Worksheet L6Q – CHEM 121 – Spring 2016 Name: _____

Directions: Complete as directed in the accompanying email. For Activity Series scoring, remember the most vigorous bubbling is a 4+ and the least is a 0+ -- anything else is in between – it is possible to have two metals score identically.

1) Complete the following data table just as you did for the experiment on Activity Series. Remember that the whole idea for scoring the reactions is based on the presence of bubbling and on the intensity of the bubbling immediately upon addition of the metal to the HCl, as well as at 20 minutes after adding the metal to the HCl.

Activity Series Record Table								
Metal	Li	K	Ca	Al	Co	Ag	Pt	Au
Observations immediately	Explosive bubbling	Vigorous bubbling	Moderate bubbling	Mild bubbling	Light bubbling	No bubbling	No bubbling	No bubbling
Observations after 20 minutes	No bubbling	No bubbling	No bubbling	No bubbling	No bubbling	No bubbling	No bubbling	No bubbling
Reactivity								
Order of reactivity								

2) Complete the following data table just as you did for the experiment on Activity Series. Remember that the whole idea for scoring the reactions is based on the presence of bubbling and on the intensity of the bubbling immediately upon addition of the metal to the HCl, as well as at 20 minutes after adding the metal to the HCl.

Activity Series Record Table								
Metal	Rb	Zn	Ba	Ni	Na	Cu	Mn	Hg
Observations immediately	Explosive bubbling	Light bubbling	Vigorous bubbling	Sporadic bubbling	Moderate bubbling	No bubbling	Mild bubbling	No bubbling
Observations after 20 minutes	No bubbling	Mild bubbling	No bubbling	Light bubbling	No bubbling	Bubbles on Surface	Sporadic bubbling	No bubbling
Reactivity								
Order of reactivity								

3) Place both activity series in order of most reactive to least reactive in the space, below.

4) Complete the following data table just as you did for the experiment on Activity Series. Remember that the whole idea for scoring the reactions is based on the presence of bubbling and on the intensity of the bubbling immediately upon addition of the metal to the HCl, as well as at 20 minutes after adding the metal to the HCl.

Activity Series Record Table								
Metal	Mg	Zn	Cu	NiCr	Pb	Fe	Sn	Al
Observations immediately	Explosive bubbling	Vigorous bubbling	No bubbling	Sporadic bubbling	No bubbling	No bubbling	Light bubbling	No bubbling
Observations after 20 minutes	No bubbling	No bubbling	Sporadic bubbling	No bubbling	Light bubbling	Mild bubbling	No bubbling	No bubbling
Reactivity								
Order of reactivity								

5) Complete the following data table just as you did for the experiment on Activity Series. Remember that the whole idea for scoring the reactions is based on the presence of bubbling and on the intensity of the bubbling immediately upon addition of the metal to the HCl, as well as at 20 minutes after adding the metal to the HCl.

Activity Series Record Table								
Metal	Ks	Nv	Ny	Sf	Lo	Tx	Wy	Hi
Observations immediately	No bubbling	Moderate bubbling	Sporadic bubbling	Light Bubbling	No bubbling	Vigorous bubbling	Moderate bubbling	Vigorous bubbling
Observations after 20 minutes	Sporadic bubbling	No bubbling	Light bubbling	Sporadic bubbling	No bubbling	Vigorous bubbling	No bubbling	No bubbling
Reactivity								
Order of reactivity								

6) Place both activity series in order of most reactive to least reactive in the space, below.

7) Use the following information to develop your own separation scheme of each cation on the next page. As we discussed in class, the goal is to separate one cation from a solution of cations, one cation at a time, one reagent at a time and to not repeat the use of any reagent. You may leave the last ion in solution as we did in class.

Reagent Dispensation Table				
Column 1	Column 2	Column 3	Column 4	Column 5
6 M HCl	H_2SO_4	6M NaOH	7.4 M NH_3	$NaHCO_3$ solution

Tube Set-Up for Cation Analysis					
	Column 1	Column 2	Column 3	Column 4	Column 5
Row 1	5 drops 2% $CuSO_4$	5 drops 2% $CuSO_4$	5 drops 2% $CuSO_4$	5 drops 2% $CuSO_4$	5 drops 2% $CuSO_4$
Row 2	5 drops $AgNO_3$	5 drops $AgNO_3$	5 drops $AgNO_3$	5 drops $AgNO_3$	5 drops $AgNO_3$
Row 3	5 drops $FeCl_3$	5 drops $FeCl_3$	5 drops $FeCl_3$	5 drops $FeCl_3$	5 drops $FeCl_3$
Row 4	5 drops Magnesia mixture	5 drops Magnesia mixture	5 drops Magnesia mixture	5 drops Magnesia mixture	5 drops Magnesia mixture

Results and Observations					
	Column 1	Column 2	Column 3	Column 4	Column 5
Row 1	No ppt	No ppt	Blue ppt	Teal ppt	No ppt
Row 2	White ppt	No ppt	Brown ppt	No ppt	Lt grn ppt
Row 3	No ppt	No ppt	Rust ppt	No ppt	No ppt
Row 4	No ppt	No ppt	No ppt	No ppt	No ppt

Flowchart for #7:

8) Use the following information to develop your own separation scheme of each cation on the next page. As we discussed in class, the goal is to separate one cation from a solution of cations, one cation at a time, one reagent at a time and to not repeat the use of any reagent. You may leave the last ion in solution as we did in class. For this flowchart, write out the chemical formula of each precipitated salt (remember that the simplest definition of a salt is a cation plus an anion):

Reagent Dispensation Table				
Column 1	Column 2	Column 3	Column 4	Column 5
HCl	$H^+ + H_2S$	$NH_4^+ + H_2S$	$(NH_4)_2CO_3$	H_2SO_4

Tube Set-Up for Cation Analysis					
	Column 1	Column 2	Column 3	Column 4	Column 5
Row 1	$Pb(NO_3)_2$	$Pb(NO_3)_2$	$Pb(NO_3)_2$	$Pb(NO_3)_2$	$Pb(NO_3)_2$
Row 2	$HgCl_2$	$HgCl_2$	$HgCl_2$	$HgCl_2$	$HgCl_2$
Row 3	$Co(NO_3)_2$	$Co(NO_3)_2$	$Co(NO_3)_2$	$Co(NO_3)_2$	$Co(NO_3)_2$
Row 4	$BaCl_2$	$BaCl_2$	$BaCl_2$	$BaCl_2$	$BaCl_2$

Results and Observations					
	Column 1	Column 2	Column 3	Column 4	Column 5
Row 1	White ppt	Brn ppt	No ppt	No ppt	No ppt
Row 2	No ppt	Brn ppt	No ppt	No ppt	No ppt
Row 3	No ppt	No ppt	Tan ppt	No ppt	No ppt
Row 4	No ppt	No ppt	No ppt	No ppt	White ppt

Flowchart for #8:

9) Use the following information to develop your own separation scheme of each cation on the next page. As we discussed in class, the goal is to separate one cation from a solution of cations, one cation at a time, one reagent at a time and to not repeat the use of any reagent. You may leave the last ion in solution as we did in class. For this flowchart, write out the chemical formula of each precipitated salt (remember that the simplest definition of a salt is a cation plus an anion):

Reagent Dispensation Table				
Column 1	Column 2	Column 3	Column 4	Column 5
HCl	$H^+ + H_2S$	$NH_4^+ + H_2S$	$(NH_4)_2CO_3$	H_2SO_4

Tube Set-Up for Cation Analysis					
	Column 1	Column 2	Column 3	Column 4	Column 5
Row 1	$Hg_2(NO_3)_2$	$Hg_2(NO_3)_2$	$Hg_2(NO_3)_2$	$Hg_2(NO_3)_2$	$Hg_2(NO_3)_2$
Row 2	$Hg(NO_3)_2$	$Hg(NO_3)_2$	$Hg(NO_3)_2$	$Hg(NO_3)_2$	$Hg(NO_3)_2$
Row 3	$Ni(NO_3)_2$	$Ni(NO_3)_2$	$Ni(NO_3)_2$	$Ni(NO_3)_2$	$Ni(NO_3)_2$
Row 4	$Sr(NO_3)_2$	$Sr(NO_3)_2$	$Sr(NO_3)_2$	$Sr(NO_3)_2$	$Sr(NO_3)_2$

Results and Observations					
	Column 1	Column 2	Column 3	Column 4	Column 5
Row 1	Grey/Blk ppt	No ppt	No ppt	No ppt	No ppt
Row 2	White ppt	Muddy brn ppt	No ppt	No ppt	No ppt
Row 3	No ppt	No ppt	Tan ppt	No ppt	No ppt
Row 4	No ppt	No ppt	No ppt	White ppt	White ppt

Flowchart for #9:

10) Use the following information to develop your own separation scheme of each cation on the next page. As we discussed in class, the goal is to separate one cation from a solution of cations, one cation at a time, one reagent at a time and to not repeat the use of any reagent. You may leave the last ion in solution as we did in class. For this flowchart, write out the chemical formula of each precipitated salt (remember that the simplest definition of a salt is a cation plus an anion):

Reagent Dispensation Table				
Column 1	Column 2	Column 3	Column 4	Column 5
NaCl	Na_2CO_3	K_2CrO_4	NH_3	$H_2C_2O_4$

Tube Set-Up for Cation Analysis					
	Column 1	Column 2	Column 3	Column 4	Column 5
Row 1	$Pb(NO_3)_2$	$Pb(NO_3)_2$	$Pb(NO_3)_2$	$Pb(NO_3)_2$	$Pb(NO_3)_2$
Row 2	$Ca(NO_3)_2$	$Ca(NO_3)_2$	$Ca(NO_3)_2$	$Ca(NO_3)_2$	$Ca(NO_3)_2$
Row 3	$AgNO_3$	$AgNO_3$	$AgNO_3$	$AgNO_3$	$AgNO_3$
Row 4	$Cu(NO_3)_2$	$Cu(NO_3)_2$	$Cu(NO_3)_2$	$Cu(NO_3)_2$	$Cu(NO_3)_2$

Results and Observations					
	Column 1	Column 2	Column 3	Column 4	Column 5
Row 1	White ppt	White ppt	Yellow ppt	No ppt	No ppt
Row 2	No ppt	White ppt	No ppt	No ppt	White ppt
Row 3	White ppt	White ppt	No ppt	No ppt	No ppt
Row 4	No ppt	Blue ppt	No ppt	No ppt	No ppt

Flowchart for #10:

11) Based on your results to Question 1, which of the following reactions "go" and which are NR? Balance each reaction that "goes".

A) $Pt + Al^{3+} \rightarrow Pt^{2+} + Al$

B) $Li + Au^{3+} \rightarrow Li^{+} + Au$

C) $Co + Al^{3+} \rightarrow Co^{2+} + Al$

D) $Li + Pt^{4+} \rightarrow Li^{+} + Pt$

E) $Co^{2+} + Co \rightarrow Co + Co^{2+}$

F) $Li + Au^{3+} \rightarrow Li^{+} + Au$

12) Using your results from Question 4, which of the following reactions "go" and which are NR? Balance each reaction that "goes".

A) $Mg + Zn^{2+} \rightarrow Mg^{2+} + Zn$

B) $Fe + Fe^{3+} \rightarrow Fe^{3+} + Fe$

C) $Al + Sn^{4+} \rightarrow Al^{3+} + Sn$

D) $Mg + Sn^{4+} \rightarrow Sn^{2+} + Mg^{2+}$

E) $Sn + Fe^{3+} \rightarrow Sn^{4+} + Fe$

F) $Zn + Pb^{4+} \rightarrow Zn^{2+} + Pb^{2+}$

13) If the reaction $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$ goes as written, complete and balance the following reactions:

A) $Pb(NO_3)_2 + NaCl \rightarrow$

B) $Hg_2(NO_3)_2 + NaCl \rightarrow$

C) $AgNO_3 + KCl \rightarrow$

D) $Pb(NO_3)_2 + KCl \rightarrow$

E) $Hg_2(NO_3)_2 + KCl \rightarrow$

F) $AgNO_3 + LiCl \rightarrow$

14) Using the table, below, write out the chemical/ion using the elemental symbol and charge(s):

Group 1	Group 2	Group 3	Group 4	Group 5
HCl Group	Acidic Hydrogen Sulfide Group	Basic Hydrogen Sulfide Group	Ammonium Carbonate Group	Soluble Group
Silver (I)	Mercury (II)	Aluminum (III)	Calcium (II)	Sodium (I)
Mercury (I)	Lead (II)	Chromium (III)	Strontium (II)	Potassium (I)
Lead (II)	Bismuth (III)	Iron (II & III)	Barium (II)	Magnesium (II)
	Copper (II)	Manganese (II)		Ammonium ion
	Cadmium (II)	Cobalt (II)		
	Arsenic (III & V)	Nickel (II)		
	Antimony (III & V)	Zinc (II)		
	Tin (II & IV)			

15) Complete the following table:

Polyatomic Ion	Polyatomic Ion Name	Compound of Origin	Name of Compound
NO_3^-		HNO_3	
NO_2^-		HNO_2	
SO_4^{2-}		H_2SO_4	
SO_3^{2-}		H_2SO_3	
PO_4^{3-}		H_3PO_4	
NH_4^+		NH_3	