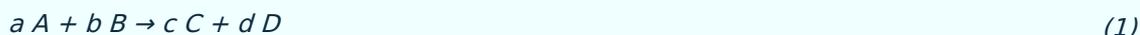


Chemical Reactions (FBLT)

Chemical reactions are events in which one group of compounds, reactants¹, are transformed into other compounds, **products**. We describe reactions with chemical equations.

E.g. in the equation



means

A, B reactants,

C, D products,

a, b, c, d **stoichiometric coefficients** which express the ratio of the number of particles of the compounds participating in the reaction.

The term "equation" implies the existence of equality between the two sides: in every chemical reaction, **mass, energy, and electric charge must be conserved**.

Let us now look at the reactions between copper and ferric ions in solution:



Like most reactions in chemistry (and almost all in biochemistry), this reaction is **reversible**. It means it can go both ways. The process stops after a certain amount of iron is reduced and a certain amount of copper is oxidized. We say that at this point the reaction has reached **an equilibrium state**, i.e. that **the concentration of reactants and products** in the reaction system **does not change** any further.

The established equilibrium can be mathematically described using the equilibrium constant, K_{eq} , which is defined as the quotient of the product of the equilibrium concentrations of products and reactants (squared by their stoichiometric coefficients):

$$K = \frac{[C]^c \cdot [D]^d}{[A]^a \cdot [B]^b} \quad (3)$$

In the case of reaction (2), we therefore get

$$K = \frac{[\text{Cu}^{2+}] \cdot [\text{Fe}^{2+}]}{[\text{Cu}^+] \cdot [\text{Fe}^{3+}]} \quad (4)$$

Assume that **the equilibrium constant** for reaction (1) is **equal to 1**, i.e. that in the equilibrium state **the product of the concentrations of products and reactants is the same**. If we now add more compound A to the system, we will break the established equilibrium, and the reaction will therefore start in a direction that will try to restore the original state again. In our case, substance A will react with substance B to form substances C and D as long as the products of concentrations ($[A] \cdot [B]$ and $[C] \cdot [D]$) are not equal again and a new equilibrium state is reached. This rule is called **Le Chatelier's principle**.

A system in equilibrium reacts to a change in conditions (pressure, temperature, concentration) in such a way as to suppress this change.