Chemistry 2, HW 20, 2025

Acids can provide H^+ (proton) for reactions with other compounds.

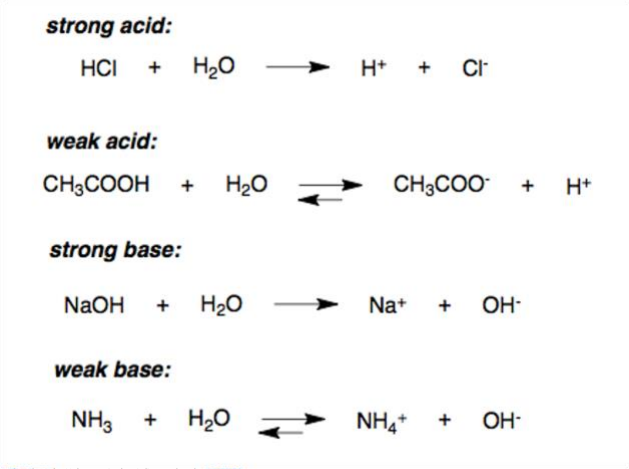
An acid is composed from atoms of hydrogen and a conjugate base. The conjugate base reacts as an independent particle. ($SO4^{2-}$, Cl^- , NO^{3-} are conjugate bases of sulfuric (H2SO4), hydrochloric (HCl), and nitric acids (HNO3) respectively, notice these are, except Cl^-, polyatomic ions).

Bases can provide OH^- for reactions with other compounds (more general definition, bases accept proton in reactions).

Salts are compound where we have different combinations of metals and conjugate bases (NaCl, $MgSO_4$, HCOONa).

A strong acid and a strong base ionize completely in water solution.

A weak acid or weak base ionize partially in aqueous solution.



A buffer is a solution that resists changes in pH when small amount of acid or base are added. Buffer usually consists of a weak acid (HA) and its conjugate base (A^-) or a weak base (B) and its conjugate acid (BH^+).
Example: acetic buffer solution, mixture of acetic acid CH3COOH and its salt CH3COONa. When we write the chemical reaction, we do not write Na in the salt, we represent salt as negative ion of the salt (conjugate base) – **$CH3COO^-$**, remember, when a salt dissolves in water, it breaks up completely into ions. The major species in the solution are CH3COOH, Na^+, $CH3COO^-$, H2O.
CH3COOH → $CH3COO^-$ + H^+
←

If acid (H^+) is added, the acetate ion ($CH3COO^-$) binds it to form CH3COOH, equilibrium is shifted to the left. If base (OH^-) is added, equilibrium is shifted to the right, acetic acid donates protons to neutralize OH^-.

The human blood buffer system maintains a stable pH (~7.4). The main buffering system in blood is the bicarbonate (HCO_3^-) and carbonic acid (H2CO3) system:

H2CO3 → HCO3$^-$ + H$^+$

If blood becomes too acidic (low pH, high H^+ concentration), $HCO3^-$ reacts with excess of protons, forming carbonic acid, the acid breaks down into carbon dioxide and water, CO2 is exhaled through the lungs.

Questions:

1. Identify the following substances as strong acid, weak acid, strong base, weak base or salt: HCOOH, HCl, H_2SO_4, NH_4NO_3, KOH, NH_3, HNO_3, Na_2SO_4, H_2CO_3, $Mg(OH)_2$, KNO_3, CH_3NH_2.
2. What will happen if blood becomes to basic (high pH, high OH^-).