

CAIE Chemistry IGCSE

6.2 Rate of reaction

Flashcards

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What does the rate of a reaction mean?



What does the rate of a reaction mean?

The time taken for a chemical reaction to occur which can be measured by the mass/volume of a reactant used up/ product formed over a period of time



What must happen for a reaction to occur?



What must happen for a reaction to occur?

Particles must collide at the correct orientation with sufficient energy to react.



How can the rate of a reaction be increased?



How can the rate of a reaction be increased?

- Increase the temperature.
- Increase the concentration.
- Increase surface area to volume ratio.
- Add a catalyst.
- Increase the pressure (for gases).



Describe how temperature affects the rate of reaction?



Describe how temperature affects the rate of reaction?

Increasing temperature increases the rate of reaction

Decreasing temperature decreases the rate of reaction



Describe how surface area affects the rate of reaction?



Describe how surface area affects the rate of reaction?

Increasing the surface area (to volume ratio or decreasing particle size) increases the rate of reaction.

Decreasing the surface area decreases the rate of reaction.



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 as more particles will have sufficient energy so more frequent successful collisions.



Describe how concentration affects the rate of reaction?



Describe how concentration affects the rate of reaction?

Increasing the concentration of reacting solutions (more particles per unit volume) increases the rate of reaction.

Decreasing the concentration of reacting solutions decreases the rate of reaction.



Describe how pressure affects the rate of reaction?



Describe how pressure affects the rate of reaction?

Increasing the pressure of reacting gases (more particles per unit volume) increases the rate of reaction.

Decreasing the pressure of reacting gases decreases the rate of reaction.



What is a catalyst?



What is an catalyst

A catalyst increases the rate of reactions without being used up at the end of the reaction. Catalysts do not affect the products being formed



What is an enzyme?



What is an enzyme?

A biological catalyst that increases the rate of reactions in living cells without being used up.



How can rate of reaction be calculated?



How can rate of reaction be calculated?

Rate of reaction =

$$\frac{\text{Amount of reactant used or product formed}}{\text{Time (s)}}$$



Suggest units that could be used for rate of reaction



Suggest units could be used for rate of reaction

g/s

cm³/s

mol/s



How can you measure the rate of reaction
when a gas is given off?



How can you measure the rate of reaction when a gas is given off?

- Measure time and measure the volume of gas produced in an upside down measuring cylinder in a trough of water or in a gas syringe.
- Measure time and the change in volume.



How can you measure the rate of reaction when a precipitate is formed?



How can you measure the rate of reaction when a precipitate is formed?

Put a black cross below a beaker containing one reactant. Add the other reactant and time how long it takes for the cross to not be visible.



Why is using the precipitation method to investigate rate of a reaction not very accurate?



Why is using the precipitation method to investigate rate of a reaction not very accurate?

It's subjective so people are likely to disagree over the exact point at which the cross is no longer visible.



How can you measure rate of reaction using a digital balance?



How can you measure rate of reaction using a digital balance?

When a gas is produced in a reaction, gases will escape from the reaction vessel, causing mass to decrease. The experiment can be carried out on a digital balance and the rate of reaction can be calculated by recording the mass at regular time intervals.



Marble chips react with hydrochloric acid to produce calcium chloride, water and carbon dioxide. How could you measure the rate of reaction?



Marble chips react with hydrochloric acid to produce calcium chloride, water and carbon dioxide. How could you measure the rate of reaction?

Since carbon dioxide is gaseous, the rate can be measured using a digital balance to measure the change in mass over a period of time or by measuring the volume of gas produced over time.



Marble chips react with hydrochloric acid to produce calcium chloride, water and carbon dioxide. How could the rate of this reaction be increased?



Marble chips react with hydrochloric acid to produce calcium chloride, water and carbon dioxide. How could the rate of this reaction be increased?

- Increase the surface area of the marble chips by turning them into a powder.
- Increase concentration of acid.
- Increase temperature.



How can the rate of reaction be plotted on a graph?

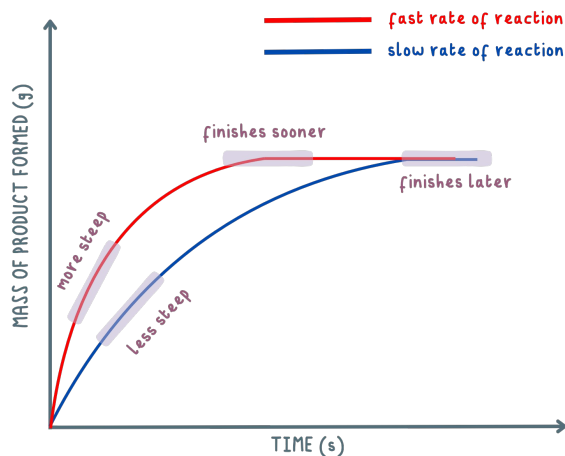


How can the rate of reaction be plotted on a graph?

Y-axis: The mass/volume of reactant used up/
product formed (in g or cm^3)

X-axis: Time (in s)

Plot the results of the reaction
and draw smooth curve

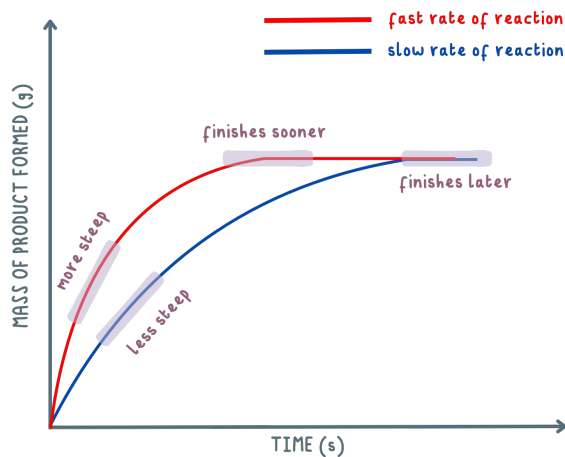


How would a fast rate of reaction be distinguished from a slow rate of reaction on a graph?



How would a fast rate of reaction be distinguished from a slow rate of reaction on a graph?

The fast rate of reaction will begin with a steeper line and become horizontal sooner (completes reaction sooner) than a slower rate of reaction

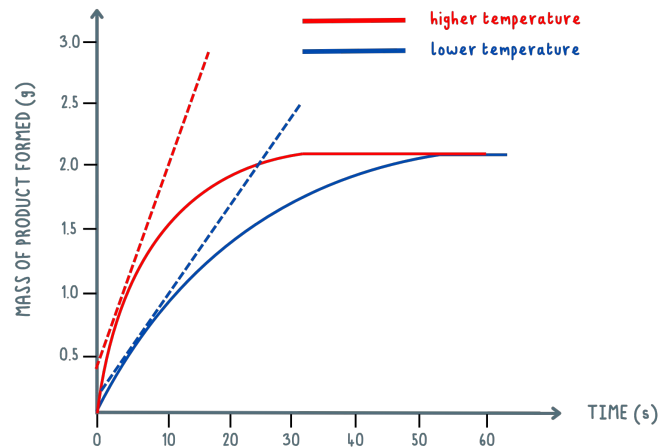


What can be drawn on the graph to calculate the rate of a reaction?



What can be drawn on the graph to calculate the rate of a reaction?

A tangent (straight line that just touches a point on the curve) can be drawn. The gradient of the tangent is then calculated to find the rate



How can the initial rate of a reaction be calculated from a graph?



How can the initial rate of a reaction be calculated from a graph?

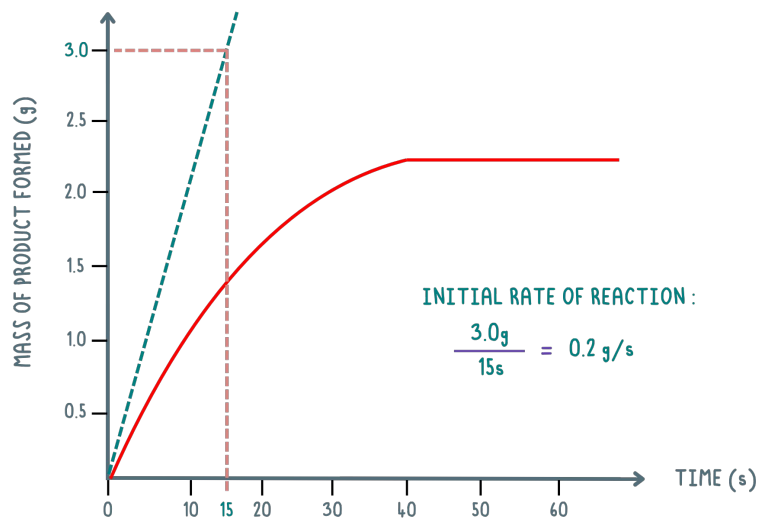
Draw tangent at time= 0s

Calculate the gradient of the tangent:

Change in mass of product = Δy

Time

Δx



How can the rate of a reaction at a specific time be calculated from a graph?



How can the rate of a reaction at a specific time be calculated from a graph?

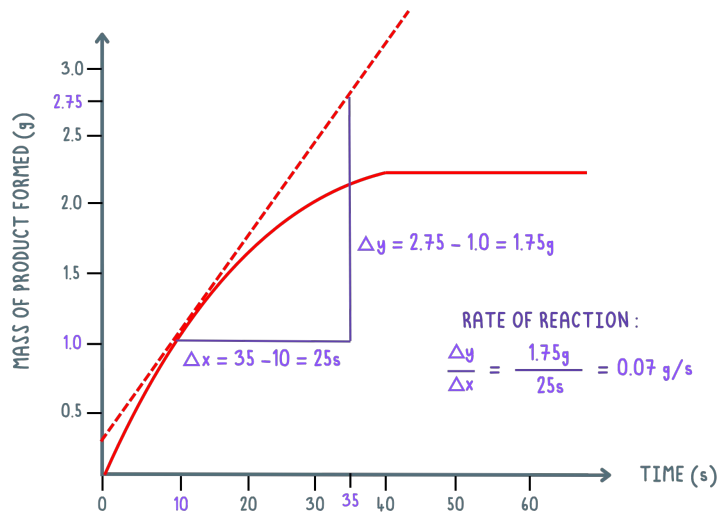
Draw tangent at specified time.

Calculate the gradient of the tangent:

Change in mass of product = Δy

Time

Δx



Describe what the collision theory means
(extended only)



Describe what the collision theory means (extended only)

For a chemical reaction to happen, the reactant particles, with enough activation energy E_a , must collide successfully with each other. By increasing the kinetic energy of the particles and increasing the number of particles per unit volume, there will be more frequent collisions between the particles, so the faster the rate of reaction.



Explain the effect of concentration on the rate of reaction, using the collision theory. (extended only)



Explain the effect of concentration on the rate of reaction, using the collision theory. (extended only)

Increasing the concentration of reacting solutions → more reactant particles in the same volume → more frequent collisions between the reactant particles → increases rate of reaction

Decreasing the concentration of reacting solutions → fewer reactant particles in the same volume → less frequent collisions between reactant particles → decreases rate of reaction



Explain the effect of pressure on the rate of reaction, using the collision theory.
(extended only)



Explain the effect of pressure on the rate of reaction, using the collision theory. (extended only)

Increasing the pressure of reacting gases → more reactant particles in the same volume → more frequent collisions between the reactant particles → increases rate of reaction

Decreasing the pressure of reacting gases → fewer reactant particles in the same volume → less frequent collisions between reactant particles → decreases rate of reaction



Explain the effect of surface area on the rate of reaction, using the collision theory. (extended only)



Explain the effect of surface area on the rate of reaction, using the collision theory. (extended only)

Increasing the surface area of a solid → exposes more reactant particles at surface → more frequent collisions between reactant particles → increases rate of reaction

Decreasing the surface area of a solid → exposes less reactant particles at surface → less frequent collisions between reactant particles → decreases rate of reaction



Explain the effect of temperature on the rate of reaction, using the collision theory. (extended only)



Explain the effect of temperature on the rate of reaction, using the collision theory. (extended only)

Increasing the temperature → more kinetic energy in the reactant particles (move more quickly) → more frequent collisions between the reactant particles → increases rate of reaction

Decreasing the temperature → less kinetic energy in the reactant particles (move more slowly) → less frequent collisions between the reactant particles → decreases rate of reaction



Explain the effect of a catalyst on the rate of reaction, using the collision theory. (extended only)



Explain the effect of a catalyst on the rate of reaction, using the collision theory. (extended only)

Adding a catalyst increases the rate of reaction as the activation energy needed for the reaction to occur is lowered, so more reactant particles have sufficient energy to collide with each other successfully

