

Reversible reactions

- ⇌ When ammonium chloride is heated it decomposes to form ammonia and hydrogen chloride

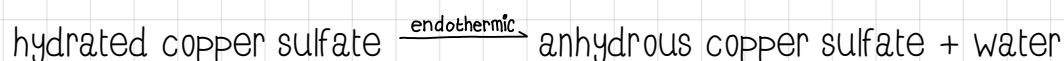


- ⇌ If the products are cooled down, they will react together and form ammonium chloride.

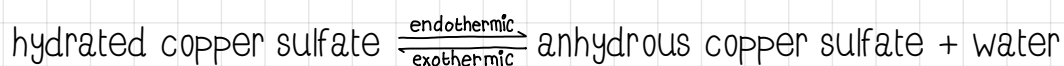


- ⇌ The double arrow symbol (\rightleftharpoons) in a reaction denotes that the reaction is reversible. The direction of the reaction can be altered by changing the conditions.

Energy changes and reversible reactions



- ⇌ When hydrated copper sulfate is heated it decomposes to form anhydrous copper sulfate and water. The reaction is endothermic.



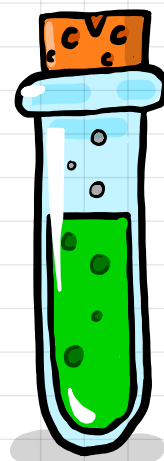
- ⇌ If the water is added back to anhydrous copper sulfate a lot of energy is released and the reaction mixture gets hot. The reverse reaction is exothermic.

- ⇌ A reaction that is exothermic in one direction will be endothermic in the reverse direction. The same amount of energy will be transferred each time.

Equilibrium

- ⇌ If the reaction is carried out in a sealed container, the reactants and the products could not escape. The left and right reactions would occur at the same rate.

- ⇌ This is called equilibrium. No change in the amount of reactants or products would be apparent.



Reversible reactions...

Le Chatelier's principle

⇌ If a system is at equilibrium and a change is made to the conditions (e.g. temperature), the system will counteract the change.

Concentration

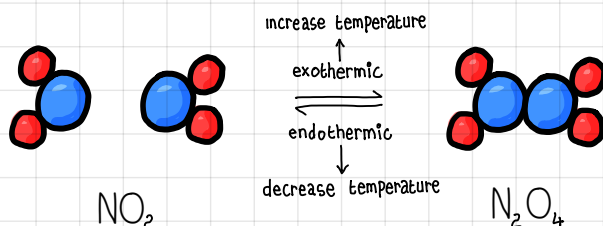


⇌ If the concentration of NO_2 is increased, the system will counteract any changes made to keep the system in equilibrium. More N_2O_4 will be formed until equilibrium will be reached.

⇌ If the concentration of N_2O_4 is decreased, then more NO_2 will react and produce more N_2O_4 until equilibrium will be reached.

⇌ If the concentration of N_2O_4 is increased, then more NO_2 will be formed until equilibrium will be reached.

Temperature



⇌ To counteract an increase in the temperature, the equilibrium will shift to the left to lower the temperature (the endothermic reaction). This means that NO_2 will increase and N_2O_4 would decrease.

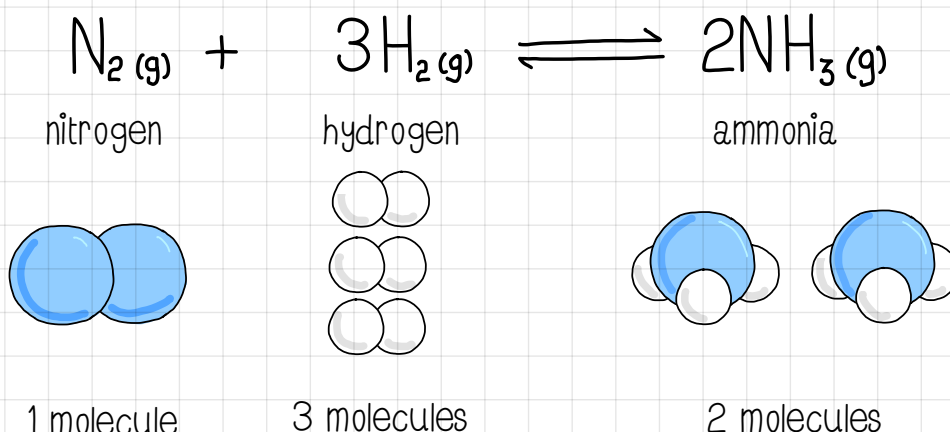
⇌ To counteract a decrease in the temperature, the equilibrium will shift to the right to increase the temperature (the exothermic reaction). This means that NO_2 will decrease and N_2O_4 would increase.

Reversible reactions...

Pressure

⇒ Changing the pressure has an effect in equilibrium reactions involving gases.

⇒ The reaction below shows the production of ammonia from nitrogen and hydrogen.

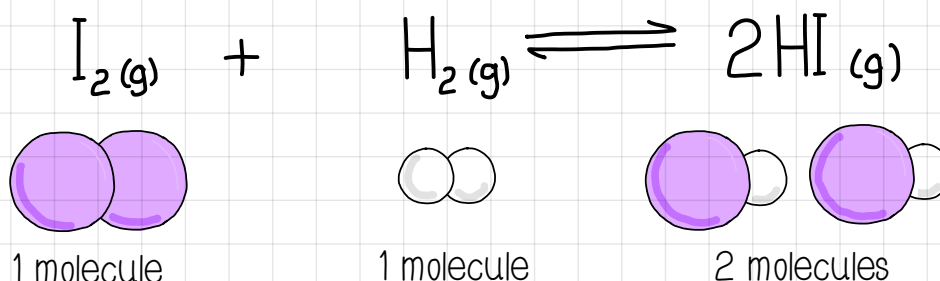


⇒ On the left hand side of the equation there are a total of 4 molecules.
On the right hand side of the equation there are a total of 2 molecules.

⇒ An **increase** in pressure causes the equilibrium position to **shift** to the side with the **smaller number** of molecules (e.g. ammonia).

⇒ A **decrease** in pressure causes the equilibrium to **shift** towards the side with the **larger number** of molecules (e.g. nitrogen and hydrogen)

⇒ Iodine reacts with hydrogen to form hydrogen iodide



⇒ The left hand side of the equation has 2 molecules and the right hand side of the equation also has 2 molecules. Because the number of molecules is **equal** on both sides, changing pressure has **no effect** on the position of equilibrium.