

## 5 • Reactions in Aqueous Solution

### Station 1 – ACIDS, BASES, AND NEUTRALS

Classify each statement as talking about an [A]cid, [B]ase, or [N]eutral.

B feels slippery

A tastes sour

B KOH

A turns cabbage juice red

B tastes bitter

N cabbage juice stays purple

N CH<sub>3</sub>OH *OH, but not OH<sup>-</sup> alcohol, not base*

A turns "phenol red solution" yellow

B increases [OH<sup>-</sup>]

A increases [H<sup>+</sup>]

A H<sub>2</sub>SO<sub>3</sub>

B NaHCO<sub>3</sub> *sodium bicarbonate*  
 $\text{HCO}_3^- + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3 + \text{OH}^-$

Hint: only one of these is neutral.

## 5 • Reactions in Aqueous Solution

### Station 2 – SOLUBILITY RULES

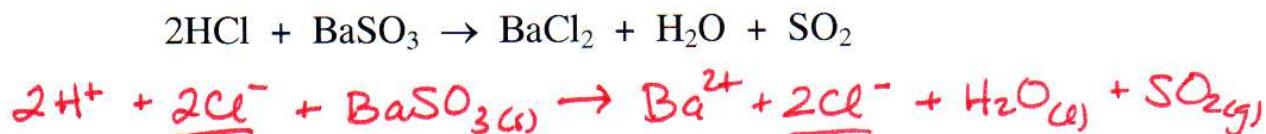
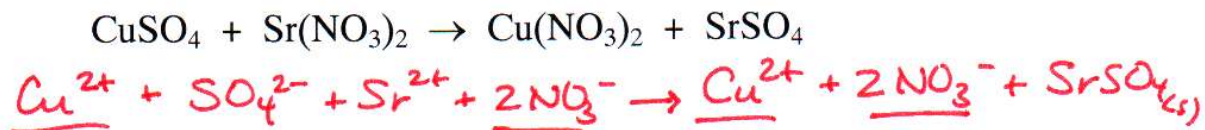
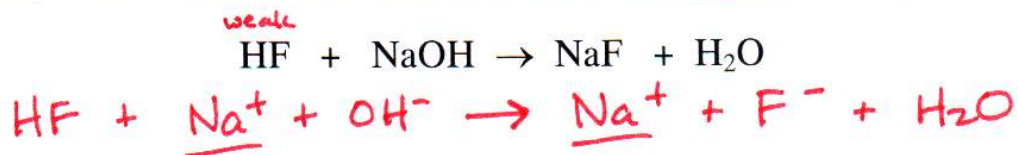
Circle the ionic compounds that are Insoluble (i.e. circle the precipitates):

<u>MgF<sub>2</sub></u>	<del>CuSO<sub>4</sub></del>	<del>NH<sub>4</sub>Cl</del>	<u>Fe(OH)<sub>3</sub></u>	<del>CsF</del>
<u>AgCl</u>	<u>CdS</u>	<del>CuF<sub>2</sub></del>	<u>PbSO<sub>4</sub></u>	<del>Ba(OH)<sub>2</sub></del>
<del>Na<sub>2</sub>SO<sub>4</sub></del>	<del>NH<sub>4</sub>OH</del>	<del>Sr(NO<sub>3</sub>)<sub>2</sub></del>	<u>Hg<sub>2</sub>I<sub>2</sub></u>	<del>Na<sub>2</sub>CrO<sub>4</sub></del>
<u>BaCO<sub>3</sub></u>	<u>PbBr<sub>2</sub></u>	<u>CaC<sub>2</sub>O<sub>4</sub></u>	<del>HC<sub>2</sub>H<sub>3</sub>O<sub>2</sub></del>	<u>MgO</u>

## 5 • Reactions in Aqueous Solution

### Station 3 – WRITE THE IONIC EQUATION

For the following molecular equations, write the ionic equation and underline out the spectators:



## 5 • Reactions in Aqueous Solution

### Station 4 – PREDICT THE PRODUCTS

Predict the products in these molecular equations. Indicate (s), (l), (g), or (aq):



## 5 • Reactions in Aqueous Solution

### Station 5 – NAMING ACIDS

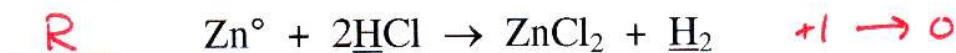
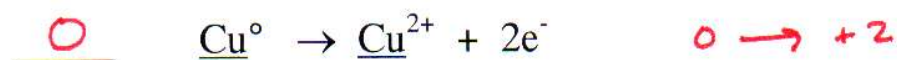
Fill in this chart:

Anion name	Anion formula	Acid formula	Acid name
cyanide	$\text{CN}^-$	$\text{HCN}$	hydrocyanic acid
chlorate	$\text{ClO}_3^-$	$\text{HClO}_3$	chloric acid
hypochlorite	$\text{ClO}^-$	$\text{HClO}$	hypochlorous acid
sulfide	$\text{S}^{2-}$	$\text{H}_2\text{S}$	hydrosulfuric acid
sulfate	$\text{SO}_4^{2-}$	$\text{H}_2\text{SO}_4$	sulfuric acid
sulfite	$\text{SO}_3^{2-}$	$\text{H}_2\text{SO}_3$	sulfurous acid
nitrate	$\text{NO}_3^-$	$\text{HNO}_3$	nitric acid
acetate	$\text{C}_2\text{H}_3\text{O}_2^-$	$\text{HC}_2\text{H}_3\text{O}_2$	acetic acid

## 5 • Reactions in Aqueous Solution

### Station 6 – RECOGNIZING OXIDATION-REDUCTION

For each statement, classify the change of the underlined element as [O]xidation, [R]eduction, or [N]either:



## 5 • Reactions in Aqueous Solution

### Station 7 – OXIDATION NUMBERS

Determine the oxidation number of the underlined element:

$+2$ $\underline{\text{Mg}}\text{F}_2$ $x + 2(-1) = 0$	$+6$ $\text{Cu}\underline{\text{S}}\text{O}_4$ $+2 + x + 4(-2) = 0$	$-3$ $\underline{\text{N}}\text{H}_4^+$ $x + 4(+1) = +1$	$+4$ $\underline{\text{C}}\text{O}_2$ $x + 2(-2) = 0$
$+1$ $\underline{\text{Ag}}\text{Cl}$ $x + (-1) = 0$	$+6$ $\underline{\text{Cr}}_2\text{O}_7^{2-}$ $2x + 7(-2) = -2$	$+5$ $\underline{\text{Cl}}\text{O}_3^-$ $x + 3(-2) = -1$	$-4$ $\underline{\text{Si}}\text{H}_4$ $x + 4(+1) = 0$

## 5 • Reactions in Aqueous Solution

### Station 8 – MOLARITY PROBLEMS

Solve the following problems:

A 2.00 mole sample of NaOH is dissolved in enough water to make 500. mL of solution. What is the concentration of the solution?

$$M = \frac{2.00 \text{ mol}}{.500 \text{ L}} = \boxed{4.00 \text{ M}}$$

$= 0.500 \text{ L}$

60.0 grams of NaOH (MM = 40.00 g·mol<sup>-1</sup>) is dissolved in enough water to make 0.750 L of solution. What is the concentration of the solution?

$$M = \frac{60.0 \text{ g} \times \frac{1 \text{ mol}}{40.00 \text{ g}}}{0.750 \text{ L}} = \boxed{2.00 \text{ M}}$$

A 250. mL sample of a 0.125 M solution of NaOH contains \_\_\_\_\_ grams of NaOH.

$$250. \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} \times \frac{0.125 \text{ mol}}{1 \text{ L}} \times \frac{40.0 \text{ g NaOH}}{1 \text{ mol NaOH}} = \boxed{1.25 \text{ g NaOH}}$$

**5 • Reactions in Aqueous Solution****Station 9 – DILUTIONS AND STOICHIOMETRY**

Show your work for these problems:

You need to make 2.00 L of 0.200 M HCl.

What volume of concentrated HCl (11.65 M) should you dilute? \_\_\_\_

$$V \cdot \underline{M} = V \cdot \underline{M}$$

$$(2.00\text{L})(\underline{0.200\text{M}}) = x(11.65\text{M})$$

$$x = \frac{(2.00\text{L})(\underline{0.200\text{M}})}{(11.65\text{M})} = \boxed{0.0343\text{L}} = \boxed{34.3\text{mL}}$$

Given the equation:  $\text{Al}_2\text{O}_3(\text{s}) + 6\text{HCl}(\text{aq}) \rightarrow 3\text{H}_2\text{O}(\text{l}) + 2\text{AlCl}_3(\text{aq})$ What volume of 0.250 M HCl is needed to completely react with 25.0 grams  $\text{Al}_2\text{O}_3$  (MM = 101.96  $\text{g}\cdot\text{mol}^{-1}$ ).

$$25.0\text{g Al}_2\text{O}_3 \times \frac{1\text{mol Al}_2\text{O}_3}{101.96\text{g}} \times \frac{6\text{mol HCl}}{1\text{mol Al}_2\text{O}_3} \times \frac{1\text{L HCl}}{0.250\text{mol HCl}} = \boxed{5.88\text{L HCl}}$$