

# Edexcel IAL Chemistry

## A-Level

### Topic 9 - Introduction to Kinetics and Equilibria

#### Flashcards

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# What factors affect the rate of reaction?



## What factors affect the rate of reaction?

- Temperature
- Pressure
- Surface area
- Concentration
- Presence of a catalyst



# How does temperature affect the rate of reaction?



## How does temperature affect the rate of reaction?

Increasing temperature increases the rate of reaction. This is because the reactants have more energy so more particles have energy above the activation energy meaning more collisions will be successful. Collisions also occur more frequently because the particles have more kinetic energy.



# How does surface area affect the rate of reaction?



How does surface area affect the rate of reaction?

Increasing the surface area of reactants increases the rate of reaction. This is because a greater surface area means there are more exposed particles so more frequent successful collisions.



# How does a catalyst affect the rate of reaction?





## How does a catalyst affect the rate of reaction?

A catalyst increases the rate of reaction. This is because it provides an alternate reaction pathway with a lower activation energy. More particles will have sufficient energy to overcome the activation energy and react, so more successful collisions occur.



# How does concentration affect the rate of reaction?



# How does concentration affect the rate of reaction?

Increasing concentration increases the rate of reaction. This is because there are more reacting particles in the same volume so there are more frequent successful collisions.



How does pressure affect the rate of a gaseous reaction?



# How does pressure affect the rate of a gaseous reaction?

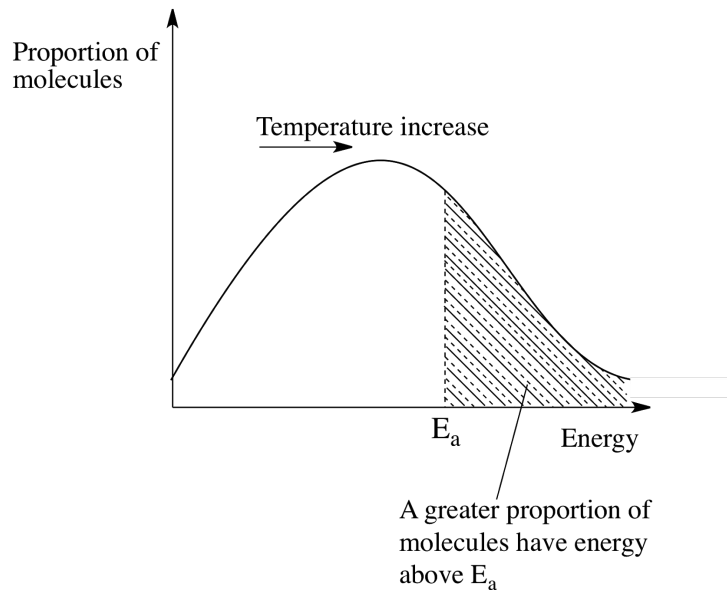
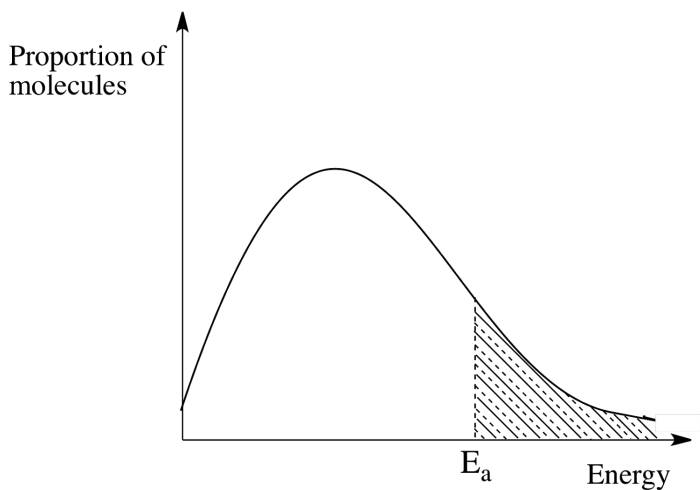
Increasing the pressure of a gaseous reaction increases the rate of reaction. This is because there are more reacting particles in the same volume of gas (or the same number of particles in a smaller volume) so more frequent successful collisions occur.



What does the Maxwell-Boltzmann distribution look like for a temperature increase?



# What does the Maxwell-Boltzmann distribution look like for a temperature increase?

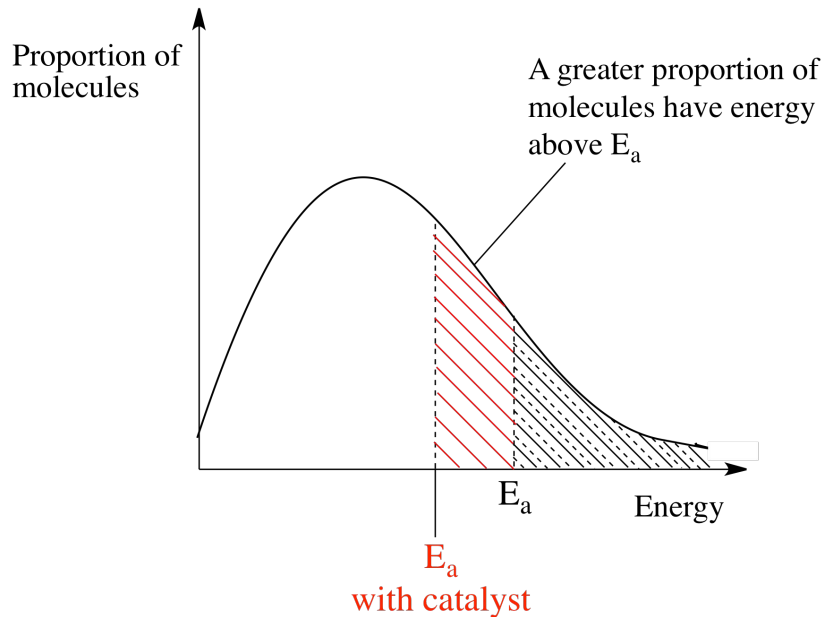


What does the Maxwell-Boltzmann distribution look like for the addition of a catalyst?





# What does the Maxwell-Boltzmann distribution look like for the addition of a catalyst?



# What is activation energy?



# What is activation energy?

The minimum amount of energy required for a reaction to occur between two reacting particles.



What is the equation for rate of reaction?



What is the equation for rate of reaction?

Rate of reaction =

Amount of reactant used or product formed

Time (s)



What units could be used for rate of reaction?



What units could be used for rate of reaction?

g/s

cm<sup>3</sup>/s

mol/s



After completing an experiment, how could you find the rate of reaction using a graph?





After completing an experiment, how could you find the rate of reaction using a graph?

Plot:

X axis: time

Y axis: amount of reactant used or product formed

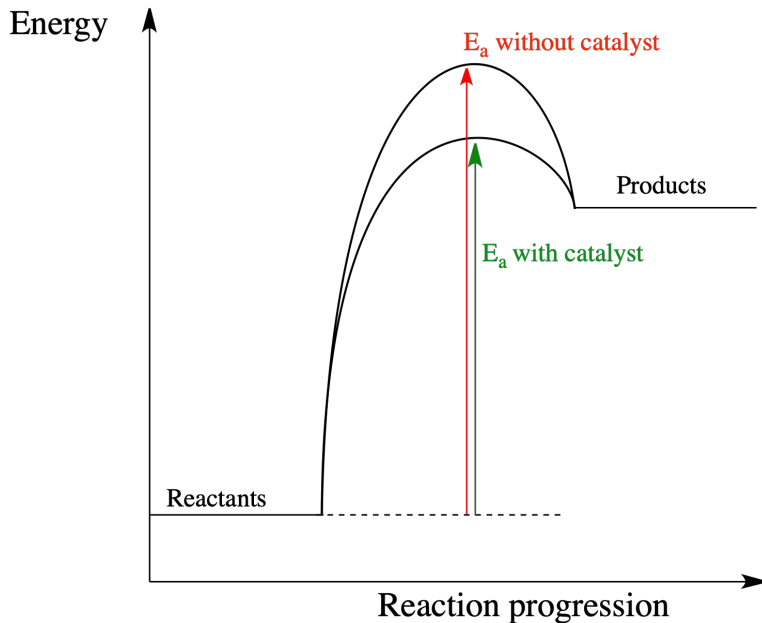
Draw a tangent to a point on the graph and find the gradient of this line ( $\Delta Y/\Delta X$ ) to find the rate of reaction at that time.



What does the enthalpy profile diagram look like for a catalysed reaction?



# What does the enthalpy profile diagram look like for a catalysed reaction?



# What is a reversible reaction?



# What is a reversible reaction?

A reversible reaction is a chemical reaction wherein the products can react to reform the reactants.



# What is meant by 'dynamic equilibrium'?



## What is meant by 'dynamic equilibrium'?

Dynamic equilibrium describes the point in a reversible reaction when the rate of the forwards reaction is equal to the rate of the backwards reaction. The concentrations of the products and reactants remains constant.



# What is Le Chatelier's principle?





## What is Le Chatelier's principle?

If a change is made to the conditions of a reversible reaction, the position of equilibrium will move to counteract the change.



How does increasing the temperature affect the equilibrium position?



How does increasing the temperature affect the equilibrium position?

Increasing the temperature would favour the endothermic reaction, so the equilibrium will shift to favour the formation of the products of the endothermic reaction.



How does decreasing the temperature affect the equilibrium position?



How does decreasing the temperature affect the equilibrium position?

Decreasing the temperature would favour the exothermic reaction, so the equilibrium will shift to favour the formation of the products of the exothermic reaction.



How does increasing the pressure affect the equilibrium position?



How does increasing the pressure affect the equilibrium?

Increasing the pressure favours the side of the reaction with the least moles of **gas**, so the equilibrium position moves to that side.



How does increasing the concentration of the reactants affect the position of equilibrium?





How does increasing the concentration of the reactants affect the position of equilibrium?

Equilibrium will shift to the right to increase the concentration of the products.



The conditions for the Haber process are  $450^{\circ}\text{C}$  and 200 atm. Why are the conditions described as a compromise?



The conditions for the Haber process are  $450^{\circ}\text{C}$  and 200 atm. Why are the conditions described as a compromise?

- A high temperature increases the rate of reaction however, it will favour the reverse reaction, decreasing the yield. A compromise of  $450^{\circ}\text{C}$  is used to obtain a sufficient rate and yield.
- A high pressure speeds up the rate and favours the forward reaction. However, high pressures can be dangerous and requires expensive machinery so a compromise of 200 atm is used.

