

Name: _____ Block: _____ Date: _____

IDENTIFYING UNKNOWN SOLUTIONS USING QUALITATIVE ANALYSIS

The term “qualitative analysis” in chemistry refers to a set of procedures used to identify a particular ion or ions in a given sample when it is not necessary to find out the quantity of any ion present. (Hence the term “qualitative” rather than “quantitative.”) In this lab, you will use qualitative analysis to identify four unknown solutions.

OBJECTIVE:

To identify four unknown solutions using only a spot plate, stir stick, a chart showing the colour of ions in aqueous solutions, a table of solubility and the solutions themselves.

MATERIALS:

- set of 4 unknown solutions
SET 1: $\text{Ba}(\text{NO}_3)_2$, CuSO_4 , Na_2CO_3 , NaOH
SET 2: KI , NaOH , $\text{Pb}(\text{NO}_3)_2$, $\text{Fe}(\text{NO}_3)_3$
- chemical spot plate
- several wooden stir sticks / toothpicks
- colour chart for ions in aqueous solutions
- table of solubility
- safety goggles and apron
- ***make sure you list all safety precautions for the chemicals***

PROCEDURE:

- *You must come up with the procedure for analyzing and identifying your aqueous solutions on your own.*
- *The procedure must include **disposal** for each of the chemicals in your SET. (Look up the MSDS forms.)*
- *Your procedure must show the steps you will use in the lab itself.*
- ***This must be written out in ink prior to the lab and be approved by the teacher.***

OBSERVATIONS:

- *initial appearance/condition/state of all reactants*
- *final appearance/condition/state of all products*
- *note whether a precipitate was formed as well as its colour, how long it took to form and whether it was heavy or light*
- *all changes and other activity occurring during the experimental procedure*
- *anything else of note that occurs during the experiment*
- *a table to present the results of any reactions would be useful 😊*
- *be sure to note the identifying letter of the unknown substances in your observations / data table*
- ***don't forget to get your observations signed before leaving the lab!***

DISCUSSION QUESTIONS:

Make sure you put all answers in complete sentences.

1. Using a chart that shows the colour of common ions in aqueous solution, can you identify any of your unknowns based on this information? Explain.
2. Which solutions that you mixed formed a precipitate? Can you identify any of the unknown solutions based on this result? Explain.
3. Are there any reactions that have no precipitate formation? Can you identify any of the unknown solutions based on this result? Explain.
4. Write out formula, complete ionic and net ionic equations for each of the reactions producing a precipitate. Make sure you include the states (aq, s).
5. For reactions not producing a precipitate, write out formula equations showing soluble compounds label (aq) to indicate their solubility.

CONCLUSION:

Some ideas:

- *identify each of your unknowns and explain how you decided*
- *summarize your results by completing the net ionic equations for those reactions that produced precipitates*
- *describe the general procedures used to identify unknown solutions*
- *explain any problems or obstacles you had and possible solutions to those problems*
- *relevance – where might this technique be useful in the real world?*
- *give at least two sources of error (these are sources of error, not your mistakes)*

Appendix 1.4: Colour Chart for Ions in Aqueous Solutions

Ion	Symbol	Colour
Chrome(II)	Cr^{2+}	Blue
Chrome(III)	Cr^{3+}	Green
Cobalt(II)	Co^{2+}	Pink
Chromate	CrO_4^{2-}	Yellow
Dichromate	$\text{Cr}_2\text{O}_7^{2-}$	Orange
Copper(I)	Cu^+	Green
Copper(II)	Cu^{2+}	Blue
Iron(II)	Fe^{2+}	Green
Iron(III)	Fe^{3+}	Pale yellow
Manganese(II)	Mn^{2+}	Pink
Permanganate	MnO_4^-	Purple
Nickel(II)	Ni^{2+}	Green