

NET IONIC EQUATIONS AND BRØNSTED-LOWRY THEORY

So far we've looked at determining conjugate acids and bases when we already have the net ionic equation. In other words, we already know which ions are going to be part of our system.

What if we have the compounds that are going to react?

Before we can write the actual reaction we must identify the reacting species. To do this we must keep the following ideas in mind:

1. All ionic compounds will dissociate completely.
2. Only strong acids will dissociate completely.
3. When strong acids and strong bases are used, use the quantitative arrow, not an equilibrium arrow.
4. Always write water as a reactant
5. Spectator ions (those that cannot act as acids or bases) are removed.

Example: Determine the acid-base neutralization that occurs between solutions of NaHSO_3 and NH_4HCO_3 .

First write down all species involved, and determine whether they can act as B-L acids or B-L bases or both.

NaHSO_3 will break into Na^+ , HSO_3^-

NH_4HCO_3 will break into NH_4^+ , HCO_3^-

Remember H_2O is there as well.

Next write down whether any of these can act as Bronsted-Lowry acids or bases or both.

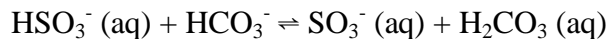
Na^+	HSO_3^-	NH_4^+	HCO_3^-	H_2O
no	BA, BB	BA	BA, BB	BA, BB

Then, use your acid-base table to choose which would be the strongest acid and which would be the strongest base. WATER WILL ONLY BE INVOLVED IF THERE IS NO OTHER ACID OR NO OTHER BASE TO REACT WITH.

In our above reaction:

BA is HSO_3^- BB is HCO_3^- so :

the net ionic reaction is:



STRENGTH OF ACIDS AND BASES

The strength of an acid or base is determined by its percent dissociation/ionization in water.

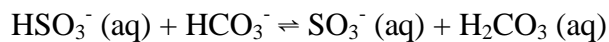
All strong acids and bases dissociate/ionize completely, 100%. Remember your strong acids are written at the top of the table, and your hydroxides are your strongest bases.

All other acids and bases are considered weak. However their strength can be determined in terms of % ionization.

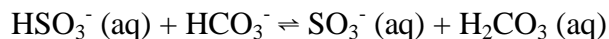
In any Brønsted-Lowry conjugate acid-base pair system, we use acid strength to determine whether reactants or products are favoured.

This is determined by the position of the strongest acid - THE SIDE OPPOSITE THE STRONGER ACID IS ALWAYS FAVOURED.

Example: in the following reaction are reactants or products favoured?



Answer: First classify your species and find the acid and conjugate acid in the equation.



BA BB CB CA

According to the table, $\text{H}_2\text{CO}_3 (\text{aq})$ is a stronger acid than $\text{HSO}_3^- (\text{aq})$, so **reactants** would be favoured.

STRENGTH VERSUS CONCENTRATION

Strength and concentration are two totally different concepts.

Strength refers to the percent dissociation. A strong acid is one that dissociates (ionizes) 100%.

Concentration is the amount of dissolved solute in a given solvent ($C = n/v$) The rule of thumb we learned last year was any acid is concentrated if it is $> 1.0 \text{ mol/L}$

HCl (aq)
strong acid

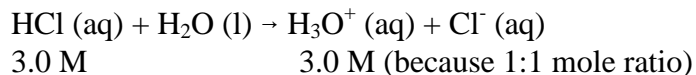
CH₃COOH (aq)
weak acid

1.0 M HCl (aq)
dilute acid

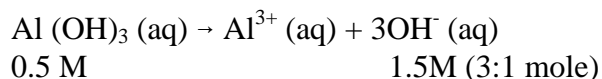
10.0 M CH₃COOH (aq)
concentrated acid

DISSOCIATION /IONIZATION EQUATIONS

When a strong acid or base is involved we can use mole ratios to calculate ion concentrations, similar to what we did in 2202.



NOTE: 100% IONIZATION MEANS REACTION ARROW ONLY GOES ONE WAY.
***WRITE ALL STRONG ACIDS AS H_3O^+ AND THEIR NEGATIVE ION



But for weak acids, we must show the equilibrium reaction and we don't dissociate completely, we use our percent reaction and multiply by the concentration of the weak acid to determine the ion concentrations. Again, though, show your acid reacting with the water to form H_3O^+ and the negative ion (anion)

