A. Balance and complete each of the following reactions.

1. $Zn(s) + 2HCl(aq) \text{ -----> } ZnCl_2(aq) + H_2(g)$
2. $CaCO_3(aq) + 2HCl(aq) \text{ -----> } CaCl_2(aq) + H_2CO_3;\ H_2CO_3 \rightarrow H_2O + CO_2$
3. $HCl(aq) + NaOH(aq) \text{ -----> } NaCl(aq) + H_2O$
4. $Ba(OH)_2 + H_2SO_4(aq) \text{ -----> } BaSO_4(s) + 2H_2O$
5. $Al(OH)_3 + 3HCl(aq) \text{ -----> } AlCl_3(aq) + 3H_2O$
6. $CaCO_3(aq) + H_2SO_4(aq) \rightarrow CaSO_4(aq) + H_2CO_3;\ H_2CO_3 \rightarrow H_2O + CO_2$
7. $2\ NaHCO_3(aq) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + H_2CO_3$

B. Neutralization Problems.

1. 25 ml of 0.6M NaOH is exactly neutralized by 30 ml of HCl. What is the molarity HCl?

$$\text{Molarity}_{(base)} \cdot \text{Volume}_{(base)} = \text{Molarity}_{(acid)} \cdot \text{Volume}_{(acid)}$$
$$(0.6M)(0.025L) = M_{acid}(0.030L)$$
$$M_{acid} = 0.5M\ HCl$$

2. 25 ml of 0.5 M $H_2SO_4$ requires 30 ml of NaOH to reach neutralization. What is the molarity of the NaOH?

$$M_{(base)} V_{(base)} = M_{(acid)} V_{(acid)}$$
$$M_{(base)}(0.030L) = (0.50M)(0.025L)$$
$$M_{(base)} = 0.42M\ NaOH$$

3. What is the molarity of a solution containing 20 grams of $Ca(OH)_2$ dissolved in 500 ml of water?

$MW_{Ca(OH)_2} = 74.0\ g/mol$; moles of $Ca(OH)_2 = 20\ g / 74.0\ g/mol = 0.27$ moles

$$\text{molarity} = \frac{\text{moles}}{L} = \frac{0.27\ \text{moles}}{0.500L} = 0.54M\ Ca(OH)_2$$

C. For each of the following, classify as neutral, slightly acidic, slightly basic, strongly acidic, or strongly basic.

1. Blood has a pH of 7.3-7.4. — slightly basic
2. Milk has a pH of 6.5. — slightly acidic
3. Lemons have a pH of 2.2. — strongly acidic
4. Drano has a pH of 14. — strongly basic
5. Household ammonia has a pH of 12. — strongly basic
6. Cane sugar has a pH of 7. — neutral

D. Which of the following will make a good buffer system? Indicate "yes" or "no".

yes 1. $HC_2H_3O_2 + NaC_2H_3O_2$ $HC_2H_3O_2$ (acetic acid) is a weak acid
no 2. $HCl + NaOH$ (strong acid + strong base)
yes 3. $NaH_2PO_4 + Na_2HPO_4$ $NaH_2PO_4$ (weak acid)
yes 4. $NaHCO_3 + Na_2CO_3$ $NaHCO_3$ (weak acid)
no 5. $HCl + NaCl$

E. Write the net ionic equation for each of the following. (see attached sheet)

1. $HNO_3(aq) + Ba(OH)_2(aq)$ ----->

2. $Zn(s) + H_2SO_4(aq)$ ----->

3. $NaCl(aq) + AgNO_3(aq)$ ----->

4. $Fe(s) + CuSO_4(aq)$ ----->

5. $H_3PO_4(aq) + Mg(OH)_2(aq)$ ------>

F. Practice Quiz Questions.

1. Which of the following is a weak electrolyte?
(a.) $NH_4OH$ (weak base) b. NaCl c. NaOH d. $H_2SO_4$ e. $Ba(OH)_2$

2. Which of the following is a strong, soluble base?
a. $Sn(OH)_2$ b. $Al(OH)_3$ c. $NH_4OH$ (d.) $Ba(OH)_2$

3. If the pH of $Na_2CO_3$ is 12, the hydrogen ion concentration is
a. 2 M (b.) $10^{-12}$M c. $10^{-2}$M d. 12 M e. none of these

4. Which of the following mixed with $NaC_2H_3O_2(aq)$ would make the best buffer?
a. HCl(aq) b. NaOH(aq) c. $NH_3(aq)$ d. $NaHCO_3(aq)$ (e.) $HC_2H_2O_2(aq)$

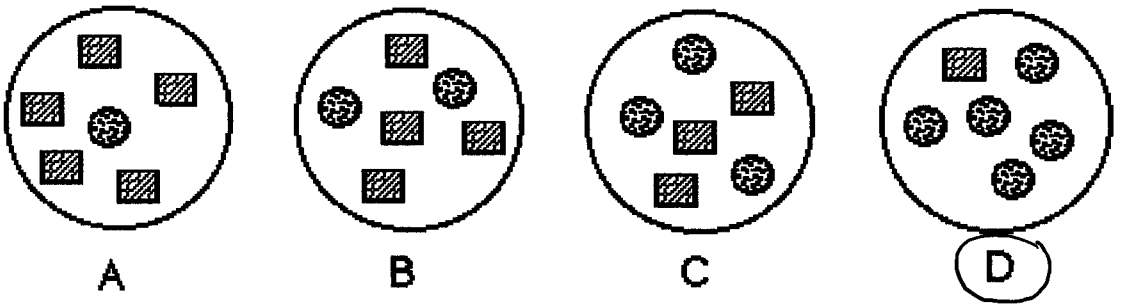
5. A pH of 1.0 is _____ times the acidity of pH 4.0.
a. 4 b. 3 c. 100 (d.) 1000 e. 1/1000

6. It requires 25 ml of 0.1M NaOH to neutralize 15 ml of $HC_2H_3O_2$. What is the molarity of the vinegar?
(a.) 0.167 M b. 0.15 M c. 1.67 M d. 0.075 M e. 0.06 M

7. If 0.1 M acetic acid is 1% ionized, its pH is
a. 1 b. 2 (c.) 3 d. 13 e. 11

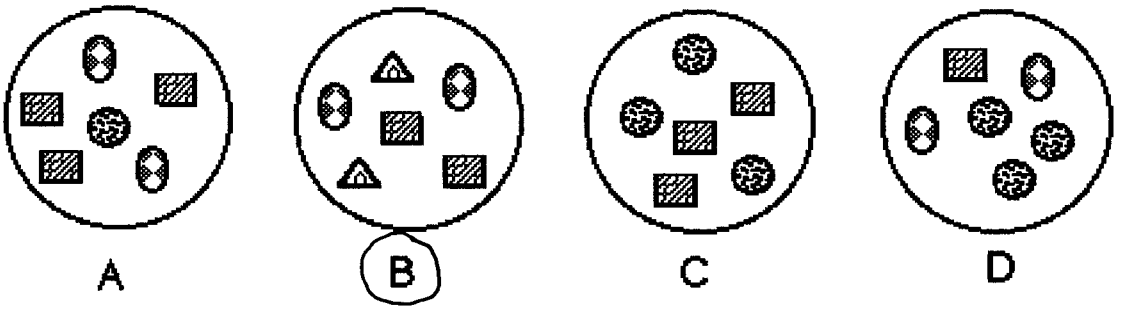
$[H^+] = 0.01 \times 0.1M = 0.001$; $pH = -\log[H^+] = 3$
(1% = 0.01)

8. Which circle demonstrates a base dissolved in water? (note: water molecules are not shown)




Let $H^{+1}$= ▨ , $OH^{-1}$= ● .

9. Which circle describes a weak acid in water? (note: water molecules are not shown).




Let $H^{+1}$= ▨ , $OH^{-1}$= ● , HX = △, and $X^{-1}$= ⬭ .

Unit 13
activity sheets

## Part E: Net Ionic Equations

1. molecular equation (balanced): $2HNO_3(aq) + Ba(OH)_2(aq) \rightarrow Ba(NO_3)_2(aq) + 2H_2O$

total ionic: $2H^+(aq) + 2NO_3^-(aq) + Ba^{2+}(aq) + 2OH^-(aq) \rightarrow Ba^{2+}(aq) + 2NO_3^-(aq) + 2H_2O$

ask me?: $NO_3^-(aq)$ & $Ba^{2+}$

net ionic: $2H^+(aq) + 2OH^-(aq) \rightarrow 2H_2O$
or $H^+(aq) + OH^-(aq) \rightarrow H_2O$

2. molecular equation (balanced): $Zn(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2(g)$

total ionic: $Zn(s) + 2H^+(aq) + SO_4^{2-}(aq) \rightarrow Zn^{2+}(aq) + SO_4^{2-}(aq) + H_2(g)$

ask me?: $SO_4^{2-}(aq)$

net ionic: $Zn(s) + 2H^+(aq) \rightarrow Zn^{2+}(aq) + H_2(g)$

3. molecular equation (balanced): $NaCl(aq) + AgNO_3(aq) \rightarrow NaNO_3(aq) + AgCl(s)$

total ionic: $Na^+(aq) + Cl^-(aq) + Ag^+(aq) + NO_3^-(aq) \rightarrow Na^+(aq) + NO_3^-(aq) + AgCl(s)$

ask me?: $Na^+(aq)$ & $NO_3^-(aq)$

net ionic: $Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$

Unit B activity sheets

## Part E: Net Ionic Equations (continued)

4. molecular equation (balanced): $Fe(s) + CuSO_4(aq) \rightarrow FeSO_4(aq) + Cu(s)$

(assume $Fe^{2+}$)

total ionic: $Fe(s) + Cu^{2+}(aq) + SO_4^{2-}(aq) \rightarrow Fe^{2+}(aq) + SO_4^{2-}(aq) + Cu(s)$

ask the?: $SO_4^{2-}(aq)$

net ionic: $Fe(s) + Cu^{2+}(aq) \rightarrow Fe^{2+}(aq) + Cu(s)$

5. molecular equation (balanced):

$2H_3PO_4(aq) + 3Mg(OH)_2(aq) \rightarrow Mg_3(PO_4)_2(s) + 6H_2O$

weak acid

total ionic:

$H_3PO_4(aq) + 3Mg^{2+}(aq) + 6OH^-(aq) \rightarrow Mg_3(PO_4)_2(s) + 6H_2O$

ask the?: none!

therefore, total ionic = net ionic