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| <ol style="list-style-type: none"> <li>1. Properties of Acids &amp; Bases</li> <li>2. Definitions of Acids and Bases</li> <li>3. Conjugate Acid-Base Pairs</li> <li>4. Amphiprotic Substances</li> </ol> |
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**Properties of Acids and Bases**

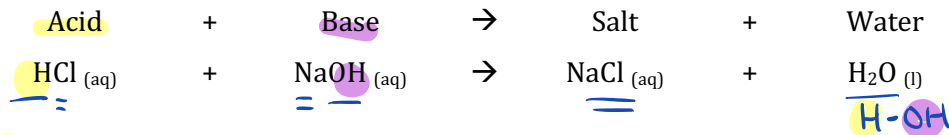
	Acids	Bases
tastes	1. Sour	1. bitter
feels	2. burns	2. slippery
pH	3. < 7	3. > 7, < 14
reacts with	4. metals	4. oils & fats

**Definitions of Acids and Bases**

Arrhenius Theory of Acid and Bases (re: Science 10)

- Arrhenius acids release  $H^+$  ions
- Arrhenius bases release  $OH^-$  ions.

Typically... (neutralization reaction)

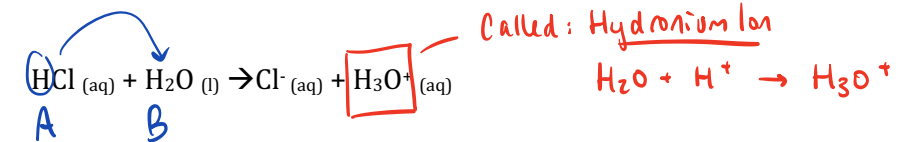


Brønsted-Lowry Acids and Bases (Chem 12)

A broader definition

- Brønsted-Lowry acids donates  $H^+$  ion. ("proton")
- Brønsted-Lowry bases accepts  $H^+$  ion.

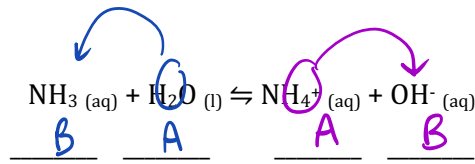
Example 1:



HCl donates a proton,  $H^+$ , to the water molecule - HCl is acting as a B-L acid.

$H_2O$  accepts a proton,  $H^+$ , from HCl - water is acting as a B-L base.

**Example 2:**



(Forward Rxn:)

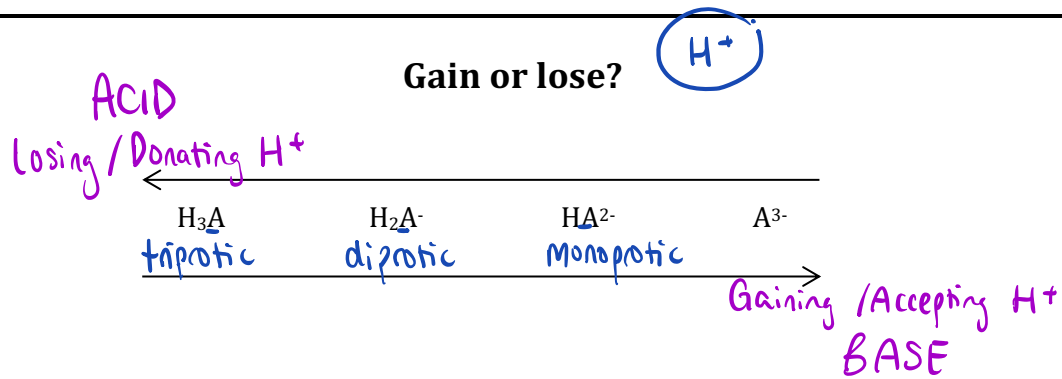
$\text{NH}_3$  accepts a proton,  $\text{H}^+$ .  $\text{NH}_3$  is acting as a B-L base.

$\text{H}_2\text{O}$  donates a proton,  $\text{H}^+$ . water is acting as a B-L acid.

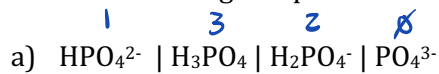
**In the reverse reaction....**

$\text{NH}_4^+$  donates a proton,  $\text{H}^+$  and is acting as a B-L acid.

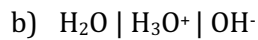
$\text{OH}^-$  accepts a proton,  $\text{H}^+$ . and is acting as a B-L base.



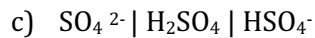
Rewrite the following compounds in order of decreasing number of protons:



Acid  
 $\text{H}_3\text{PO}_4, \text{H}_2\text{PO}_4^-, \text{HPO}_4^{2-}, \text{PO}_4^{3-}$ 
Base



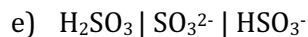
Acid  
 $\text{H}_3\text{O}^+, \text{H}_2\text{O}, \text{OH}^-$ 
Base



Acid  
 $\text{H}_2\text{SO}_4, \text{HSO}_4^-, \text{SO}_4^{2-}$ 
Base

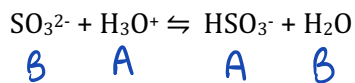
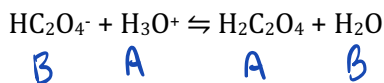
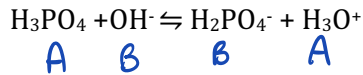
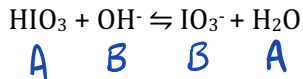
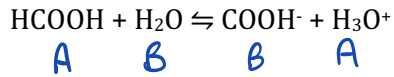
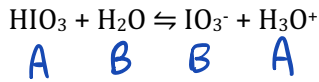
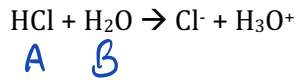
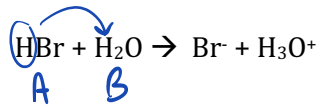
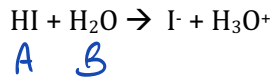
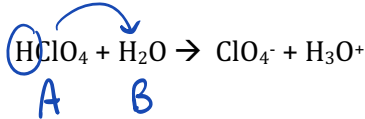


Acid  
 $\text{NH}_4^+, \text{NH}_3, \text{NH}_2^-$ 
Base



Acid  
 $\text{H}_2\text{SO}_3, \text{HSO}_3^-, \text{SO}_3^{2-}$ 
Base

**Practice! Identify the following as an acid or base**

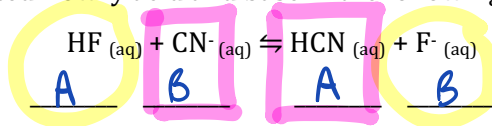


**Hebden Workbook Pg. 117 #11, 12**  
**Brønsted-Lowry Acid-Base Worksheet #1-8**

/ Day 1

**Conjugate Acid-Base Pairs**

**Example 3** – Identify the Brønsted-Lowry acid and base in the following reaction:



Two substances that differ by one  $\text{H}^+$  ion are called a conjugate acid-base pair.

Let's practice!



Complete the following table:

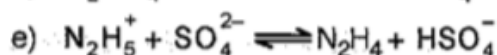
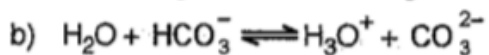
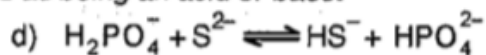
Conjugate Acid (donates a proton)	Conjugate Base (accepts a proton)
$\text{H}_2\text{C}_2\text{O}_4$	$\text{HC}_2\text{O}_4^-$
$\text{HSO}_3^-$	$\text{SO}_3^{2-}$
$\text{HCO}_3^-$	$\text{CO}_3^{2-}$
$\text{H}_2\text{O}_2$	$\text{HO}_2^-$
$\text{H}_3\text{BO}_3$	$\text{H}_2\text{BO}_3^-$
$\text{HCOOH}$	$\text{COOH}^-$
$\text{C}_6\text{H}_6\text{O}_7^-$	$\text{C}_6\text{H}_5\text{O}_7^{2-}$
$\text{H}_3\text{O}^+$	$\text{H}_2\text{O}$
$\text{H}_2\text{O}$	$\text{OH}^-$

has one more  
 $\text{H}^+$

has one fewer  
 $\text{H}^+$

**Hebden Workbook pg. 119 #13**

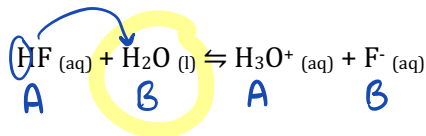
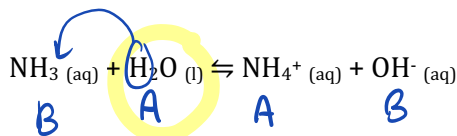
13. Identify each species in the following equations as being an acid or base.



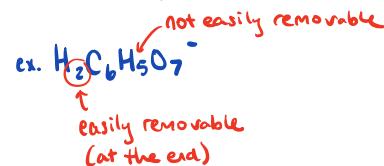
# Amphiprotic Substances

Substances that can act as an acid and a base

Consider the two reactions below:



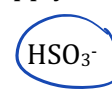
Generally, if a substance has:  
1. A negative charge and  
2. An easily removable H  
Then it is amphiprotic



In the first reaction, water acts as a BL-acid. In the second reaction, water acts as a BL-base.

**An amphiprotic substance has the ability to act as an acid or a base, depending on what it is reacting with.**

1. Which of the following would be expected to exhibit amphiprotic behavior. Circle those that apply.



2. Of the species that were circled in the above question, write two equations: (1) behaving as an acid with water (2) behaving as a base with water

