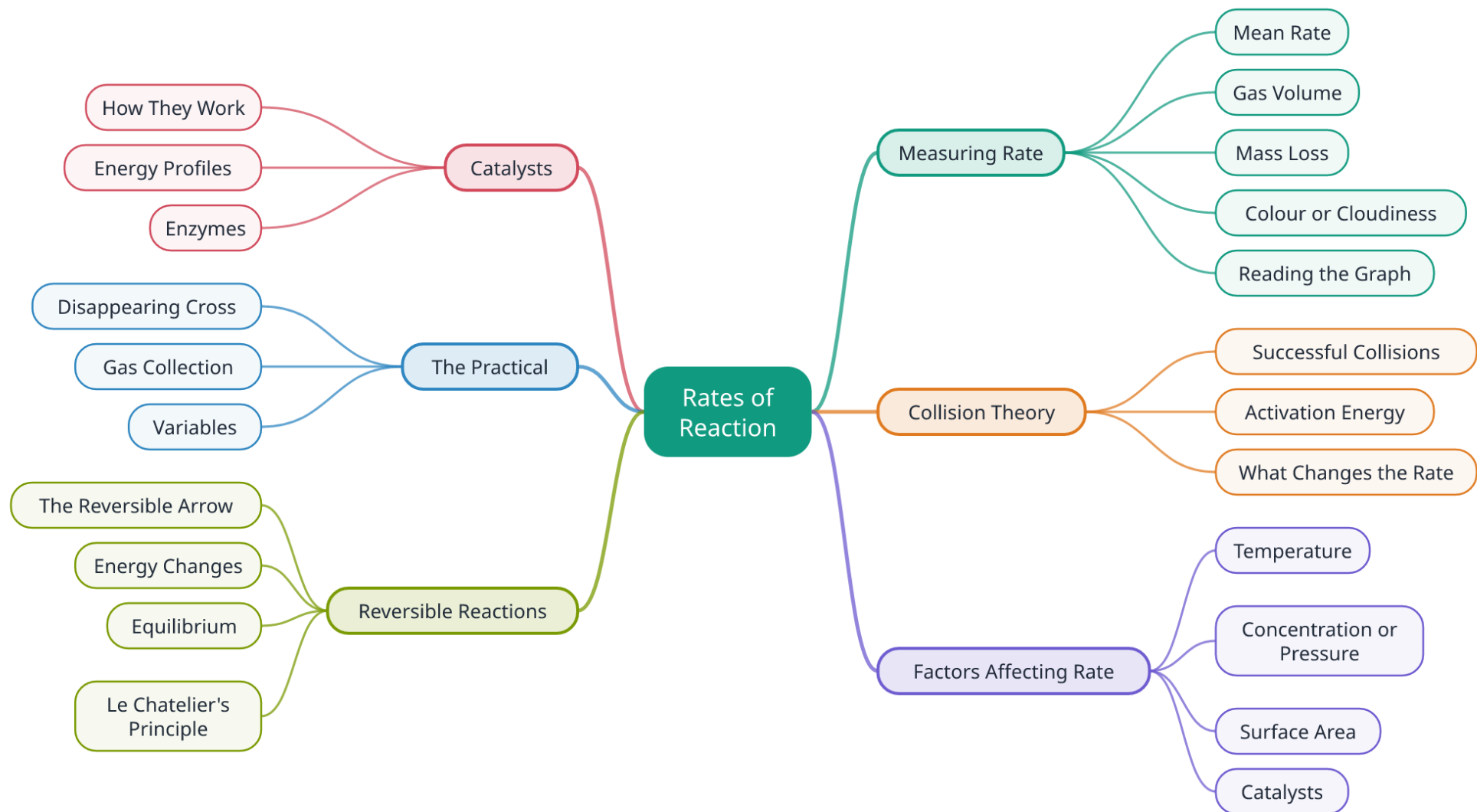


Rates of Reaction Mind Map (GCSE)

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Rates of Reaction mind map explained

Measuring Rate

The rate is how quickly reactants are used up or products are formed.

Mean Rate

mean rate = quantity of reactant used $\div$ time, or quantity of product formed $\div$ time. Units such as g/s or cm³/s, and mol/s at higher tier.

Gas Volume

Collect the gas in a gas syringe or upturned measuring cylinder and record the volume over time.

Mass Loss

Put the flask on a balance and record the mass as the gas escapes.

Colour or Cloudiness

Time how long a cross under the flask takes to disappear as a precipitate forms.

Reading the Graph

A steeper line means a faster reaction. The line levels off when a reactant is used up. Higher tier: find the rate at a point from the gradient of a tangent.

Collision Theory

Chemical reactions happen only when particles collide.

Successful Collisions

Particles must collide with enough energy to react.

Activation Energy

The minimum amount of energy particles need to react.

What Changes the Rate

The rate increases if collisions happen more often, or if more of them have at least the activation energy.

Factors Affecting Rate

Explain each one in terms of collisions.

Temperature

Particles move faster, so they collide more often, and more collisions have at least the activation energy. Both increase the rate.

Concentration or Pressure

More particles in the same volume, so collisions happen more often.

Surface Area

Smaller pieces have a larger surface area to volume ratio, so more particles are exposed and collisions happen more often.

Catalysts

Speed up a reaction without being used up. Covered in the next branch.

Catalysts

Substances that increase the rate of a reaction but are not used up, so they are not in the equation.

How They Work

They provide a different pathway for the reaction with a lower activation energy, so more collisions are successful.

Energy Profiles

On a reaction profile, a catalyst lowers the peak (the activation energy) but not the energy of the reactants or products.

Enzymes

Biological catalysts, used in living things and in industry.

The Practical

AQA required practical and Edexcel core practical: how concentration (or another condition) affects the rate.

Disappearing Cross

Sodium thiosulfate reacts with hydrochloric acid to form a sulfur precipitate. Time how long it takes for a cross under the flask to disappear, at different concentrations.

Gas Collection

Magnesium, or marble chips, with hydrochloric acid. Measure the volume of gas produced over time.

Variables

- Independent: concentration of the acid or thiosulfate
- Dependent: time taken, or volume of gas
- Control: temperature, volumes, and the same person judging the cross

Reversible Reactions

Mainly AQA topic 6. Reactions where the products can react to form the reactants again.

The Reversible Arrow

Written with the $\rightleftharpoons$ symbol. For example, ammonium chloride $\rightleftharpoons$ ammonia + hydrogen chloride.

Energy Changes

If the reaction is exothermic one way, it is endothermic the other way, transferring the same amount of energy. Example: blue hydrated copper sulfate $\rightleftharpoons$ white anhydrous copper sulfate + water.

Equilibrium

In a closed system, the forward and reverse reactions eventually happen at exactly the same rate.

Le Chatelier's Principle

Higher tier. If conditions change, the position of equilibrium shifts to counteract the change.

How to revise with this mind map

1. Use collision theory every time. For each factor, say whether collisions become more frequent, more energetic, or both. Saying the reaction is just faster gets no marks.
2. For temperature, give both reasons: particles collide more often and more of the collisions have enough energy.
3. Learn the practical method, the variables and how to make it a fair test. It is examined in detail on both boards.
4. Practise reading rate graphs: which line is fastest, when the reaction stops, and why two lines finish at the same height when the same amount of limiting reactant is used.
5. Make it yours. Build your own rates of reaction map in Mindmapi from your class notes, and ask the AI about any branch you are unsure of. The answer is saved into that branch's notes for next time.