**CH 204 Spring 2008**
**Dr. Brian Anderson**
**Experiment 3 Help Sheet**

**Discussion questions:**

You should have a total of 15 different precipitation reactions from your observations in lab. Five of the reactions turned a cloudy white due to unavoidable trace contaminants in the chemicals, and not due to a reaction between the intended reactants themselves. These are *false positives*. These five are not among the 15 reactions we are looking for.

$Na_2S + HCl$
$Na_2S + H_2SO_4$
$Na_2S + HNO_3$
$Na_2S + Ba(NO_3)_2$
$Ba(NO_3)_2 + NaOH$

For each of the 15 precipitates formed, you will need to write a *molecular equation* and a *net ionic equation*. That means 30 equations total. These 30 equations make up 30 points out of the 40 points your lab report is worth, so get them right! *Remember to write the correct charges on the ions!*

If you are not sure what a molecular equation and a net ionic equation look like, check the lecture slides for Experiment 3, available at

http://courses.cm.utexas.edu/banderson/ch204/ppts.html

For more on writing these equations, look at pages 99 – 105 in Zumdahl (the current 302 textbook).

**Post-Lab**

**Question 1**: If you don't know how to come up with the formulas for these compounds, look at pages 34 – 38 in Zumdahl, and pages 40 – 42 for some examples. Each of these three compounds is a precipitate. For each one what you need to do is write a net ionic equation for the reaction that formed the precipitate, and then add counter ions to the two reagents and create a balanced molecular equation for the reaction. The easiest and most foolproof way to make molecular equations out of net ionic equations is to always stick with safe counter ions (those that are *always soluble*).

**Post-lab problems 2 and 3** can be answered using the same 11 reagents we used in lab. To make life easier for yourself and for your TA, limit your answers to those 11 choices.

*If you choose something other than those 11 reagents, your TA will mark it wrong!* (There are an endless variety of chemically correct answers to each of these questions, and your TA does not have enough time to verify every obscure choice that Google comes up with.)

**Question 2**: Imagine that you have two beakers sitting in front of you. One beaker holds an aqueous solution of the first chemical listed, and the other beaker is an aqueous solution of the second chemical. What you need to do for each of these problems is find ***one chemical that we used in lab*** that you could add to both beakers that would enable you to tell which beaker holds which of the two chemicals. The key here is to find something that will form a precipitate with one of the chemicals listed, but not with the other. For problem 2a, for example, you're going to be looking for a chemical that will form a precipitate with $K_2S$, but not with $Ba(NO_3)_2$. Since the potassium is always soluble, and so are nitrates, you're looking for something that will precipitate with $S^{2-}$ or with $Ba^{2+}$. Use the solubility chart in Appendix 2 of the lab manual to find suitable answers for these.

*Hint:* The chemical you add has to be a *compound*. You can't just add $SO_4^{2-}$ to a solution, but you can add $H_2SO_4$. To ensure that your counter ion doesn't also precipitate out something in the beaker, always use a Group I metal or an anion like nitrate that you know will always be soluble (in this example $NO_3^-$ is the counter ion).

*Remember:* All of your answers to these questions must be among the 11 known solutions from Part I of this experiment, or they will be marked wrong!

**Question 3:** This one is just like the problems in Question 2, but instead of having only two unlabelled beakers in front of you, there are five. You have to add one reagent from the 11 we used in lab that will enable you to identify one of the five reagents. For example, if you add $Ba(NO_3)_2$ to a sample from each bottle, the one that forms a precipitate will be the $MgSO_4$ (because you will form $BaSO_{4(s)}$ and none of the other anions in those five bottles will precipitate with $Ba^{2+}$.) Then you have to find another reagent from the 11 we used in lab that will enable you to identify one of the remaining four bottles. Keep doing this until there is only one bottle left. What you are looking for in each case is a reagent that will either precipitate with *only one* of the unknowns, or a reagent that will precipitate with all of them *except* one.

To simplify your task, you can choose reagents from the subset below: HCl, $HNO_3$, $H_2SO_4$, $Ba(NO_3)_2$, $Na_2S$, and $AgNO_3$.

Use the solubility table on page A-5 of the lab manual to guide you in determining which compounds are and are not soluble. Your observations in Part I of this experiment may also help you find suitable choices for questions 2 and 3. *Don't choose any "slightly soluble" precipitates from the solubility table unless you saw those precipitates in the lab!*