Qualitative Analysis Worksheet

As you work through the steps in the lab procedures, record your experimental values and the results on this worksheet.

Complete the following table with your results from Part A and B of the Qualitative Analysis lab. Write the color of the solid formed upon addition of KI to the known solution in the well plate. The table is also for the confirmatory tests for the clear solution retained from Part B. (Write "NA" if there was already a solid present and the test was not performed.)

Data Table A: Confirmatory Tests for Individual Ions

Ion	Part	Solution	Results of adding KI solution
Ag^{1+}	A	Well plate solution	
	B	Solution from HCl	
	B	Solution from hot water	
	B	Solution from ammonia	
Hg_2^{2+}	A	Well plate solution	
	B	Solution from HCl	
	B	Solution from hot water	
	B	Solution from ammonia	
Pb^{2+}	A	Well plate solution	
	B	Solution from HCl	
	B	Solution from hot water	
	B	Solution from ammonia	

Complete the following table with your results from Part B of the Qualitative Analysis lab. Write "Yes" if the ion was soluble in the solution (no solid was formed) or "No" if the ion was insoluble in the solution (solid was formed). Remember to perform a confirmatory test for any solution in which a precipitate does NOT form, and enter your results in Data Table A.

Data Table B: Solubility of Individual Ions

	Ag^{1+}	Hg_2^{2+}	Pb^{2+}
Soluble in HCl			
Soluble in hot water			
Soluble in ammonia			

Answer the following questions based on your experience. (Select all that apply.)

(a) Which ions, if any, can you separate by their solubility in HCl?

- ☐ Ag^+
- ☐ Hg_2^{2+}
- ☐ Pb^{2+}
- ☐ none

(b) Which ions, if any, can you separate by their solubility in hot water?]

- ☐ Ag^+
- ☐ Hg_2^{2+}
- ☐ Pb^{2+}
- ☐ none

(c) Which ions, if any, can you separate by their solubility in NH_3?

- ☐ Ag^+
- ☐ Hg_2^{2+}
- ☐ Pb^{2+}
- ☐ none

Answer each of the following questions regarding your conclusions from Part B.

(a) Adding KI to the original Ag^+ solution gave the same result as adding KI to which of the following solutions from Part A?

- ☐ solution from ammonia
- ☐ solution from HCl
- ☐ solution from hot water
- ☐ none of these

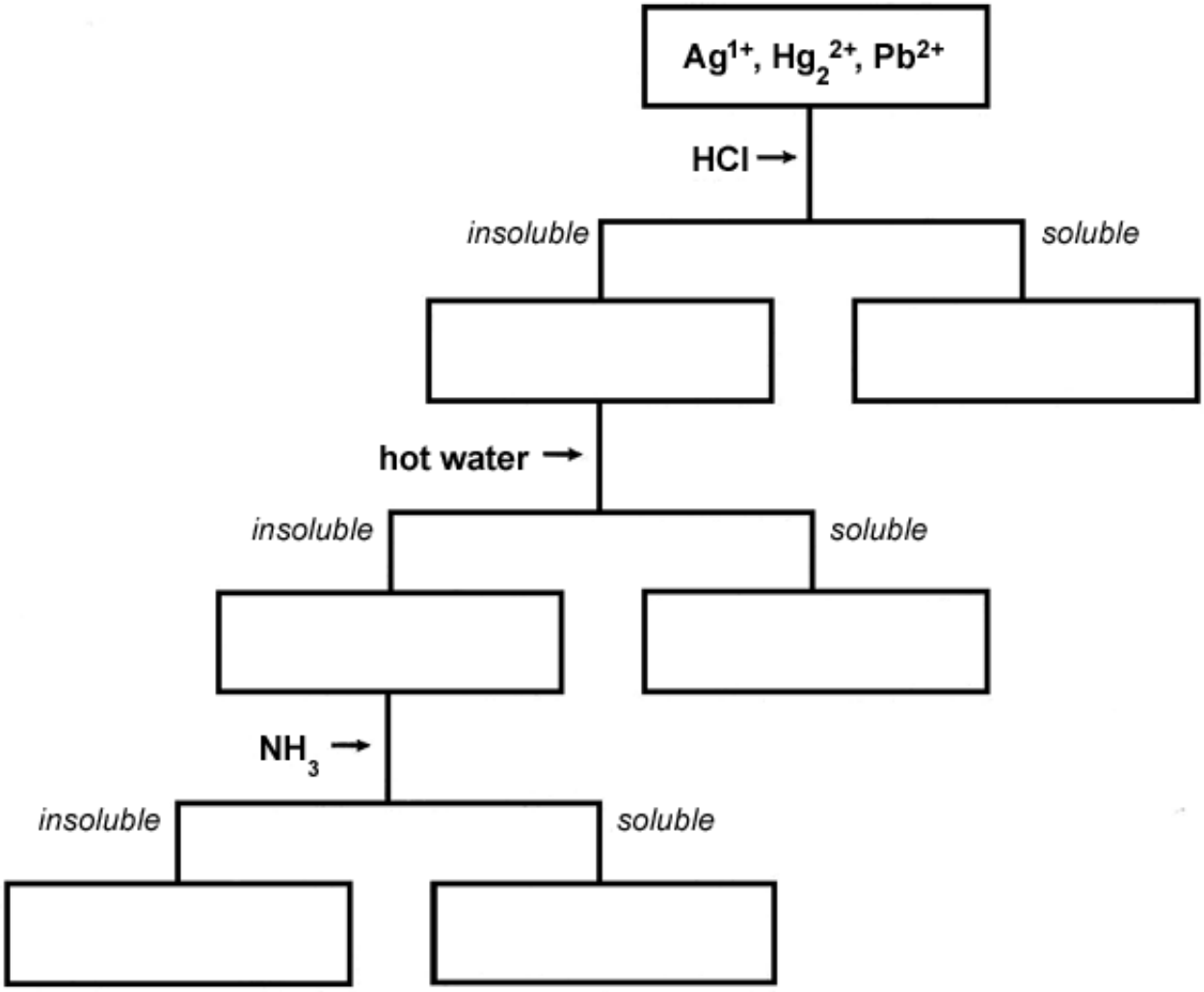
(b) Adding KI to the original Hg_2^{2+} solution gave the same result as adding KI to which of the following solutions from Part A?

- ☐ solution from ammonia
- ☐ solution from HCl
- ☐ solution from hot water
- ☐ none of these

(c) Adding KI to the original Pb^{2+} solution gave the same result as adding KI to which of the following solutions from Part A?

- ☐ solution from ammonia
- ☐ solution from HCl
- ☐ solution from hot water
- ☐ none of these

Use the data you have acquired in Parts A and B to complete the flow chart below.



Complete the following table with your results from Part C of the Qualitative Analysis lab. Write the answer that most closely corresponds to your observations.

Data Table C1: Solubility of a Mixture of Ag^+, Hg_2^{2+}, Pb^{2+}

	Mixture of Ag^{1+}, Hg_2^{2+}, Pb^{2+}
Soluble in HCl	
Soluble in hot water	
Soluble in ammonia	

Complete the following table with your results from Part C of the Qualitative Analysis lab. Write the color of the solid formed upon addition of KI to the supernatant.

Data Table C2: Confirmatory Tests for Ions in Mixture of Ag^+, $Hg_2{}^{2+}$, Pb^{2+}

Solution	Color after adding KI solution
Supernatant from HCl addition	
Supernatant from hot water	
Supernatant from ammonia	

Based on your confirmatory tests, describe where the solution ions ended up. (Choose the correct description from the right-hand column for each ion.)

Ag^+

Hg_2^{2+}

Pb^{2+}

A. This ion forms a precipitate with HCl. The precipitate is insoluble in hot water or ammonia.

B. This ion does not precipitate with HCl but will form a precipitate with ammonia. The precipitate is bright yellow in color.

C. This ion forms a precipitate with HCl. The precipitate is insoluble in hot water but is soluble in ammonia. Addition of KI to the ammonia supernatant produces a pale yellow precipitate.

D. This ion forms a precipitate with HCl. The precipitate is soluble in hot water. Addition of KI to the hot water supernatant produces a bright yellow precipitate.

E. This ion does not precipitate with HCl but will form a precipitate in hot water. The precipitate is a dark brown in color.

Enter your data for Tables D1 and D2 and utilize your observations to determine the ions in your unknown mixture. (*Note*: You will not be entering the data from these tables into WebAssign. However, you will need the data and observations to answer later questions that are in WebAssign.)

Data Table D1: Solubility of Unknown Mixture # _____

	Unknown Mixture
Soluble in HCl	
Soluble in hot water	
Soluble in ammonia	

Data Table D2: Confirmatory Tests for Ions in Unknown Mixture

Solution	Results of adding KI solution
Supernatant from HCl addition	
Supernatant from hot water	
Supernatant from ammonia	

Utilize your observations of solubility of the unknown mixture and the confirmatory tests for ions in the unknown mixture to answer the following.

(a) What is the unknown sample?

(b) What ions are present? (Select all that apply.)

- ☐ Ag^{+}
- ☐ Hg_2^{2+}
- ☐ Pb^{2+}
- ☐ No ions are present.

During your lab, Ag^+, Hg_2^{2+}, and Pb^{2+} ions were separated by their solubility in the presence of various anions. (Use the lowest possible coefficients. Include states-of-matter under the given conditions in your answer.)

(a) Write the net reaction that occurs when HCl is added to a solution containing Pb^{2+}. (*Note*: This part is randomized in the WebAssign question, so it may not match the worksheet.)

(b) Write the reaction that occurs when a solution containing $PbCl_2$ precipitate is heated.

(c) Choose the likely reaction that occurs when an aqueous solution of NH_3 is added to a test tube containing solid AgCl and water.

- ☐ $AgCl(s) + NH_3(aq) \rightarrow AgNH_3(s) + Cl^-(aq)$
- ☐ $AgCl(s) + NH_3(aq) \rightarrow [AgCl(NH_3)]^+(aq)$
- ☐ $AgCl(s) + NH_3(aq) \rightarrow Ag^+(aq) + NH_3(aq) + Cl^-(aq)$
- ☐ $AgCl(s) + 2\ NH_3(aq) \rightarrow [Ag(NH_3)_2]^+(aq) + Cl^-(aq)$