

Acids and Bases

Overview of Acids and Bases

Acid-base Acids and Bases

Acids: Donates its proton in these process (H⁺)
 Base: Donates its electron in these (OH⁻)



Remember: It only is water, if only H⁺ and OH⁻

What does organic molecules and inorganic substance?

Organic Acids and Bases

Acids are proton donors (the molecule is losing its proton)
 Bases are proton acceptors (the molecule is OH being the base)



General Acids and Bases of Acid-Base reactions

It shows the proton flow, the base gets protonic charge of the base and attacks for more proton hydrogens of the acid.
 It shows the bond of the hydrogen and where the electrons in the other atom.

Remember: **acid always don't accept of electrons**

Both Alkalinity and General Definitions are from Proton Properties. What if there is no proton transfer?

Levy's Acids and Bases

Acids work as electron pair acceptors.
 Bases work as electron pair donors.



As in the Levy's acids, acids and bases are described in terms of electron.

One of the best acid-base theories is now widely.

As a general practice, consider acids as 1 and bases as 2.

Acid Strength

What does it mean "strong acid"?

Generally speaking, the more the acid dissociates into a proton, the stronger it is.



The dissociation of the acid is a reversible reaction that is described by equilibrium constant.



Acid Strength and pKa

The Ka value of weak acid (1) and weak base (2) are shown below.



It is related to a stronger acid because in the 1 higher.
 To simplify the equation, pKa is used, which is the pKa of the given acid.

$\text{pKa} = -\log K_a$

$\text{pKa}_1 + \log K_{a2} = \text{pKa}_2 + \log K_{a1} = \text{pH}$

So, **the stronger the acid, the lower the pKa value**. It is the opposite for the base.

Below are pKa values of some common functional groups.



What makes the Acid Strong?

The strength of the acid is defined by the stability of the conjugate base for the given acid.

The stronger the acid, the more stable its conjugate base.



Stable if more resonance and electronegative atoms provide their charge and there are no factors that is considered when assessing the stability of the conjugate base.

- 1) The first and the best factor is the **charge** to which the hydrogen is connected. Usually to **oxygen** (for Phenols/alcohols) and **fluorine** (for Hydrofluoric acid).
- 2) When the same atom, oxygen (for acid) always work as electronegative in the base.



When comparing elements in different rows, the more electronegative, the more stable the conjugate base. Larger atoms have higher polarizability and results for negative charge better in the charge is spread over.



There are more stable when charge spread in more electronegative than with. The smaller atom is larger and stabilizes the negative charge better.

2) When comparing for same atom, think which conjugate base is **more electronegative**.



1) The best factor for determining the acidity is called **inductive**. Inductive or inductive effect is the transmission of charge through atoms. Electronegative atoms pull the negative charge and help to stabilize the conjugate base.



The more electronegative, the more electron withdrawing, the stronger the acid.



The closer the electronegative atom to the hydrogen, the stronger the acid.

Resonance Acids

1) The best factor is the **number** of pi bonds connected to the hydrogen. The explains the great difference of pKa values of alcohols, aldehydes, and ketones.



2) which is more electronegative than O, or the more electronegative, the stronger the acid. Therefore, for **nitro**, **nitro** > **nitro** > **nitro**.

The primary acids, Alcohols, Aldehydes, Ketones, defined the increasing the acidity of a compound is known as **alpha**.

Remember: the electron for conjugate base.



The Position of Equilibrium for an Acid-Base Reaction

is the following reaction, consider possible:



Acid-base reactions are reversible, so another way of asking the question is: is the equilibrium of the reaction shifted to the right (products) or to the left (reactants)? To answer this question, you need to remember that the equilibrium of acids and bases reactions is shifted towards the weaker acid and base.

So, you need to compare the pKa of the acid with acid and to compare with conjugate acid. The equilibrium will be shifted to the higher pKa (weaker acid) side.



is the acid the pKa of the conjugate acid is greater higher than acid pKa, or the equilibrium is shifted to the right. Therefore, the right pointing arrow is shown larger.

Choosing a Base to Deprotonate a Given Compound

Suppose you need to deprotonate the following compound. → OH
 Deprotonate means remove the proton acidic proton.

First, find its pKa value. → OH pKa = 17

Find the chemical equation of the conjugate reacting with a conjugate base (B⁻).



The pKa of the conjugate acid must be higher than 17, so reaction will not proceed.

Find a conjugate base with pKa value with pKa > 17. Answer are react other pKa > 17.



Choosing an Acid to Protonate a Given Compound

Suppose you need to protonate a given compound about 17 (OH⁻), that means it needs a very reactive base and needs to be quenched before being stopped.

To do this, write the chemical equation of what is with a weak acid.



The pKa of the acid (the conjugate acid of what is) is 10. Therefore, the pKa of OH⁻ and water is smaller than 10, so reaction will proceed, means acid reacts. Therefore, a strong acid in a given state could be protonating for what is because its pKa is 10 and it is a better strength of an acid than water.



Handerson-Hasselbalch Equation

The equation shows whether the compound with a given pKa is in its acidic or basic (deprotonated) form in an aqueous solution depending on the pH of that solution.

$\text{pKa} = \text{pH} + \log \frac{[\text{A}^-]}{[\text{HA}]}$

Two graphs and implications of the Handerson-Hasselbalch equation.

1) If the pH < pKa, 2) If the pH = pKa, 3) If the pH > pKa.



The pKa of benzoic acid is 4.2. Therefore, it is mostly in its acidic form because normally in aqueous pKa < 7, which is the environment of the cell pH 7. So, the drug will be in its active form. There.

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