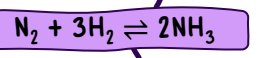


# The Haber process

## 10.4 THE HABER PROCESS AND THE USE OF NPK FERTILISERS (Chemistry only)



Makes ammonia,  $NH_3$

Nitrogen and ammonia reactants

Nitrogen from the air

Ammonia used to make nitric acid

Ammonia is used to produce nitrogen salts

Contain salts of nitrogen, phosphorus and potassium

Unused hydrogen and ammonia is reused - no waste

Low temperature favours forwards reaction ...

...but there still needs to be a temperature high enough to have a fast rate of reaction

Compromise

Conditions: 450°C temperature  
200 atm pressure

Increasing pressure increases the percentage yield...

...but high pressures are expensive and dangerous

Iron catalyst

### NPK fertilisers

Provide plants with important elements for growth

Help the crop grow bigger and faster

To produce soluble phosphates, react with...

Sulfuric acid - produces calcium phosphate and calcium sulfate

Nitric acid - produces phosphoric acid and calcium nitrate

Phosphoric acid - produces calcium phosphate

Some ammonia breaks down into the reactants

Reversible

Liquid run out the bottom

Ammonia forms as a gas which cools in the condenser to form a liquid

Hydrogen from reacting methane with steam

React ammonia with nitric acid to produce ammonium nitrate

Compare the lab reaction with the industrial reaction

Potassium chloride and potassium sulfate can be mined

**AQA**