

# CIE Chemistry IGCSE

## Topic 7 - Chemical Reactions

### Flashcards



# How do physical changes differ from chemical changes?



# How do physical changes differ from chemical changes?

A physical change affects the forces between particles. The particles and their chemical properties remain the same.

A chemical affects the chemical properties of the substance.



What does the term 'activation energy' mean?



What does the term 'activation energy' mean?

The minimum amount of energy required for a reaction to occur.



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).



How does temperature affect the rate of reaction?



## How does temperature affect the rate of reaction?

Increasing temperature increases the rate of reaction because the reactants have more energy so more particles have energy above the activation energy. This means there will be a greater number of collisions. Collisions also occur more frequently because the particles have more kinetic energy.



How does surface area affect the rate of reaction?



How does surface area affect the rate of reaction?

Increasing the surface area of reactants increases the rate of reaction because there are more exposed particles so more frequent successful collisions.



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 because it provides an alternate reaction pathway with a lower activation energy. More particles will have sufficient energy to overcome the activation energy and react so there are more frequent successful collisions.



How does concentration affect the rate of reaction?





# How does concentration affect the rate of reaction?

Increasing concentration increases the rate of reaction because there are more reacting particles in the same volume so there are more frequent successful collisions.



How does pressure affect the rate of a gaseous reaction?



How does pressure affect the rate of a gaseous reaction?

Increasing the pressure of a gaseous reaction increases the rate of reaction because there are more reacting particles in the same volume of gas (or the same number of particles in a smaller volume) so more frequent successful collisions occur.



# 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?  
(extended only)



How can rate of reaction be calculated?  
(extended only)

Rate of reaction =

Amount of reactant used or product formed

Time (s)



Suggest units that could be used for rate  
of reaction  
(extended only)





Suggest units could be used for rate of reaction  
(extended only)

g/s

cm<sup>3</sup>/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 mass.



How can you measure the rate of reaction when a precipitate is formed?  
(extended only)



How can you measure the rate of reaction when a precipitate is formed? (extended only)

Put a black cross below a beaker containing one reactant. Add the other reactant and time how long it takes for the cross to disappear.



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



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

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?  
(extended only)





How can you measure rate of reaction using a digital balance? (extended only)

When a gas is produced as this will escape 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?

(extended only)



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

**(extended only)**

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?

(extended only)



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

(extended only)

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



Explain the potential danger of explosive combustion in a flour mill



Explain the potential danger of explosive combustion in a flour mill

- Flour particles are very small so there is a very large surface area.
- If the flour is combusted, an explosion would occur due to the large surface area.



Explain the potential danger of explosive combustion of methane in mines





## Explain the potential danger of explosive combustion of methane in mines

- In coal mines, there is an increased air pressure. This means there is a high concentration of methane (a by-product of coal) in the air. There is no way to dilute the methane.
- Explosion occurs when the concentrated methane comes into contact with a heat source.



Increasing temperature and increasing concentration both cause an increase in collision rate. What is the other effect of increasing temperature?

(extended only)



Increasing temperature and increasing concentration both cause an increase in collision rate. What is the other effect of increasing temperature?

(extended only)

The number of molecules with energy above the activation energy increases so more collisions are successful.



# What are photochemical reactions? (extended only)



What are photochemical reactions? (extended only)

Reactions that are initiated by light



# How does light affect the rate of photochemical reactions?

(extended only)



How does light affect the rate of photochemical reactions? (extended only)

As light intensity increases, the rate of reaction increases.



# How are silver salts used in photography? (extended only)





# How are silver salts used in photography? (extended only)

- Silver halide salts are used in black and white photography.
- Silver chloride is light sensitive and breaks down to form silver metal which appears black.
- The more intense the light on the film, the faster the rate of reaction so the darker the photograph appears.



What happens to the silver ions when silver salts are used in photography?  
(extended only)



What happens to the silver ions when silver salts are used in photography? (extended only)

Silver ions are reduced to form silver.



# Where does photosynthesis take place in plants?

(extended only)



Where does photosynthesis take place in plants?  
(extended only)

In the leaves



# How does photosynthesis take place in plants?

(extended only)



# How does photosynthesis take place in plants? (extended only)

The green pigment chlorophyll absorbs light energy, allowing carbon dioxide to react with water to produce glucose and oxygen.



# What is a reversible reaction?





# What is a reversible reaction?

A reaction in which the products can react to reform the original reactants.

Denoted by the symbol:  $\rightleftharpoons$



How can the direction of a reversible reaction be altered?



How can the direction of a reversible reaction be altered?

Changing the reaction conditions.

E.g. Temperature, pressure,  
concentration.



The dehydration of copper (II) sulfate is a reversible reaction. Describe how the conditions can be altered to change the reaction direction.



The dehydration of copper (II) sulfate is a reversible reaction. Describe how the conditions can be altered to change the reaction direction.

Anhydrous copper (II) sulfate + water  $\rightleftharpoons$  hydrated copper (II) sulfate

The white solid will turn blue in the presence of water.

- Add water to cause the forward reaction to occur.
- Heat the hydrated copper (II) sulfate to evaporate the water so that the backwards reaction occurs.



The dehydration of cobalt (II) chloride is a reversible reaction. Describe how the conditions can be altered to change the reaction direction.



The dehydration of cobalt (II) chloride is a reversible reaction. Describe how the conditions can be altered to change the reaction direction.

Anhydrous cobalt(II) chloride + water  $\rightleftharpoons$  hydrated cobalt(II) chloride

The blue solid will turn pink in the presence of water.

- Add water to cause the forward reaction to occur.
- Heat the hydrated cobalt(II) chloride to evaporate the water so that the backwards reaction occurs.



What is meant by the term dynamic  
equilibrium?  
(extended only)





What is meant by the term dynamic equilibrium?  
(extended only)

Dynamic equilibrium is when the rate of the forward reaction equals the rate of the backwards reaction. This means the concentration of reactants and products remain the same even though reactions are constantly occurring.



# What is a closed system? (extended only)



What is a closed system? (extended only)

A system where nothing is added or removed. All reactants and products remain in the reaction vessel.



Why is equilibrium only reached if the reaction takes place in a closed system?  
(extended only)



Why is equilibrium only reached if the reaction takes place in a closed system? (**extended only**)

The closed system prevents any reactants and products escaping so that they are able to react continuously.



Explain the effect of changing the temperature of a reversible reaction if the forward reaction is endothermic  
**(extended only)**



Explain the effect of increasing the temperature of a reversible reaction if the forward reaction is endothermic (**extended only**)

The forward reaction is endothermic so increasing the temperature favours the forward reaction. The equilibrium will shift towards the left and the yield of the products will increase.



Explain the effect of changing the pressure of a reversible gaseous reaction  
(extended only)



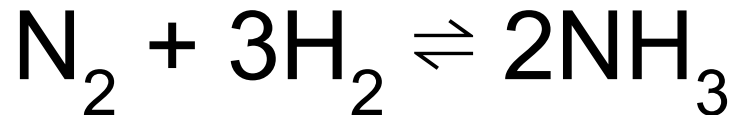


Explain the effect of increasing the pressure of a reversible gaseous reaction (**extended only**)

An increase in pressure will favour the reaction that produces the least number of molecules. The equilibrium position will shift towards the side that produces the fewest gaseous molecules.



The equation for the Haber process is

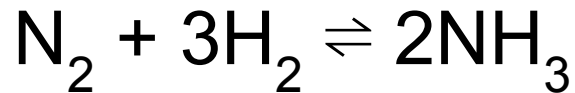


Explain the effect of decreasing the pressure on the yield of ammonia

(extended only)



The equation for the Haber process is



Explain the effect of increasing the pressure on the yield of ammonia (**extended only**)

Increasing the pressure will shift equilibrium to the right as there are fewer molecules of gas.

The yield of ammonia will increase.



The concentrations of the reactants are increased during a reversible reaction.

What effect will this have on the equilibrium position?

(extended only)



The concentrations of the reactants are increased during a reversible reaction. What effect will this have on the equilibrium position? (**extended only**)

The equilibrium will shift to the right so the product yield will increase. This reduces the effect of the increased concentration of reactants.



If there are equal gaseous molecules of the reactant and product in a reversible reaction, what effect will changing the pressure have on the equilibrium position?

(extended only)



If there are equal gaseous molecules of the reactant and product in a reversible reaction, what effect will changing the pressure have on the equilibrium position? (extended only)

No effect



Explain what oxidation means in terms of oxygen





Explain what oxidation means in terms of oxygen

Gain of oxygen



Explain what reduction means in terms of oxygen



Explain what reduction means in terms of oxygen

Loss of oxygen



Explain what oxidation means in terms of  
electrons  
(extended only)



Explain what oxidation means in terms of electrons  
(extended only)

Loss of electrons



Explain what reduction means in terms  
of electrons  
(extended only)



Explain what reduction means in terms of electrons  
(extended only)

Gain of electrons



# What is a redox reaction? (extended only)





What is a redox reaction? (extended only)

A reaction in which oxidation and reduction take place at the same time.



What is the oxidation state of iron in iron(II) chloride?



What is the oxidation state of iron in iron(II) chloride?

+2

(Fe<sup>2+</sup>)



What is the oxidation state of manganese in manganate(VII)?



What is the oxidation state of manganese in manganate (VII)?

+7

(Mn<sup>7+</sup>)



# How can redox reactions be identified? (extended only)



How can redox reactions be identified?  
(extended only)

Elements will undergo a change in  
oxidation state.



What is the colour change observed  
when potassium manganate(VII) is  
reduced?  
(extended only)





What is the colour change observed when potassium manganate(VII) is reduced?

(extended only)

Potassium manganate(VII) is purple and turns colourless when it is reduced.



What is the colour change observed  
when potassium iodide is oxidised?  
(extended only)

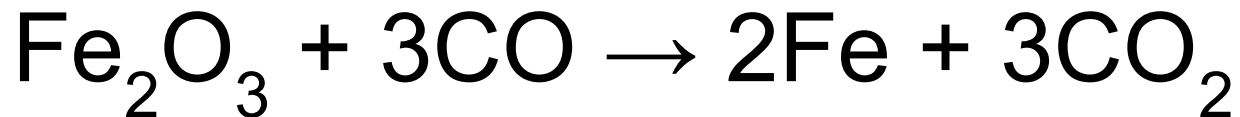


What is the colour change observed when potassium iodide is oxidised? (**extended only**)

Potassium iodide is a colourless solution which turns brown when oxidised.



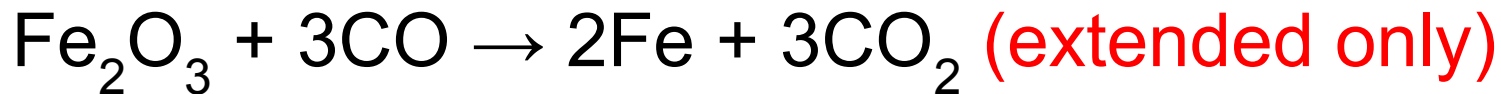
Identify which species are reduced and oxidised in the equation below:



(extended only)



Identify which species are reduced and oxidised in the reaction below:



$\text{Fe}^{3+}$  becomes Fe. The oxidation state goes from +3 to 0 so Fe is reduced.

$\text{C}^{2+}$  becomes  $\text{C}^{4+}$ . The oxidation state goes from +2 to +4 so C is oxidised.



# What are reducing and oxidising agents? (extended only)



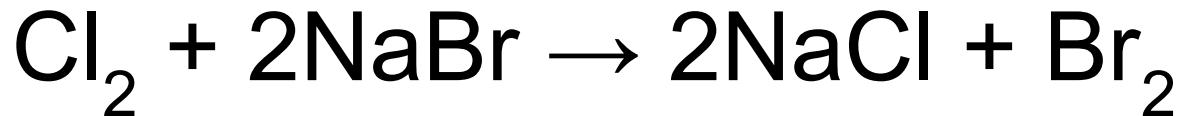
# What are reducing and oxidising agents? (extended only)

Reducing agent - a substance which reduces another substance during a redox reaction.

Oxidising agent - a substance which oxidises another substance in a redox reaction.



Identify the oxidising and reducing agents in the equation below:

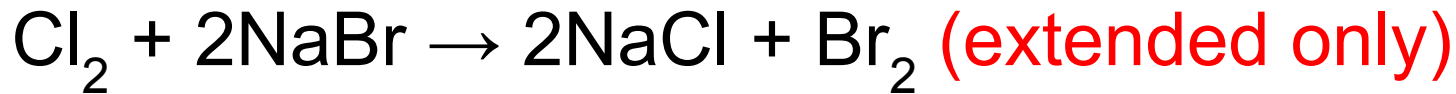


(extended only)





Identify the oxidising and reducing agents in the equation below:



The oxidation state of chlorine goes from 0 to -1. Chlorine has been reduced so chlorine is the oxidising agent.

The oxidation state of bromine goes from -1 to 0. Bromine has been oxidised so the bromide ion is the reducing agent.

