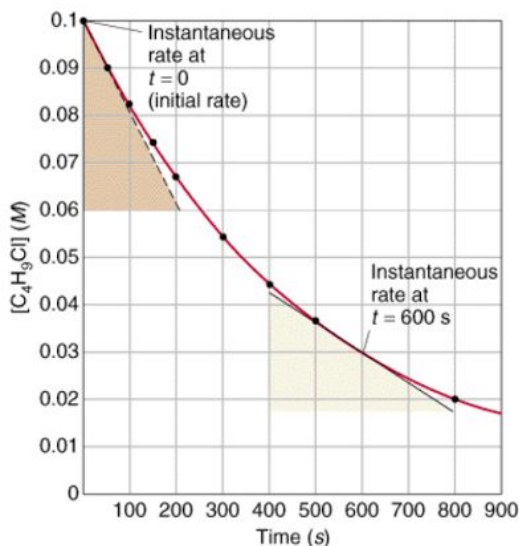
## Calculating rates of reactions

- Rates of reactions can be measured using the amount of product used, or amount of product formed over time:

$$\text{Rate of reaction} = \frac{\text{amount of reactant used}}{\text{Time}}$$

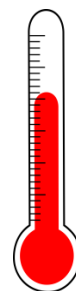
$$\text{Rate of reaction} = \frac{\text{amount of product formed}}{\text{Time}}$$

- o Quantity of reactant or product can be measured by the mass in grams or by a volume in  $\text{cm}^3$
- o Units of rate of reaction may be given as  $\text{g/s}$  or  $\text{cm}^3/\text{s}$
- o **You can also use quantity of reactants in terms of moles (instead of mass or volume) and therefore, units for rate of reaction in  $\text{mol/s}$**
- To find the rate of reaction graphically:
  - o To measure the rate of reaction: draw tangents to curves and use the slope of the tangent
  - o **Calculate the gradient of a tangent to the curve on these graphs as a measure of rate of reaction at a specific time**



## Factors which affect the rates of chemical reactions

- Factors:
  - o concentration
  - o pressure
  - o surface area
  - o temperature
  - o catalysts



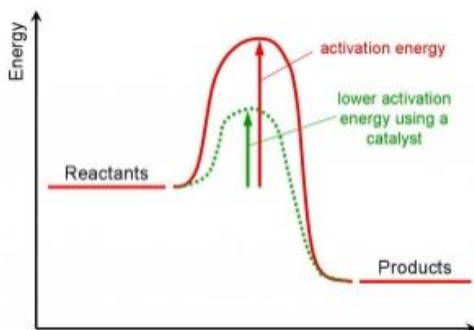


## Collision theory and activation energy

- Collision theory: chemical reactions can occur only when reacting particles collide with each other and with sufficient energy
- Activation energy: the minimum amount of energy that particles must have to react
- Increasing the concentration of reactants in solution, the pressure of reacting gases, and the surface area of solid reactants **increases the frequency of collisions** and so **increases the rate of reaction**.
- Increasing the temperature **increases the frequency of collisions** and makes the **collisions more energetic**, and so **increases the rate of reaction**.

## Catalysts

- Catalysts are substances that speed up chemical reactions without being changed or used up during the reaction.
- Enzymes act as catalysts in biological systems
- Catalysts are not included in the equation for a reaction



- Catalysts decrease the activation energy; this increases the proportion of particles with energy to react.
- Catalysts provide a different pathway for a chemical reaction that has a lower activation energy.

