

Acids, Bases, and Equilibrium Constants

Define –
hydronium ion:

classical acid-base definition:

neutralization:

acid-dissociation constant:

strong acid:

weak acid:

strong base:

weak base:

Examples:

Classify each of the following compounds as a strong acid, weak acid, strong base, or weak base:

a. H_2SeO_4 b. $(\text{CH}_3)_2\text{CHCOOH}$ c. KOH d. $(\text{CH}_3)_2\text{CHNH}_2$

Of the following pairs, which member is the stronger acid or base?

a. HClO or HClO_3 b. HCl or CH_3COOH c. NaOH or CH_3NH_2

The pH Scale

Define –
autoionization:

ion-product constant for water:

pH:

acid-base indicators:

Examples:

A research chemist adds a measured amount of HCl gas to pure water at 25 C and obtains a solution with $[\text{H}_3\text{O}^+] = 3.0 \times 10^{-4} \text{ M}$. Calculate $[\text{OH}^-]$. Is the solution neutral, acidic, or basic? (K_w at 25 C is 1.0×10^{-14})

Calculate $[\text{H}_3\text{O}^+]$ in a solution that is at 25 C and has $[\text{OH}^-] = 6.7 \times 10^{-2}$. Is the solution neutral, acidic, or basic?

In an art restoration project, a conservator prepares copper-plate etching solutions by diluting concentrated HNO_3 to 2.0 M, 0.30 M, and 0.0063 M HNO_3 . Calculate $[\text{H}_3\text{O}^+]$, pH, $[\text{OH}^-]$, and pOH of the three solutions at 25 C.

A solution of NaOH has a pH of 9.52. What is $[\text{H}_3\text{O}^+]$, $[\text{OH}^-]$, and pOH at 25 C?

Another Way to Look at Acids & Bases

Define –

Bronsted-Lowry acid-base definition:

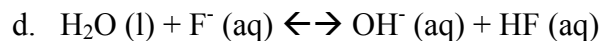
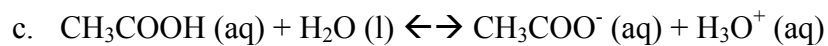
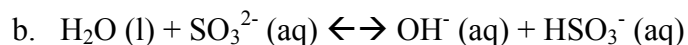
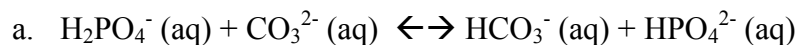
proton donor:

proton acceptor:

conjugate acid-base pair:

Examples:

Identify the conjugate acid-base pairs in the following reactions:



Weak Acid-Base Equilibria

Phenylacetic acid ($\text{C}_6\text{H}_5\text{CH}_2\text{COOH}$, simplified HPac) builds up in the blood of persons with phenylketonuria, an inherited disorder that, if untreated, causes mental retardation and death. A study of the acid shows that the pH of 0.12 M HPac is 2.62. What is the K_a of phenylacetic acid?

The conjugate acid of ammonia is NH_4^+ , a weak acid. If a 0.2 M NH_4Cl solution has a pH of 5.0, what is the K_a of NH_4^+ ?

Propanoic acid ($\text{CH}_3\text{CH}_2\text{COOH}$, simplified HPr) is a carboxylic acid whose salts are used to retard mold growth in foods. What is the $[\text{H}_3\text{O}^+]$ of 0.10 M HPr ($K_a = 1.3 \times 10^{-5}$)?

Cyanic acid (HOCN) is an extremely acid, unstable substance. What is the $[\text{H}_3\text{O}^+]$ and pH of 0.10 M HOCN ($K_a = 3.5 \times 10^{-4}$)?