

# WJEC (Eduqas) Chemistry GCSE

## 9 - Rate of Chemical Change and Dynamic Equilibrium Flashcards

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# What is activation energy?



# What is activation energy?

The minimum amount of energy that particles must collide with to react.



Define rate of reaction.



# Define rate of reaction.

- The measure of the amount of product formed or reactant used over time.
- The units of rate of reaction may be given as g/s,  $\text{cm}^3/\text{s}$  or mol/s.



Suggest an example of a practical method that can be used to determine the rate of reaction.



Suggest an example of a practical method that can be used to determine the rate of reaction.

- Gas collection
- Loss of mass
- Precipitation



Suggest a formula that can be used to calculate the rate of reaction.





Suggest a formula that can be used to calculate the rate of reaction.

- Rate of reaction = amount of reactant used  $\div$  time
- Rate of reaction = amount of product formed  $\div$  time

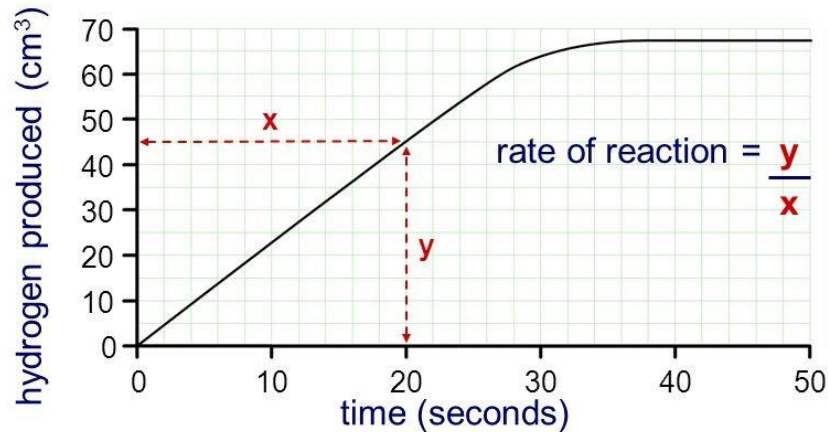


How do you find the rate of reaction from a graph?



# How do you find the rate of reaction from a graph?

- Draw tangents to curves and use the slope of the tangent as a measure of the rate of reaction
- Calculate the gradient of a tangent to the curve on these graphs as a measure of rate of reaction at a specific time



List factors affecting rates of chemical reactions.



# List factors affecting rates of chemical reactions.

- Temperature
- Pressure of reacting gases
- Concentration of reacting particles
- Surface area of solid reactants



Explain how temperature can increase rates of chemical reactions.



# Explain how temperature can increase rates of chemical reactions.

- Increasing the temperature means the particles will have more kinetic energy and so will move faster.
- If the molecules are moving faster they will collide more often.
- Since they've gained kinetic energy, a larger proportion of the particles will possess energy equal to or greater than the activation energy.
- Hence, the rate of reaction increases.



Explain how increasing the pressure of reacting gases can increase the rate of reaction.





# Explain how increasing the pressure of reacting gases can increase the rate of reaction.

- Increasing the pressure of gaseous reactants means the reacting particles will be closer together.
- This means they will collide more often. Therefore, there will be a higher rate of successful collisions
- This leads to a faster rate of reaction.



Explain how increasing the concentration of reactants in solution can increase the rate of reaction.



# Explain how increasing the concentration of reactants in solution can increase the rate of reaction.

- Increasing the concentration of reactants in solution means the reacting particles will be closer together.
- This means they will collide more often. Therefore, there will be a higher rate of successful collisions
- This will result in a faster rate of reaction.



Explain how increasing the surface area of solid reactants can increase the rate of reaction.



# Explain how increasing the surface area of solid reactants can increase the rate of reaction.

- Increasing the surface area of the reactants means there are more exposed reacting particles.
- This means there are more frequent successful collisions in a given time.
- Hence, rate of reaction increases.



# What is a catalyst?



# What is a catalyst?

- A catalyst is a substance used to increase the rate of reaction by providing a different reaction pathway with a lower activation energy.
- They are not used up or changed during the reaction.



How do you identify a catalyst in a reaction?





# How do you identify a catalyst in a reaction?

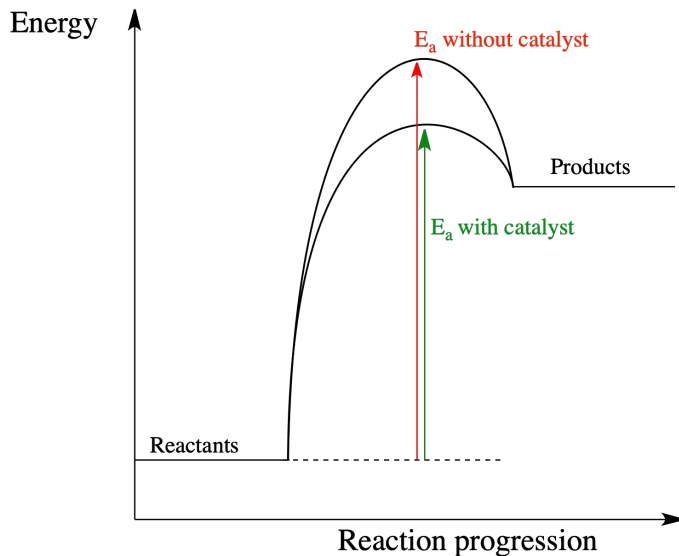
- Whatever stays the same and is not affected throughout the reaction is identified as the catalyst
- They usually aren't included in the reaction equation



Draw a diagram to indicate how catalyst speeds up rate of reaction by affecting activation energy.



Draw a diagram to indicate how catalyst speeds up rate of reaction by affecting activation energy.



Give an example of a catalyst in a biological system.



Give an example of a catalyst in a biological system.

Enzymes



# What are enzymes?



# What are enzymes?

- Biological catalysts which speed up biochemical reactions so that organisms can survive.
- They are used in the production of alcoholic drinks.



# What is meant by a reversible reaction?





# What is meant by a reversible reaction?

- A reaction in which the products can react together to reform the reactants.
- Reversible reactions are denoted by the symbol  $\rightleftharpoons$
- The direction of the reaction can be changed by changing the conditions



Define dynamic equilibrium.



# Define dynamic equilibrium.

- Dynamic equilibrium is a state reached by a reversible reaction when the rate of the forward reaction is equal to the rate of the backward reaction.
- At dynamic equilibrium, the concentration of reactants and products remains constant.



# Which factors affect equilibrium?



# Which factors affect equilibrium?

- Temperature
- Concentration of reactants or products
- Pressure



Explain what is meant by Le Chatelier's Principle.



# Explain what is meant by Le Chatelier's Principle.

If a reaction at equilibrium is subjected to a change in concentration, temperature or pressure, the position of equilibrium will move to counteract the change.



How does increasing concentration of reactants affect equilibrium?





# How does increasing concentration of reactants affect equilibrium?

The position of equilibrium shifts towards products (right) so more product is produced until equilibrium is reached again.



How does increasing concentration of products affect equilibrium?



# How does increasing concentration of products affect equilibrium?

Position of equilibrium shifts towards reactants (left) so more reactant is produced until equilibrium is reached again.



# How does increasing temperature affect equilibrium?



# How does increasing temperature affect equilibrium?

Equilibrium moves in the direction of the endothermic reaction, e.g. if the forward reaction is endothermic, then if the temperature is increased, equilibrium shifts right to produce more product



How does decreasing the temperature affect equilibrium?



# How does decreasing the temperature affect equilibrium?

- Equilibrium shifts in the direction of the exothermic reaction



# How does increasing the pressure affect equilibrium?





# How does increasing the pressure affect equilibrium?

An increase in pressure causes the equilibrium position to shift towards the side with the smaller number of moles of gas.



How does decreasing the pressure affect equilibrium?



# How does decreasing the pressure affect equilibrium?

A decrease in pressure causes the equilibrium position to shift towards the side with the larger number of moles of gas.

