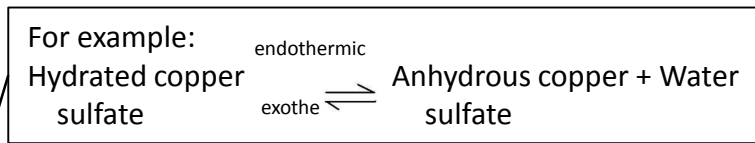


The relative amounts of reactants and products at equilibrium depend on the conditions of the reaction.

If one direction of a reversible reaction is exothermic, the opposite direction is endothermic. The same amount of energy is transferred in each case.



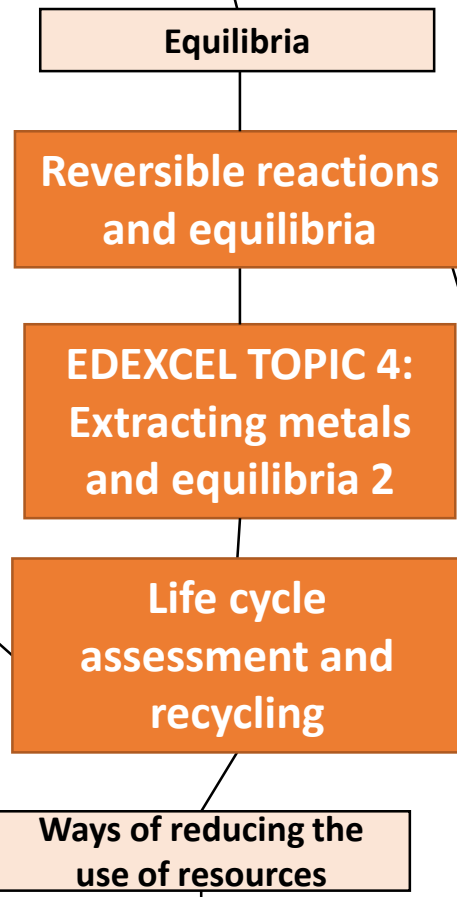
**Energy changes and reversible reactions**

**Equilibrium in reversible reactions**  
 When a reversible reaction occurs in apparatus which prevents the escape of reactants and products, equilibrium is reached when the forward and reverse reactions occur exactly at the same rate.

<b>Le Chatelier's Principles</b>	States that when a system experiences a disturbance (change in condition), it will respond to restore a new equilibrium state.
<b>Changing concentration</b>	If the concentration of a reactant is increased, more products will be formed . If the concentration of a product is decreased, more reactants will react.
<b>Changing temperature</b>	If the temperature of a system at equilibrium is increased: - Exothermic reaction = products decrease - Endothermic reaction = products increase
<b>Changing pressure (gaseous reactions)</b>	For a gaseous system at equilibrium: - Pressure increase = equilibrium position shifts to side of equation with smaller number of molecules. - Pressure decrease = equilibrium position shifts to side of equation with larger number of molecules.

Reversible reactions

Changing conditions and equilibrium (HT)



Life cycle assessment

**The Haber process**

<b>The Haber process</b>	This process uses nitrogen from the air and hydrogen from natural gas to form ammonia. The reaction is reversible and uses optimum conditions and a catalyst in order to reach dynamic equilibrium.
<b>Optimum temperature</b>	The optimum temperature for the Haber process is 450°C.
<b>Optimum pressure</b>	The optimum pressure for the Haber process is 200 atmospheres.
<b>The use of a catalyst</b>	The Haber process uses an iron catalyst. This does not alter the position of the equilibrium but it does increase the rate of the reaction.

<b>Reversible reactions</b>	In some chemical reactions, the products can react again to re-form the reactants.
<b>Representing reversible reactions</b>	$A + B \rightleftharpoons C + D$
<b>The direction</b>	The direction of reversible reactions can be changed by changing conditions: $A + B \xrightleftharpoons[\text{cool}]{\text{heat}} C + D$

<b>LCAS</b>	<b>Life cycle assessments are carried out to assess the environmental impact of products</b>	They are assessed at these stages: - Extraction and processing raw materials - Manufacturing and packaging - Use and operation during lifetime - Disposal
<b>Values</b>	<b>Allocating numerical values to pollutant effects is difficult</b>	Value judgments are allocated to the effects of pollutants so LCA is not a purely objective process.

<b>Reduce, reuse and recycle</b>	<b>This strategy reduces the use of limited resources</b>	This, therefore, reduces energy sources being used, reduces waste (landfill) and reduces environmental impacts.
<b>Limited raw materials</b>	<b>Used for metals, glass, building materials, plastics and clay ceramics</b>	Most of the energy required for these processes comes from limited resources. Obtaining raw materials from the Earth by quarrying and mining causes environmental impacts.
<b>Reusing and recycling</b>	<b>Metals can be recycled by melting and recasting/reforming</b>	Glass bottles can be reused. They are crushed and melted to make different glass products. Products that cannot be reused are recycled.