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# Chemistry

For the IB Diploma

Brighter Thinking
Better Learning

# Chapter 17

## How fast? The rate of chemical change

# Using volume of gas produced to work out the rate of reaction

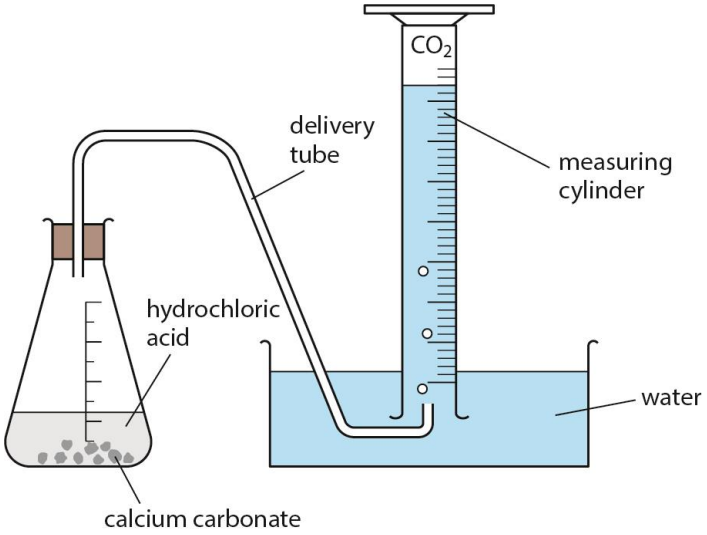


**Figure 17.1**: An experiment to measure rate of $CO_2$ production. Instead of a measuring cylinder, a gas burette or a gas syringe could be used.

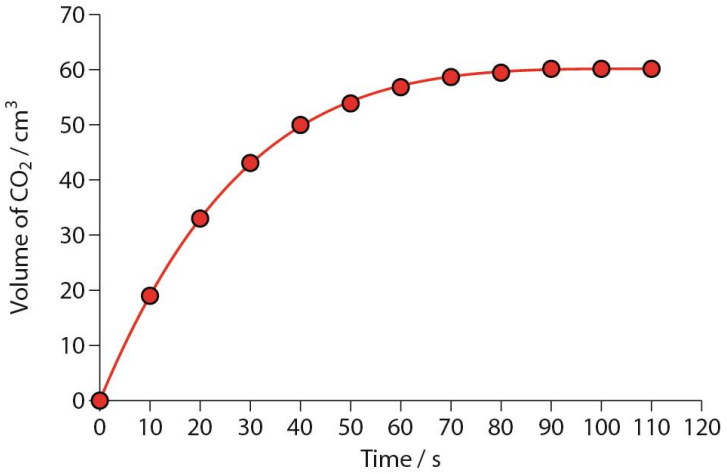


**Figure 17.2**: Change in volume with time.

# Working out the initial rate by using the tangent

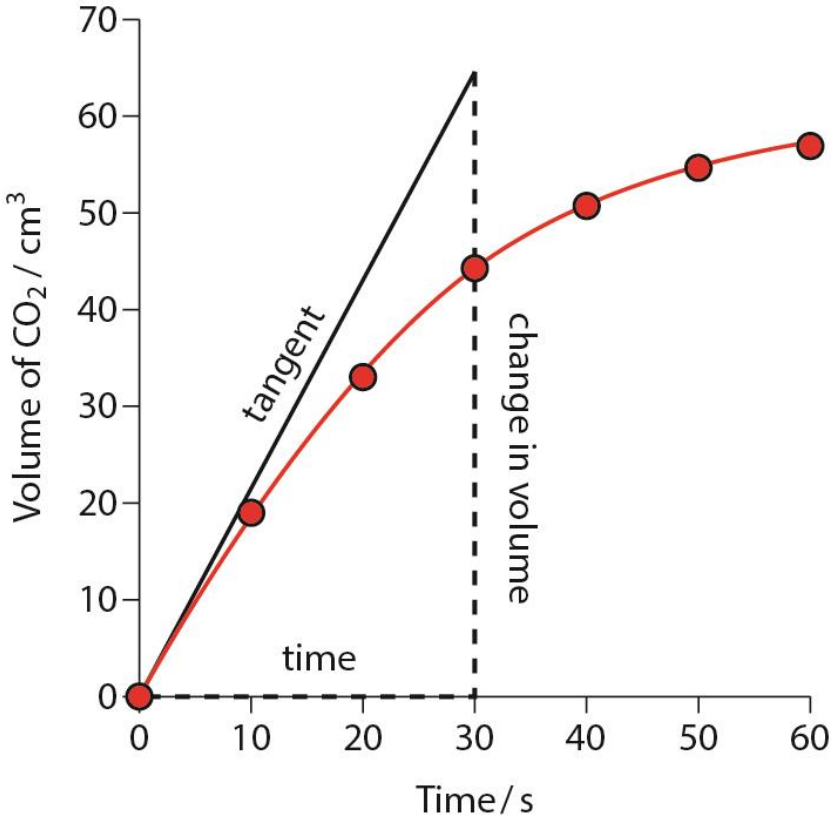


**Figure 17.3**: The tangent is drawn at the initial point to determine the initial rate.

# Collision theory

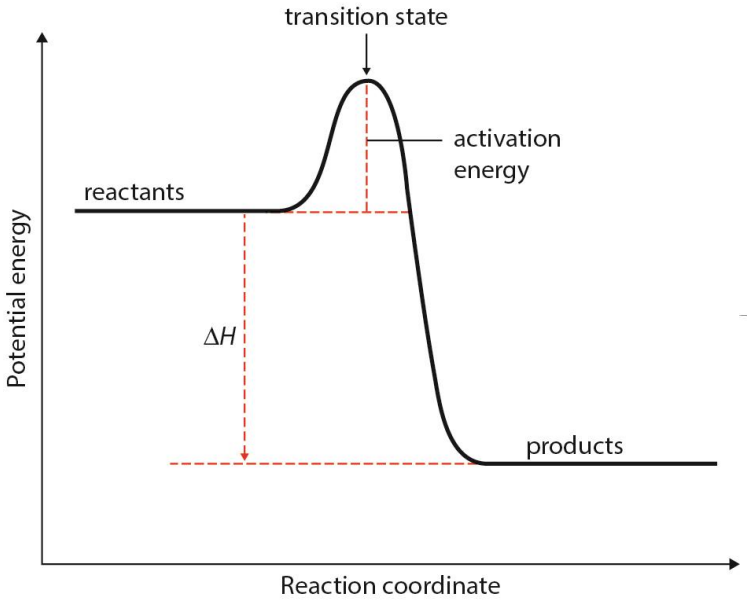


**Figure 17.4**: A potential energy profile, showing the activation energy for an exothermic reaction.

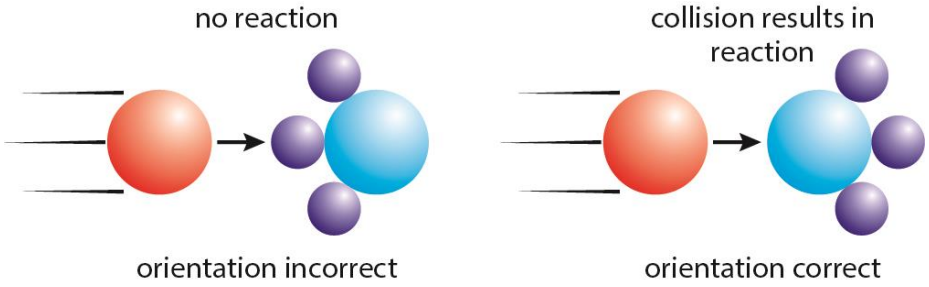


**Figure 17.5**: Orientation is important.

# The effect of temperature on rate of reaction

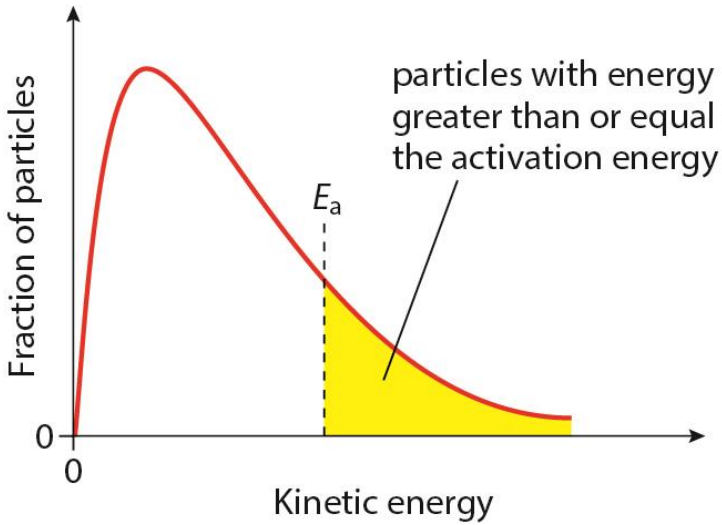


**Figure 17.6**: The Maxwell–Boltzmann distribution of the energy of the particles in a sample of gas.

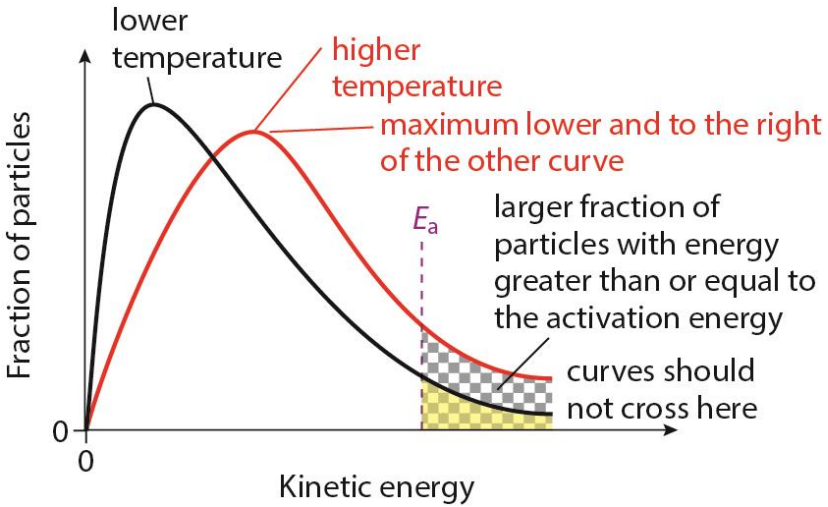


**Figure 17.7**: The yellow-shaded area represents the number of particles with energy greater than or equal to the activation energy at the lower temperature. The checked area represents the number of particles with energy greater than or equal to the activation energy ($E_a$) at the higher temperature. The areas underneath the curves are the same because this is the total of all the fractions of particles, that is one.

# How does a catalyst affect the rate of reaction?

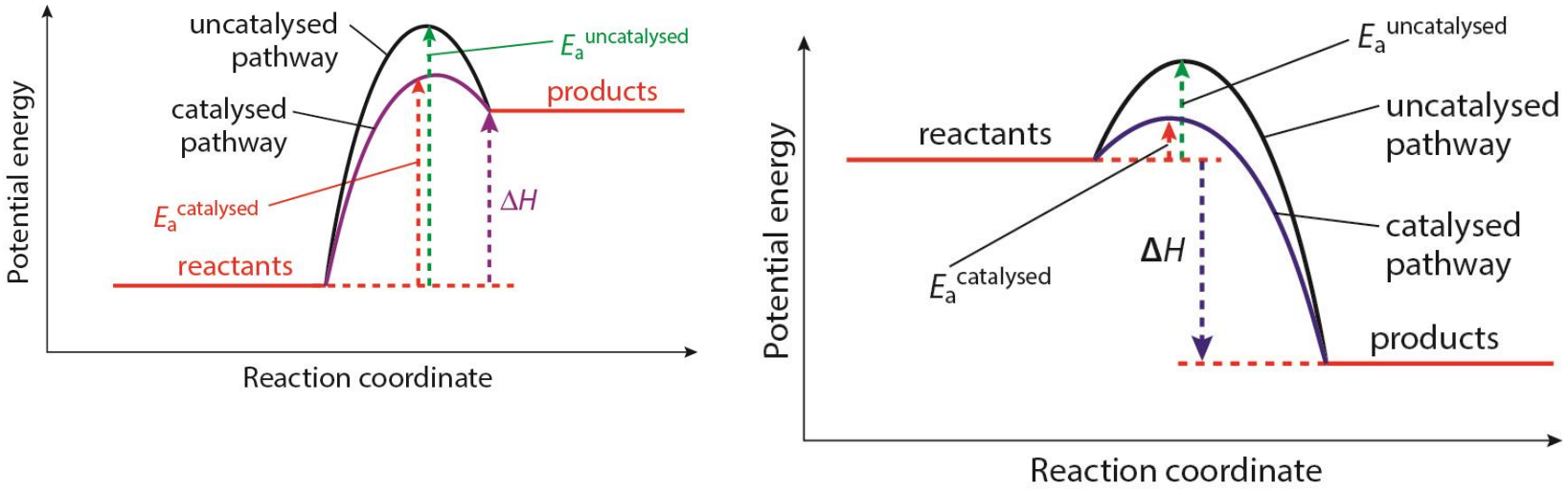


**Figure 17.8**: Potential energy profiles showing the effect of a catalyst on the activation energy of **a** an exothermic reaction and **b** an endothermic reaction.

# How does a catalyst affect the rate of reaction?

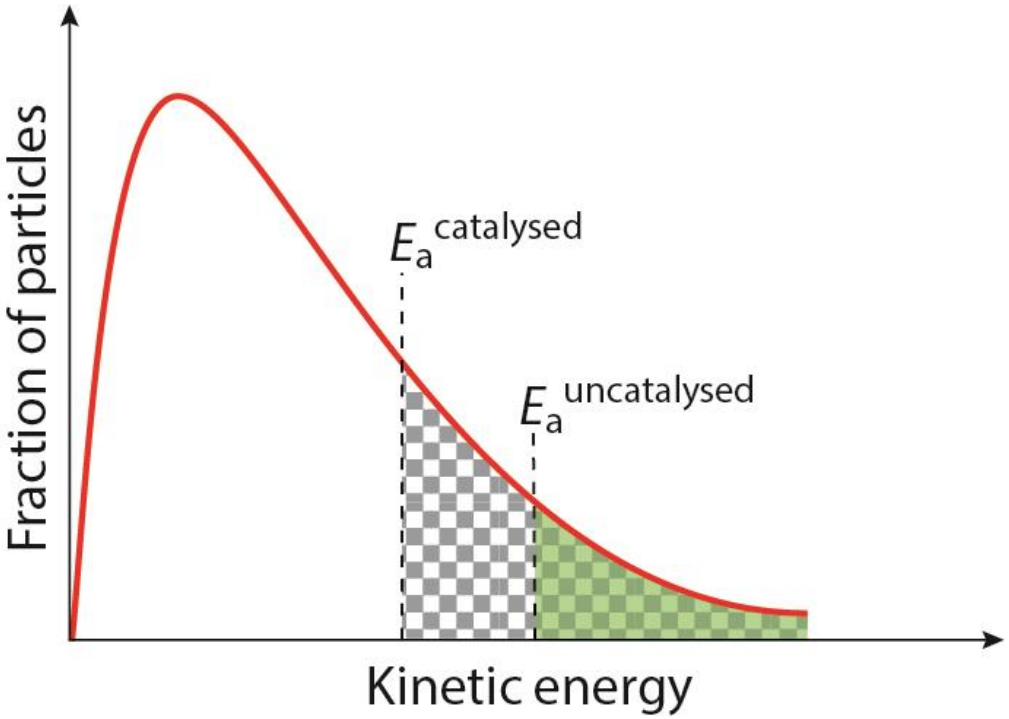


**Figure 17.9**: The green-shaded area represents the number of particles with energy greater than or equal to the activation energy for the uncatalysed reaction. The checked area represents the number of particles with energy greater than or equal to the activation energy for the catalysed reaction.