

Chapter 6 Equilibria - GCSE Assumed Knowledge

Learning Objectives	Keypoints
Describe how some reactions are reversible	<p>In some reactions, the products can be changed back into the reactants. These reactions are called reversible reactions. The symbol \rightleftharpoons is used instead of an arrow (\rightarrow) when writing chemical equations for reversible reactions.</p> <p>In a reversible reaction, one of the reactions will be exothermic and the other will be endothermic.</p>
Describe some examples of reversible reactions	<p>Two examples of reversible reactions are:</p> <p>hydrated copper sulfate \rightleftharpoons anhydrous copper sulfate + water</p> $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$
Describe the conditions under which dynamic equilibrium occurs	<p>A closed system is one where no chemicals can leave or enter, for example, a stoppered flask.</p> <p>A reversible reaction will reach equilibrium in a closed system. Equilibrium means that the rate of the forward and backwards reactions are equal. This means that the concentrations of the reactants and products will remain constant (but they will not be the same as each other). This is called a dynamic equilibrium because both the forward and backward reactions are still happening.</p>
Predict the effect of changing reaction conditions on equilibrium position	<p>The equilibrium position is a way of representing the proportion of products and reactants in an equilibrium.</p> <p>If the equilibrium position is on the left, then we have more reactants than products. If the equilibrium position is on the right, then we have less reactants than products.</p> <p>Using a catalyst does not affect the equilibrium position.</p> <p>We can change the equilibrium position by changing the conditions of a reaction. Le Chatelier's principle states that 'when a change is made to a reaction at equilibrium, the position of equilibrium moves to oppose the change'. This means that:</p> <p>Increasing the temperature favours the endothermic reaction and decreasing the temperature favours the exothermic reaction.</p> <p>Increasing the concentration of the reactants, or reducing the concentration of the products, will favour the products side of the equation.</p> <p>Increasing the concentration of the products, or reducing the concentration of the reactants, will favour the reactants side of the equation.</p> <p>For a reaction involving a gas, increasing the pressure will favour the side with the fewest moles of gas.</p>
Explain appropriate conditions to produce a particular product using a reversible reaction	<p>The equilibrium yield is how much of a product is made at equilibrium. In industrial chemistry, conditions will be chosen to give as high an equilibrium yield as possible. However, sometimes, compromise conditions are used.</p> <p>For example, if a high pressure is needed to give a high equilibrium yield then a compromise pressure will be used as high pressure is expensive, needs specialist equipment and uses a lot of energy.</p> <p>If a low temperature is needed to give a high equilibrium yield, then a compromise temperature will be used as a low temperature will give a low rate of reaction.</p>