

Edexcel Chemistry GCSE

Topic 4 - Extracting Metals and Equilibria

Flashcards

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What are the products when a metal reacts with cold water?



What are the products when a metal reacts with cold water?

Metal hydroxide and hydrogen gas.



What are the products when a metal reacts with steam?



What are the products when a metal reacts with steam?

Metal oxide and hydrogen gas.



Write the chemical equation for the reaction that occurs when calcium reacts with cold water



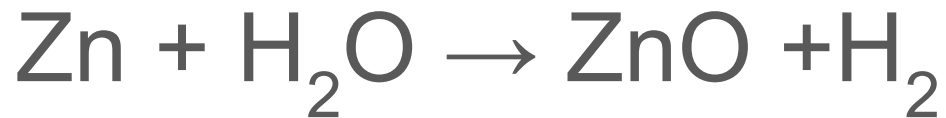
Write the chemical equation for the reaction that occurs when calcium reacts with cold water



Write the chemical equation for the reaction that occurs when zinc reacts with steam



Write the chemical equation for the reaction that occurs when zinc reacts with steam



What are the products when a metal reacts with a dilute acid?



What are the products when a metal reacts with dilute acids?

Salt and hydrogen.



If a metal reacts with cold water, what does it suggest about the reactivity of this metals?



If a metal reacts with cold water, what does it suggest about the reactivity of this metals?

It suggests the metal is very reactive as only the most reactive metals can react with cold water.



A metal reacts with oxygen but not acid or cold water. What does this suggest about the reactivity of this metal?



A metal reacts with oxygen but not acid or cold water. What does this suggest about the reactivity of this metal?

Not very reactive, most metals react with oxygen.



Name a metal which will not react with water, acid or oxygen



Name a metal which will not react with water, acid or oxygen

Gold



Describe an experiment that uses displacement to compare the reactivity of two metals



Describe an experiment that uses displacement to compare the reactivity of two metals

Add a solid metal to a salt solution (the salt must contain a different metal).

If the solid metal is more reactive, it will gradually disappear, displacing the metal that was in the salt solution.

If nothing happens, the metal in the salt is more reactive and can't be displaced.



What would you expect to observe when magnesium is added to copper sulfate solution?



What would you expect to observe when magnesium is added to copper sulfate solution?

The copper sulfate solution is blue.

Magnesium is more reactive than copper so when magnesium is added the blue solution decolourises and copper coats the surface of the magnesium.



Why can a displacement reaction be called a redox reaction? Explain in terms of electron transfer
(higher only)



Why can a displacement reaction be called a redox reaction? Explain in terms of electron transfer
(higher only)

A redox reaction occurs when reduction and oxidation are taking place in the same reaction.

In a displacement reaction, the more reactive metal atoms lose electrons to form ions (oxidation) and the less reactive metal ions gain electrons to form the element (reduction).



Fill in the gap: 'The reactivity of a metal
is related to its tendency to form
,



‘Fill in the gap: ‘The reactivity of a metal is related to its tendency to form _____’

Cations (positive ions)



Which metals are most easily oxidised?



Which metals are most easily oxidised?

The metals highest in the reactivity series. More reactive metals are more likely to react with water and dilute acids to form cations.



Where are most metals extracted from?



Where are most metals extracted from?

From ores found in the Earth's crust.



What is an ore?



What is an ore?

A rock which contains metals often chemically combined with other substances.



Which metals are found in the earth's crust as uncombined elements?



Which metals are found in the earth's crust as uncombined elements?

Unreactive metals



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



Most ores contain metals chemically combined with oxygen. What process must be carried out to extract the metal?



Most ores contain metals chemically combined with oxygen. What process must be carried out to extract the metal?

Reduction



Which two methods could be used to extract metals from their ores?



How can metals be extracted from their ores?

Reduction with carbon: Can only be done if the metal is less reactive than carbon (links to reactivity series).

Electrolysis: Can be done with all metals, but requires a large amount of energy (high cost).



How would you extract iron from its ore?



How would you extract iron from its ore?

Iron is less reactive than carbon so can be extracted by reduction with carbon.

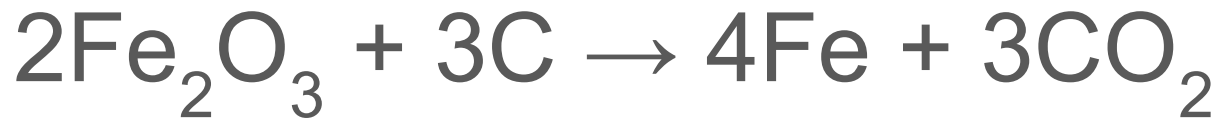
Electrolysis could also be used, but this would use a lot of unnecessary energy (high cost).



What is the chemical equation for the reduction of iron with carbon?



What is the chemical equation for the reduction of iron with carbon?



How can aluminium be extracted from its ore?



How can aluminium be extracted from its ore?

Aluminium is more reactive than carbon so electrolysis must be used.

When the molten ore undergoes electrolysis, the metal forms at the cathode.



When aluminium is extracted from aluminium oxide, why is it first dissolved in molten cryolite?



When aluminium is extracted from aluminium oxide, why is it first dissolved in molten cryolite?

Aluminium oxide has a very high melting point. It is dissolved in molten cryolite to produce an electrolyte with a lower melting point, reducing energy usage and cost.



How can plants be used as an
alternative metal extraction method?
How does it work?
(higher only)



How can plants be used as an alternative metal extraction method? How does it work?

(higher only)

Phytoextraction:

Plants are grown in areas with metals in the soil. The plants take up metals through their roots and concentrate them in their shoots and leaves. These plants are burned and the metals are removed from the ash.



How can bacteria be used as an
alternative metal extraction method?
How does it work?
(higher only)



How can bacteria be used as an alternative metal extraction method? How does it work?

(higher only)

Bacterial extraction:

Some bacteria absorb metal compounds. These bacteria produce solutions called leachates containing the metals. Scrap iron can be used to remove the metal from the leachate.



What are the limitations of biological
methods of extraction?
(higher only)



What are the limitations of biological methods of extraction?

(higher only)

- Only suitable for low grade ores with smaller quantities of metals.
- Slow processes.
- Require displacement or electrolysis for the final step.



How is a metal's relative resistance to oxidation related to its position in the reactivity series?



How is a metal's relative resistance to oxidation related to its position in the reactivity series?

Oxidation is the loss of electrons. Metals lower in the reactivity series are less reactive. This means they are less likely to form their cations so are more resistant to oxidation.



What are the advantages of recycling metals?



What are the advantages of recycling metals?

- Economically beneficial because electrolysis is expensive.
- Prevents the detrimental environmental impact of mining and extraction of new metals.
- Less waste produced so less landfill.
- Less energy required compared to electrolysis.
- More sustainable - not using up the finite resources.
- Recycling process provides employment.



What is a life cycle assessment?



What is a life cycle assessment?

Analysis of the overall environmental impact that a product may have throughout its lifetime.



What different factors does a life cycle assessment of a product consider?



What different factors does a life cycle assessment of a product consider?

- Extraction and processing of raw materials.
- Manufacturing.
- Packaging and transportation.
- Use of the product.
- Disposal.



What is a reversible reaction?



What is a reversible reaction?

A reaction in which the products can react to form 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.



What is meant by the term dynamic equilibrium?



What is meant by the term dynamic equilibrium?

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 are constant even though compounds are continually reacting.



What is a closed system?



What is a closed system?

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?



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

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



What is the Haber process?



What is the Haber process?

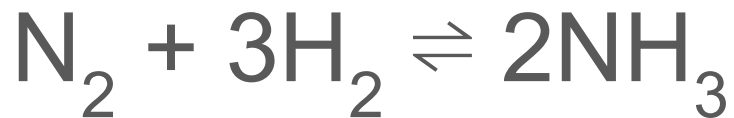
An industrial process used to produce ammonia (for making fertilisers).



Write the chemical equation for the reversible reaction between nitrogen and hydrogen, forming ammonia



Write the chemical equation for the reversible reaction between nitrogen and hydrogen, forming ammonia



Where are the sources of nitrogen and hydrogen for the Haber process?



Where are the sources of nitrogen and hydrogen for the Haber process?

Nitrogen: Extracted from the air.

Hydrogen: Obtained from natural gas.



True or false?

‘The process used to form ammonia is a reversible reaction that will never reach dynamic equilibrium’



True or false? 'The process used to form ammonia is a reversible reaction that will never reach dynamic equilibrium'

FALSE

The formation of ammonia is a reversible reaction that will reach dynamic equilibrium in a closed system.



What conditions are used for the Haber process?



What conditions are used for the Haber process?

- 450°C temperature
- 200 atm pressure
- Iron catalyst



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



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

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



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

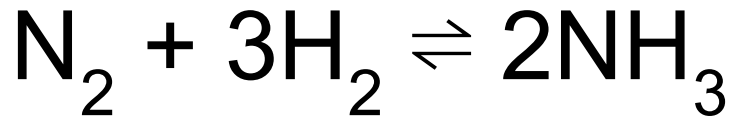


Explain the effect of increasing the pressure of a reversible gaseous reaction
(higher only)

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

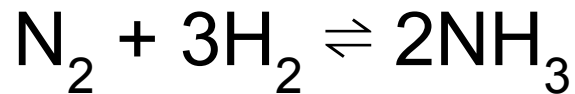


Explain the effect of decreasing the pressure on the yield of ammonia

(higher only)



The equation for the Haber process is



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

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



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



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

The equilibrium will shift to the right so the product yield will increase. This will reduce the effect of the increased concentration of the 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? **(higher 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? (higher only)

No effect

