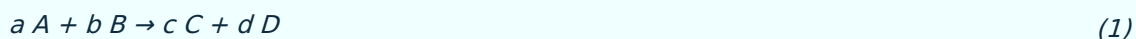


Chemical Reactions (FBLT)

Chemical reactions are events in which one group of compounds, reactants', 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, **stoichiometric coefficients** which express the ratio of the number of particles of
d 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.