

**Chem 121**  
**Test 2**  
**Version A**

You have 50 minutes to complete this 100 point test. Show all work for full credit. You may use a non-graphing, scientific calculator.

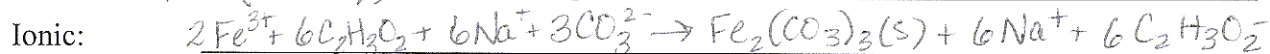
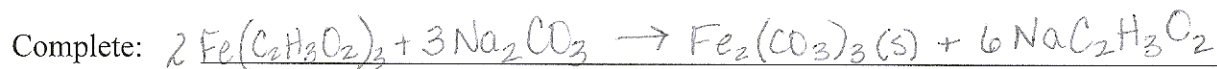
1. (5 pts) Identify each compound below as soluble (S) or insoluble (IS). (circle one)

a. $\text{BaCl}_2$	(S)	or	IS
b. $\text{Na}_2\text{SO}_4$	(S)	or	IS
c. $\text{Cu}_2\text{CO}_3$	S	or	(IS)
d. $\text{Cr}(\text{NO}_3)_3$	(S)	or	IS
e. $\text{BaSO}_4$	S	or	(IS)

2. (5 pts) Identify each compound below as a strong acid (SA), a weak acid (WA), a strong base (SB) or a weak base (WB). (circle one)

a. $\text{HCl}$	(SA)	WA	SB	WB
b. $\text{Ca}(\text{OH})_2$	SA	WA	(SB)	WB
c. $\text{NH}_3$	SA	WA	SB	(WB)
d. $\text{HC}_2\text{H}_3\text{O}_2$	SA	(WA)	SB	WB
e. $\text{H}_3\text{PO}_4$	SA	(WA)	SB	WB

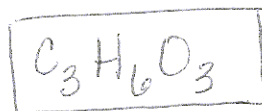
3. (15 pts) Write the complete, ionic and net ionic balanced equations for the reaction of iron(III) acetate with sodium carbonate. Don't forget to indicate the precipitate.



4. (10 pts) What is the molecular formula of a compound whose molar mass is 90.08 g/mol and whose empirical formula is  $\text{CH}_2\text{O}$ ?

$$\text{CH}_2\text{O} \quad \text{MM} = 12.01 + 2(1.008) + 16.00 = 30.03 \text{ g/mol}$$

$$\frac{\text{MM of MF}}{\text{MM of EF}} = \frac{90.08}{30.03} = 3$$



5. (10 pts) Calculate the molar mass of cobalt(II) nitrate hexahydrate.

$$\begin{array}{r}
 \text{Co}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O} \\
 1 \text{ Co} = 58.93 \\
 2 \text{ N} = 2(14.01) = 28.02 \\
 6 \text{ O} = 6(16.00) = 96.00 \\
 12 \text{ H} = 12(1.008) = 12.096 \\
 6 \text{ O} = 6(16.00) = 96.00 \\
 \hline
 291.05 \text{ g/mol}
 \end{array}$$

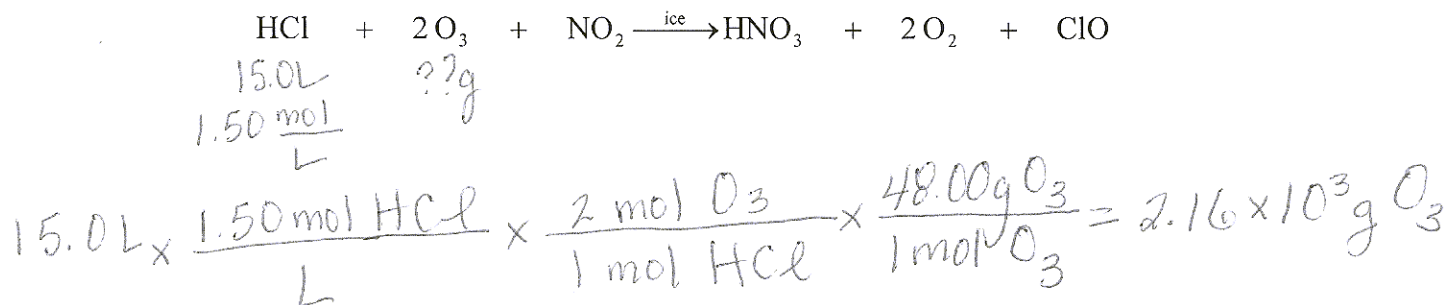
6. (10 pts) How many atoms of carbon are there in 15.0g C<sub>6</sub>H<sub>6</sub>? (MM of C<sub>6</sub>H<sub>6</sub> = 78.11 g/mol)

$$15.0 \text{ g C}_6\text{H}_6 \times \frac{1 \text{ mol C}_6\text{H}_6}{78.11 \text{ g C}_6\text{H}_6} \times \frac{6 \text{ mol C}}{1 \text{ mol C}_6\text{H}_6} \times \frac{6.02 \times 10^{23} \text{ atoms}}{1 \text{ mol C}} = 6.94 \times 10^{23} \text{ atoms C}$$

7. (10 pts) Calculate the molar concentration of a solution made by dissolving 2.50 g NaCl in 350.0 mL of water. Assume the volume of the final solution is the volume of the water. (MM of NaCl = 58.44 g/mol)

$$\frac{2.50 \text{ g NaCl}}{350.0 \text{ mL}} \times \frac{1 \text{ mol NaCl}}{58.44 \text{ g NaCl}} \times \frac{1000 \text{ mL}}{1 \text{ L}} = 0.122 \text{ M NaCl}$$

8. (15 pts) It has been found that the depletion of the ozone layer near Antarctica is caused by the reaction of ozone (O<sub>3</sub>) with chlorine containing molecules in the presence of stratospheric ice. How many grams of O<sub>3</sub> will be depleted if 15.0L of 1.50M HCl is allowed to react with excess NO<sub>2</sub>? (MM of O<sub>3</sub> = 48.00 g/mol)

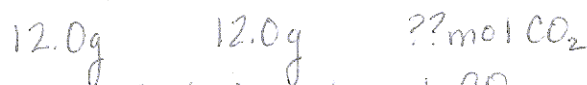
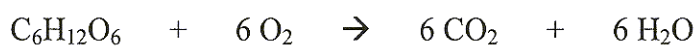


9. (5 pts) What volume (in mL) of 0.125 M  $K_2SO_4$  is needed to make 250.0 mL of 0.0500 M  $K_2SO_4$ ?

$$V_c (0.125 M K_2SO_4) = (250.0 mL)(0.0500 M K_2SO_4)$$

$$V_c = 100. mL$$

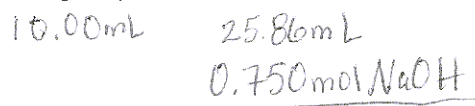
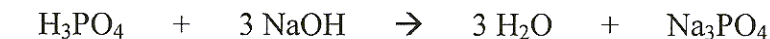
10. (15 pts) One of the most important reactions in the body involves glucose. In aerobic metabolism, glucose reacts with oxygen to form carbon dioxide and water. How many moles of carbon dioxide are formed from the reaction of 12.0 g  $C_6H_{12}O_6$  with 12.0 g  $O_2$ ? (MM of  $C_6H_{12}O_6$  = 180.16 g/mol, MM of  $O_2$  = 32.00 g/mol)



$$12.0g C_6H_{12}O_6 \times \frac{1 mol C_6H_{12}O_6}{180.16g} \times \frac{6 mol CO_2}{1 mol C_6H_{12}O_6} = 0.400 mol CO_2$$

$$12.0g O_2 \times \frac{1 mol O_2}{32.00g O_2} \times \frac{6 mol CO_2}{6 mol O_2} = \boxed{0.375 mol CO_2}$$

11. (10 pts) A 10.00 mL sample of phosphoric acid ( $H_3PO_4$ ) was titrated with 25.86 mL of 0.750 M NaOH. Calculate the concentration of the phosphoric acid.



$$25.86 mL \times \frac{1 L}{1000 mL} \times \frac{0.750 mol NaOH}{L} \times \frac{1 mol H_3PO_4}{3 mol NaOH} = 6.47 \times 10^{-3} mol H_3PO_4$$

$$C_{H_3PO_4} = \frac{6.47 \times 10^{-3} mol}{10.00 mL} \times \frac{1000 mL}{L}$$

$$= \boxed{0.647 M H_3PO_4}$$

Name: Solution Key

**Chem 121  
Test 2  
Version B**

You have 50 minutes to complete this 100 point test. Show all work for full credit. You may use a non-graphing, scientific calculator.

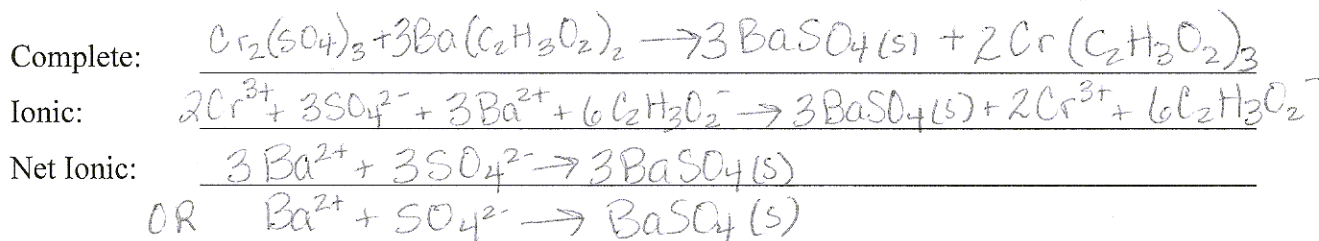
1. (5 pts) Identify each compound below as soluble (S) or insoluble (IS). (circle one)

- |                               |          |    |           |
|-------------------------------|----------|----|-----------|
| a. $\text{CaSO}_4$            | S        | or | <u>IS</u> |
| b. $\text{K}_3\text{PO}_4$    | <u>S</u> | or | IS        |
| c. $\text{Zn}(\text{NO}_3)_2$ | <u>S</u> | or | IS        |
| d. $\text{NiCO}_3$            | S        | or | <u>IS</u> |
| e. $\text{MgCl}_2$            | <u>S</u> | or | IS        |

2. (5 pts) Identify each compound below as a strong acid (SA), a weak acid (WA), a strong base (SB) or a weak base (WB). (circle one)

- |                             |           |           |           |           |
|-----------------------------|-----------|-----------|-----------|-----------|
| a. $\text{Ba}(\text{OH})_2$ | SA        | WA        | <u>SB</u> | WB        |
| b. $\text{H}_2\text{CO}_3$  | SA        | <u>WA</u> | SB        | WB        |
| c. $\text{HNO}_3$           | <u>SA</u> | WA        | SB        | WB        |
| d. $\text{HF}$              | <u>SA</u> | WA        | SB        | WB        |
| e. $\text{NH}_3$            | SA        | WA        | SB        | <u>WB</u> |

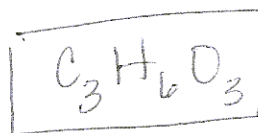
3. (15 pts) Write the complete, ionic and net ionic balanced equations for the reaction of chromium(III) sulfate with barium acetate. Don't forget to indicate the precipitate.



4. (10 pts) What is the molecular formula of a compound whose molar mass is 90.08 g/mol and whose empirical formula is  $\text{CH}_2\text{O}$ ?

$$\text{MM of } \text{CH}_2\text{O} = 12.01 + (2 \cdot 1.008) + 16.00 = 30.03 \text{ g/mol}$$

$$\frac{\text{MM of MF}}{\text{MM of EF}} = \frac{90.08}{30.03} = 3$$



5. (10 pts) Calculate the molar mass of nickel(II) nitrate pentahydrate.

$$\begin{array}{r}
 \text{Ni}(\text{NO}_3)_2 \cdot 5\text{H}_2\text{O} \quad 1 \text{ Ni} = 58.71 \\
 \quad \quad \quad \quad \quad \quad \quad 2 \text{ N} = 2(14.01) = 28.02 \\
 \quad \quad \quad \quad \quad \quad \quad 6 \text{ O} = 6(16.00) = 96.00 \\
 \quad \quad \quad \quad \quad \quad \quad 10 \text{ H} = 10(1.008) = 10.08 \\
 \quad \quad \quad \quad \quad \quad \quad 5 \text{ O} = 5(16.00) = 80.00 \\
 \hline
 \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad 272.81 \text{ g/mol}
 \end{array}$$

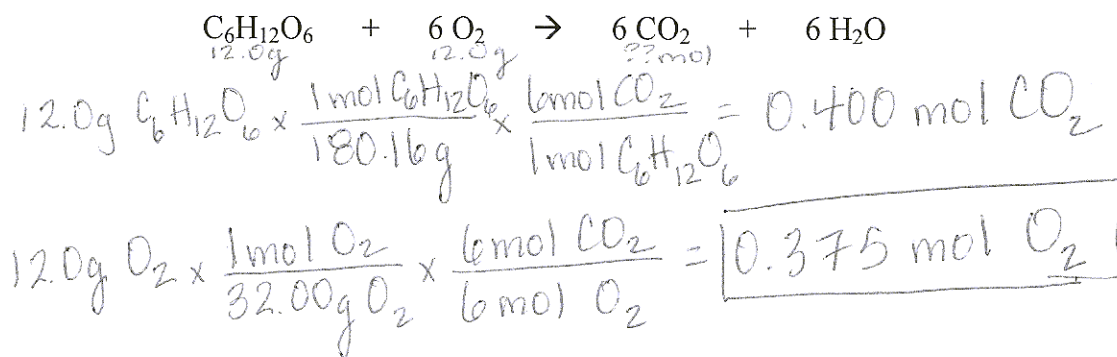
6. (10 pts) How many atoms of hydrogen are there in 15.0g C<sub>6</sub>H<sub>6</sub>? (MM of C<sub>6</sub>H<sub>6</sub> = 78.11 g/mol)

$$\begin{array}{l}
 15.0 \text{ g C}_6\text{H}_6 \times \frac{1 \text{ mol C}_6\text{H}_6}{78.11 \text{ g C}_6\text{H}_6} \times \frac{6 \text{ mol H}}{1 \text{ mol C}_6\text{H}_6} \times \frac{6.02 \times 10^{23} \text{ atoms H}}{1 \text{ mol H}} \\
 = 6.94 \times 10^{23} \text{ atoms H}
 \end{array}$$

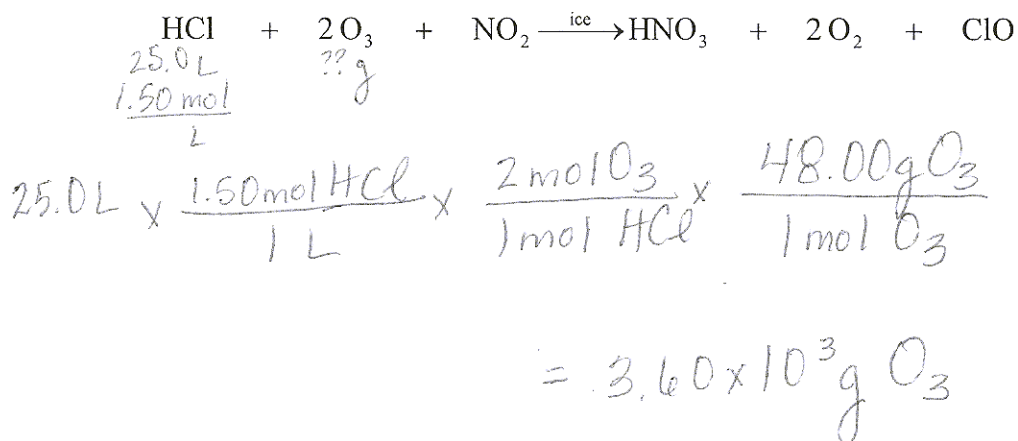
7. (5 pts) What volume (in mL) of 0.125 M K<sub>2</sub>SO<sub>4</sub> is needed to make 250.0 mL of 0.0500 M K<sub>2</sub>SO<sub>4</sub>?

$$\begin{array}{l}
 V_c(0.125 \text{ M K}_2\text{SO}_4) = (250.0 \text{ mL})(0.0500 \text{ M K}_2\text{SO}_4) \\
 V_c = 100. \text{ mL}
 \end{array}$$

8. (15 pts) One of the most important reactions in the body involves glucose. In aerobic metabolism, glucose reacts with oxygen to form carbon dioxide and water. How many moles of carbon dioxide are formed from the reaction of 12.0 g C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> with 12.0 g O<sub>2</sub>? (MM of C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> = 180.16 g/mol, MM of O<sub>2</sub> = 32.00 g/mol)



9. (15 pts) It has been found that the depletion of the ozone layer near Antarctica is caused by the reaction of ozone ( $O_3$ ) with chlorine containing molecules in the presence of stratospheric ice. How many grams of  $O_3$  will be depleted if 25.0L of 1.50M HCl is allowed to react with excess  $NO_2$ ? (MM of  $O_3 = 48.00$  g/mol)



10. (10 pts) Calculate the molar concentration of a solution made by dissolving 2.50 g KCl in 250.0 mL of water. Assume the volume of the final solution is the volume of the water. (MM of KCl = 74.55 g/mol)

$$\frac{2.50\text{g KCl}}{250.0\text{ mL}} \times \frac{1\text{mol KCl}}{74.55\text{g KCl}} \times \frac{1000\text{ mL}}{1\text{ L}} = 0.134\text{ M KCl}$$

11. (10 pts) A 10.00 mL sample of sulfuric acid ( $H_2SO_4$ ) was titrated with 25.86 mL of 0.750 M NaOH. Calculate the concentration of the sulfuric acid.

