

# WJEC (Eduqas) Chemistry GCSE

## 11 - Production, Use and Disposal of Important Chemicals and Materials Flashcards

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# What is the Haber process?



# What is the Haber process?

An industrial process which produces ammonia from the reaction between nitrogen and hydrogen. The reaction conditions are  $450^{\circ}\text{C}$ , 200 atm and an iron catalyst.



# Why is the Haber process important in agriculture?



# Why is the Haber process important in agriculture?

It is used to manufacture ammonia, which is used to produce nitrogen-based fertilisers.



State the chemical equation which is involved in the Haber process.



State the chemical equation which is involved in the Haber process.

nitrogen + hydrogen  $\rightleftharpoons$  ammonia



Suggest the catalyst, temperature and pressure used in the Haber process.





# Suggest the catalyst, temperature and pressure used in the Haber process.

- The catalyst used is iron
- The temperature is set to about 450 °C
- The pressure is set to about 200 atmospheres



Why are nitrogen, phosphorus and potassium important in agriculture?



# Why are nitrogen, phosphorus and potassium are important in agriculture?

They are used as fertilisers



How does the production of fertilisers in a laboratory differ to their industrial production?



# How does the production of fertilisers in a laboratory differ to their industrial production?

In a laboratory:

- Reactants: ammonia solution and dilute sulfuric acid (bought from chemical manufacturers)
- Small scale (very little is produced)
- Only involves a few stages (titration then crystallisation)



Suggest 2 potential disadvantages of overusing NPK fertilisers.



## Suggest 2 potential disadvantages of overusing NPK fertilisers.

- When they're washed off the land by rainwater into rivers and lakes there is an increase of nitrate and phosphate in the water, encouraging algae growth.
- Algae growth forms a bloom over the water surface, preventing sunlight from reaching other water plants, which then die.
- Bacteria break down the dead plants and use up the oxygen in the water so the body of water may be left completely lifeless.



Describe a test to identify ammonia gas and ammonium salt.





# Describe a test to identify ammonia in gas and salt form.

- Ammonia in gas form turns damp red litmus paper blue.
- To test for ammonium ions in ammonium salts, add sodium hydroxide and then test the gas given off with red litmus paper. Ammonia forms a white smoke of ammonium chloride when hydrogen chloride gas, from concentrated hydrochloric acid, is held near it.



What are the two conditions that ensure a good reaction rate?



# What are the two conditions that ensure a good reaction rate?

- High temperature
- High pressure



What are the factors worth considering before deciding where to create chemical plants?



# What are the factors worth considering before deciding where to create chemical plants?

- Chemical plants create jobs, supporting the local economy.
- They create noise and dust pollution, especially whilst being created, so they shouldn't be close to too many houses.
- Wildlife habitats will be destroyed.



# What is percentage yield?



# What is percentage yield?

The percentage ratio of the actual yield of product from a reaction compared to the theoretical yield.



Suggest an equation to calculate percentage yield.





Suggest an equation to calculate percentage yield.

Percentage yield = actual yield  $\div$  theoretical yield  $\times$  100



# What is a theoretical yield?



# What is a theoretical yield?

The maximum possible mass of product that can be obtained from a reaction.



Define atom economy.



# Define atom economy.

The measure of the amount of starting materials that end up as useful products.



Suggest an equation to calculate percentage of atom economy.



Suggest an equation to calculate percentage of atom economy.

Percentage atom economy =

Molecular mass of desired product  $\div$  sum of molecular masses of all reactants  $\times 100$



List down 3 factors often used to select the best reaction pathways.





List down 3 factors often used to select the best reaction pathways.

- Atom economy
- Percentage yield
- Rate of reaction
- Equilibrium position
- Usefulness of byproducts



# What is the meaning of by-products?



# What is the meaning of by-products?

- A secondary product made in the reaction of something else.
- The usefulness of a by-product influences whether a particular reaction pathway is chosen.



Explain the meaning of corrosion.



# Explain the meaning of corrosion.

The destruction of materials by chemical reactions with substances in the environment, e.g. rusting (when iron reacts with oxygen in moist air).



What are the two elements needed for corrosion to take place?



# What are the two elements needed for corrosion to take place?

- Water
- Air



Suggest practical measures that can be taken to prevent corrosion.





# Suggest practical measures that can be taken to prevent corrosion.

- Apply a coating that acts as a barrier, such as greasing, painting or electroplating
- Aluminium has an oxide coating that protects the metal from further corrosion
- Some coatings are reactive and contain a more reactive metal to provide sacrificial protection



Explain what is meant by sacrificial protection.



# Explain what is meant by sacrificial protection.

- The protection of iron or steel against corrosion by using a more reactive metal.
- Zinc is often used as a sacrificial metal.
- Sacrificial protection creates a physical barrier to oxygen and water, preventing corrosion of the metal.



# What is an alloy?



# What is an alloy?

- A metal compound made by combining two or more metals together.
- This process is carried out to give the material greater strength or resistance to corrosion.



# Why are alloys considered stronger than pure metals?



# Why are alloys considered stronger than pure metals?

- In a pure metal, all the metal ions are of the same size in a regular arrangement, allowing the layers to slide over each other easily, making the metal soft and malleable.
- In an alloy, you have ions of different metals, which have different sizes. This disrupts the regular structure and prevents the ions from being able to slide as easily, leaving a much harder, stronger metal.



What are the two metals used to create stainless steel?





# What are the two metals used to create stainless steel?

- Chromium and nickel



Give an example of an alloy, and relate its properties to its use.



Give an example of an alloy, and relate its properties to its use.

- Low-carbon steels are easily shaped - used for sheeting (malleable)
- High carbon steels are hard - used for cutting tools
- Stainless steels are resistant to corrosion - used for cutlery



# What are the properties of glass ceramics?



# What are the properties of glass ceramics?

- Transparent
- Hard
- Brittle
- Poor heat and electrical conductors



# What are the properties of clay ceramics?



# What are the properties of clay ceramics?

- Opaque
- Hard
- Brittle
- Poor heat and electrical conductors



# What are the properties of polymers?





# What are the properties of polymers?

- Can be made transparent/translucent/opaque
- Poor heat and electrical conductors
- Can be tough or ductile



# What are the properties of metals?



# What are the properties of metals?

- Shiny
- Good heat and electrical conductors
- Hard
- Tough



List two uses of glass ceramics



# List two uses of glass ceramics

- Windows
- Bottles



List two uses of clay ceramics



# List two uses of clay ceramics

- Bricks
- Porcelain



List two uses of polymers





# List two uses of polymers

- Plastic bags
- Bottles



List two uses of metals



# List two uses of metals

- Cars
- Bridges
- Electric cables



# What is a life-cycle assessment?



# What is a life-cycle assessment?

- The analysis of the impact a product has on the environment.
- It considers the raw materials, manufacturing, packaging, transportation, product use and disposal.



# How can we reduce our consumption of resources?



# How can we reduce our consumption of resources?

- By reducing use of materials
- Reuse or recycle materials by end users
- Products such as papers or metals can be recycled
- Other products such as glass bottles can be reused

