AQA Chemistry GCSE

Topic 6: The Rate and Extent of Chemical Change

Flashcards

How is rate of reaction calculated?

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Rate of reaction = $\frac{\text{amount (e.g. grams, cm}^3\text{) of reactant used or product formed}}{\text{time}}$

Rate of reaction (mol/s) = $\frac{\text{Moles of reactant used or product formed}}{\text{time}}$

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What are the various units for rate of reaction?

What are the various units for rate of reaction?

Can include g/s or cm^3/s or mol/s

Generally, mass/time, volume/time, moles/time

Name three common ways of measuring rate of reaction

Name three common ways of measuring rate of reaction

- Loss in mass of reactants
- Volume of gas produced
- Time for a solution to become opaque

Describe measuring the rate by monitoring mass loss

Describe measuring the rate by monitoring mass loss

Place the reaction flask on a balance. In these reactions (e.g. metal carbonate + acid) a gas is given off, so record the decrease in mass in time intervals (note hydrogen is too light). Plot a graph of mass vs time.

Describe measuring the rate by monitoring the volume of a gas

Describe measuring the rate by monitoring the volume of a gas

Connect a gas syringe to a reaction flask and measure the volume of a gas formed in time intervals. Plot a graph of volume vs time.

Describe measuring the rate by monitoring the disappearance of a cross

Describe measuring the rate by monitoring the disappearance of a cross

Take a piece of paper and mark a cross (X) on it. Put the reaction flask on this cross. Mix the reagents, and measure how long it takes for a cloudy mixture to conceal a cross.

How to find a rate of reaction at some time, t, from a graph of amount of reactant vs time?

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How to find a rate of reaction at some time, t, from a graph of amount of reactant vs time?

- Pick a point corresponding to the time t, and find the tangent to the curve at this point.
- The tangent is the gradient of this graph - it tells you how fast the reaction proceeds at this point. The steeper the tangent line, the faster the rate. Gradient of tangent can be expressed in change in *y* values over change in *x* values.

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State five factors affecting the rate of a chemical reaction

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- Concentration of reactants
- Pressure of gases (volume)
- Surface area
- Temperature
- Catalysts

What is the collision theory?

What is the collision theory?

Chemical reactions can occur only when reacting particles collide with each other with sufficient energy (more than or equal to activation energy).

Describe and explain the effect of increasing temperature on the rate of reaction

Describe and explain the effect of increasing temperature on the rate of reaction

T increases = faster reaction

As T increases, kinetic energy of particles increases, i.e. more energetic collisions

Also, they move faster, so they collide more frequently

However, there is no straight line relationship between rate and temperature, i.e. they are not directly proportional to each other

Describe and explain the effect of increasing concentration on the rate of reaction

Describe and explain the effect of increasing concentration on the rate of reaction

Conc. increases = faster reaction,

More reactants = more frequent collisions

Describe and explain the effect of increasing pressure of a gas on the rate of reaction

Describe and explain the effect of increasing pressure of a gas on the rate of reaction

Increasing the pressure of reacting gases, is the same as increasing concentration. It increases the number of gas molecules in the same volume and so increases the frequency of collisions and therefore increases the rate of reaction.

Note that volume and pressure are inversely proportional to each other. Increasing the volume retards the reaction.

Describe and explain the effect of increasing surface area

Describe and explain the effect of increasing surface area

If solid reactants are in smaller pieces, they have a greater surface area. Increasing the surface area of solid reactants increases the frequency of collisions and so increases the rate of reaction, e.g. block of magnesium reacts slower with acid then magnesium powder.

What is a catalyst and how does it work? How does it affect the reaction profile?

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A catalyst changes the rate of reaction but is not used up. It increases rate of reaction by providing a different pathway for the reaction that has a lower activation energy. The reaction profile for a catalysed reaction will have a lower maximum of the curve (lower activation energy).

What is an enzyme?

What is an enzyme?

An enzyme is a molecule that acts as a catalyst in a biological system.

What is a reversible reaction?

What is a reversible reaction?

A reversible reaction occurs when the products of a reaction can react backwards to produce the original reactants

When is dynamic equilibrium reached?

When is dynamic equilibrium reached?

In a closed system, when the forward and reverse reactions occur at the same rate and the concentrations of reactants and products remain constant.

Describe Le Chatelier's Principle

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If a system is at equilibrium and a change is made to any of the conditions, then the system responds to counteract change and restore the equilibrium.

Describe the effect of changing the concentration of reactant and product on the position of the equilibrium

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Describe the effect of changing the concentration of reactant and product on the position of the equilibrium

If the concentration of one of the reactants or products is changed, the system is no longer at equilibrium and the concentrations of all the substances will change until equilibrium is reached again. If the concentration of a reactant is increased, more products will be formed until equilibrium is reached again. If the concentration of a product is decreased, more reactants will react until equilibrium is reached again.

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Describe the effect of changing temperature on the position of the equilibrium

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Describe the effect of changing temperature on the position of the equilibrium

If the temperature of a system at equilibrium is increased:

- the relative amount of products at equilibrium increases for an endothermic reaction
- the relative amount of products at equilibrium decreases for an exothermic reaction.

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Describe the effect of changing pressure on the position of the equilibrium

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Describe the effect of changing pressure on the position of the equilibrium

This applies to equilibria that involve gases

An increase in pressure causes the equilibrium position to shift towards the side with the smaller number of molecules as shown by the symbol equation for that reaction. A decrease in pressure causes the equilibrium position to shift towards the side with the larger number of molecules as shown by the symbol equation for that reaction. Pressure has no effect on the reactions where the numbers of gas molecules are equal on both sides of the equation.

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Describe the effect of a catalyst on the position of the equilibrium

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Describe the effect of a catalyst on the position of the equilibrium

No effect.

It just speeds up both forward and backward reactions equally.

i.e. equilibrium is achieved faster.

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