Equations for Acids & Bases

Chem Worksheet 19-1

Name _____

An **acid** is defined as a substance that donates a proton (written H^+) while a **base** is the substance that receives a proton. Typically the chemical formula can be used to determine the acid, because it will begin with the symbol H. For example in the following equation HCl is the acid and it donates a proton to water.

Acids donate protons
Bases accept protons

A proton is a hydrogen ion

$$\underset{\textbf{acid}}{HCl} + \underset{\textbf{base}}{H_2O} \rightarrow H_3O^+ + Cl^-$$

In this reaction the HCl is the acid, while the H_2O acts as the base. This creates two new products: **hydronium**, H_3O^+, and the chloride ion, Cl^-.

Some acids have the ability to donate two or three protons and these are known as **diprotic** or **triprotic acids** respectively. For these acids each successive step of hydrogen donation is represented with its own equation. Consider the diprotic acid called carbonic acid, H_2CO_3.

First step: $\underset{\textbf{acid}}{H_2CO_3} + \underset{\textbf{base}}{H_2O} \rightarrow H_3O^+ + HCO_3^-$

Second step: $\underset{\textbf{acid}}{HCO_3^-} + \underset{\textbf{base}}{H_2O} \rightarrow H_3O^+ + CO_3^{2-}$

Example

Write the chemical equation that shows what happens when HF (acid) is added to water.

- write the equation $\underset{\textbf{acid}}{HF} + \underset{\textbf{base}}{H_2O} \rightarrow F^- + H_3O^+$
- check to make sure **the atoms** and the **charge** are balanced

Rewrite each equation and label the acid and the base in each reaction.

1. $NH_3 + H_2O \rightarrow NH_4^+ + OH^-$
2. $HI + OH^- \rightarrow I^- + H_2O$
3. $HCO_3^- + HNO_3 \rightarrow H_2CO_3 + NO_3^-$
4. $H_2O + CN^- \rightarrow HCN + OH^-$
5. $OH^- + NH_4^+ \rightarrow H_2O + NH_3$
6. $H_2SO_4 + PO_4^{3-} \rightarrow HPO_4^{2-} + HSO_4^-$

Fill in the following table.

	Acid	Base	Equation
7	HNO_3	OH^-	$HNO_3 + OH^- \rightarrow H_2O + NO_3^-$
8			$CH_3NH_2 + H_2O \rightarrow OH^- + CH_3NH_3^+$
9	HCN		$HCN + H_2O \rightarrow H_3O^+ + CN^-$
10	HBr	H_2O	
11	HPO_4^{2-}	NH_3	
12			$OH^- + H_2S \rightarrow H_2O + HS^-$
13	$H_2C_2O_4$	OH^-	
14	HClO	NH_3	
15	HSO_4^-	CO_3^{2-}	