| Subject: Science (Chemistry) | Topic: Rate of chemical change | Year Group: 10 |
|---|---|---|

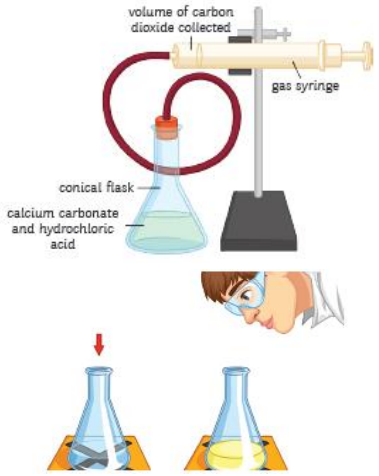
## Equations

| | |
|---|---|
| 1 | Rate of reaction = quantity of reactant used / time taken |
| 2 | Rate of reaction = quantity of product formed / time taken |

Required Practical

From this practical you should be able to describe 2 ways in which the rate of reaction can be measured.

1. Measuring the production of gas
2. Measuring the changes in the colour




## Factors affecting the rate of reaction

The rate of chemical change will be increased if there are more frequent successful collisions between reactant particles

| | | |
|---|---|---|
| 1 | Temperature | When the temperature of the reaction mixture is increased, the reactant particles gain kinetic energy and move much more quickly. This results is more frequent successful collisions increasing the rate of reaction. |
| 2 | Concentration and pressure | If the number of reactant particles in a given space is doubled , there will be more frequent successful collisions between reactant particles, therefore increasing the rate of reaction. |
| 3 | Surface area | Only reactant particles on the surface of a solid are able to collide and react. The greater the surface area the more reactant particles are exposed, leading to more frequent collisions. |
| 4 | Catalyst | When a catalyst is used in a chemical reaction the frequency of collisions is unchanged. More particles are able to react. The particles have energy greater than that of the activation energy. Consequently there is an increase in the rate of reaction. |

## Key Vocabulary

| | | |
|---|---|---|
| 1 | Reversable reaction | A reversible reaction is one in which the reactants form products. The products are then able to react together to reform the reactants. The symbol for a reversible reaction is ⇌ . |
| 2 | Catalyst | A substance that speeds up a chemical reaction without getting used up. A catalyst lowers the activation energy. Biological catalysts are called enzymes. |
| 3 | Dynamic equilibrium | A point where the forward and reverse reactions are occurring at the same rate. |

## Measuring a reaction mixture

| | | |
|---|---|---|
| 1 | Measuring the change in mass | The reaction mixture is placed on a mass balance. As the reaction proceeds and the gaseous product is given off the mass of the flask will decrease. The rate for the reaction is : Rate (g/s) = change in mass (g) / time taken.(s) |
| 2 | Measuring the volume of gas produced | The reaction mixture is connected to a gas syringe. As the reaction proceeds the gas is collected. The rare for the reaction is: Rate ($cm^3/s$) = volume of gas produced ($cm^3$) / time taken (s). |

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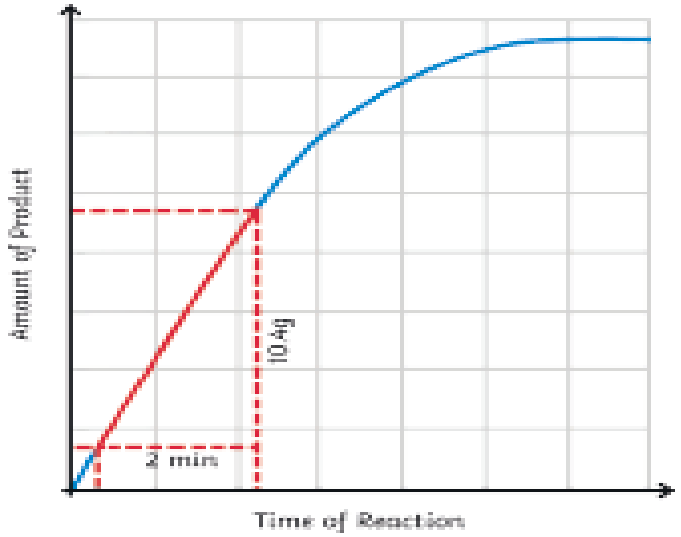
## Calculating gradient (Higher Tier)




Gradient = y/x

On the graph, draw construction lines on the part of the graph that has straight lines. Measure the values of x and y.

## Changing conditions and the effect on the position of equilibrium (Higher Tier)

At equilibrium the amounts of reactants and products are the same. In order to change the amount of reactants and products at equilibrium the conditions of the reaction must be changed. This is known as Le Chatelier's Principle

| Change | Effect | Explanation |
|---|---|---|
| Decrease concentration of product | Favours the forward reaction | Opposes the change by making less reactant and more product |
| Increase concentration of product | Favours the reverse reaction | Opposes the change by making more reactant and less product |
| Decrease concentration of reactant | Favours the reverse reaction | Opposes the change by making more reactant and less product |
| Increase concentration of reactant | Favours the forward reaction | Opposes the change by making less reactant and more product |
| Increasing temperature of surroundings | Favours the endothermic reaction | Opposes the change by decreasing the temperature of the surroundings |
| Decreasing the temperature of surroundings | Favours the exothermic reaction | Opposes the change by increasing the surroundings |
| Increase the pressure | Favours the reaction that results in fewer molecules | Decreasing the number of molecules within the vessel opposes the change because it decreases the pressure |
| Decrease the pressure | Favours the direction that results in more molecules | Increasing the number of molecules within the vessel opposes the change because it increases the pressure |

The Beckfoot Big Picture

## Past Learning

1. Measuring rate of reaction
2. Temperature
3. Concentration
4. Surface area
5. Pressure and catalysts
6. Required practical
7. Reversible reactions
8. Le Chatelier's Principle
9. Assessment

# Present Learning

**Scheme of Work: Rate of chemical change (Trilogy)**

**Learning Objective**: **Measuring the rate of reaction**

To develop our understanding of

**Chunk it: I can…**

**Define** the term 'rate of reaction'
**Calculate** rates of reaction from the use of graphs
**Describe** the collision theory

## Key Vocabulary

Catalyst
Collision
Collision theory
Frequency of collision
Rate of reaction

## Assessment

**Lesson 4:** CMP – Factors affecting the rate of reaction
**Lesson 8:** CMP – Factors affecting the rate of reaction
**Lesson 9:** End of unit assessment.

## Future Learning

A Level Chemistry -

## Wider World

An understanding of this units content helps Scientists to develop