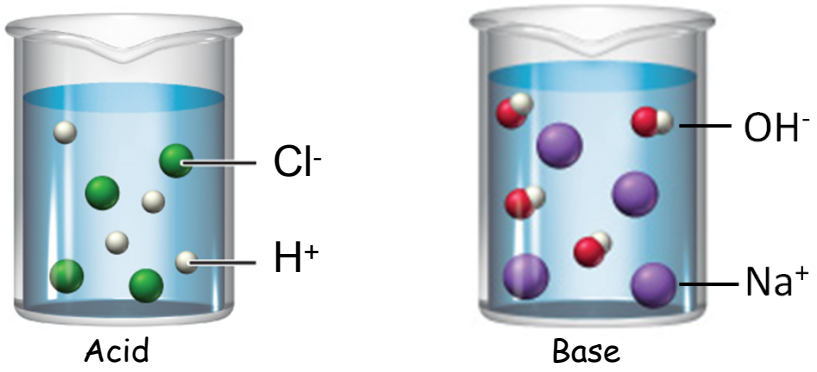
Name _____

Experiment 6
Acids and Bases

Things To Know:

Most liquids are either acids or bases to some degree. Whether a liquid is an acid or base depends on the type of ions in it. A hydrogen ion is created when a hydrogen atom loses an electron and carries a positive electric charge. A hydroxide ion consists of an oxygen and hydrogen atom held together by a single covalent bond and carries a negative electric charge. If the liquid has more hydrogen ions, it is an acid. If it has more hydroxide ions, it is a base.

Figure 15: Acid and Base Solutions



When solutions of an acid and a base are poured together the hydrogen ion reacts with the hydroxide ion to form water. If the water is evaporated, the sodium ion and the chloride ion will join to form sodium chloride, table salt. Acid-base reactions are also called neutralization reactions.

Neutralization Reaction

$$HCl + NaOH \rightarrow H_2O + NaCl$$

Calcium (Ca^{2+}) requires two OH^- ions to balance the charge. The formula is $Ca(OH)_2$ and the name is calcium hydroxide. Two molecules of HCl are required to react with calcium hydroxide. A coefficient is a number placed in front of a chemical symbol or formula. It shows the number of the substance involved in the reaction. For example, the red number 2 in the neutralization reaction below is called a coefficient. The coefficients are needed to balance the chemical equation.

Neutralization Reaction

$$2\ HCl + Ca(OH)_2 \rightarrow 2\ H_2O + CaCl_2$$

What To Do:

1. Use the Introduction to Chemistry Model Set to build HCl and NaOH. Use a short (25 mm) gray bond to attach the hydrogen atom to the chlorine atom to form hydrogen chloride, Use a white bond to represent an ionic bond between the metal, sodium, and the nonmetal, oxygen. Use a short (25 mm) gray bond to attach the hydrogen atom to the oxygen atom.
2. Using only the atoms in HCl and NaOH, rearrange the atoms to build water and table salt, NaCl. Sodium chloride has an ionic bond.
3. Build the acid(s) and base(s) in each neutralization reaction in Activity Table 6.
4. The products of a neutralization reaction are water and salt. A salt is made of a positive metal ion (cation) and a negative nonmetal ion (anion). Rearrange the atoms in the acid(s) and base(s) to simulate a neutralization reaction.
5. Balance each of the acid-base neutralization reactions by writing coefficients in the blanks before each formula.

Activity Table 6: Balanced Acid-Base Neutralization Reactions

Neutralization Reactions
$HBr + NaOH \rightarrow \_\_\_\_\_ H_2O + \_\_\_\_\_ NaBr$
$2\ HF + Mg(OH)_2 \rightarrow \_\_\_\_\_ H_2O + \_\_\_\_\_ MgF_2$
$H_2S + \_\_\_\_\_ LiOH \rightarrow \_\_\_\_\_ H_2O + \_\_\_\_\_ Li_2S$
$6\ HCl + \_\_\_\_\_ Al(OH)_3 \rightarrow \_\_\_\_\_ H_2O + \_\_\_\_\_ AlCl_3$

Discussion Questions for Experiment 6

1. Which ion is more abundant in acids?
2. Which ion is more abundant in bases?
3. What is another name for an acid-base reaction?
4. What are the products of an acid-base reaction?
5. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.