

CHEM 1405 – Identifying 5 solutions Lab Report

Objectives: (1) To identify five unknown solutions by comparing their reactions with those of five known solutions. These will be pdf files from the simulation that you submit to the dropbox. (2) To write balanced molecular, complete ionic and net ionic equations for reactions that occur between known solutions. These will be scanned hand-written document submitted to the dropbox.

Background: In this experiment five known solutions will be reacted with each other. Observations will be made specifically looking for a precipitate or gas bubbles. If a precipitate is formed, you will also note its color. Observations will be recorded using the following guide.

Table 1: Recording Observation

Observation	Symbol to record
Gas bubbles formed	G
White precipitate	W
Yellow precipitate	Y
Black or gray precipitate	B
No reaction observed	X

The reactions with unknowns will then be performed and the results compared to those of the knowns. Based on the results, the identity of the unknown solutions can be determined. Finally, reactions are written for each of the two known solutions mixed that produced a precipitate or gas. To predict the products, double displacement reactions are assumed.

Procedure:

Given that this experiment will be done with a simulation, no PPE is required. Find the experiment simulation at <http://web.mst.edu/~gbert/droppers/droppers.html>

Simulation Instructions:

Practice using the tools in the simulation. Try adding solutions to the well plate and look for reactions to occur. Click on the blue links on the right to see what happens when you select new problem, knowns/unknowns, check your work, etc. Most of the reactions can be seen best with a black background so I recommend starting with a black background to make initial observations. Practice using the arrows to provide a black background. After making observations with the black background, use the white background to ensure that you didn't miss an observation of a black/gray solid formed. Simply exploring is the best way to learn the simulation, but if you would like the instructions they are on the right hand side of the simulation screen and also included [here](#). Once you are comfortable using the simulation tools, proceed with the experiment and complete the data sheet and post lab questions. The grade for this lab will be based on the printed simulation results that you will submit to the drop box in D2L as well as the scanned hand-written Chemical Equations.

On the honor code, students can try the initial knowns/unknowns as many times as needed to get the correct answer, but the new solutions portion of the lab can only be performed once.

Experiment:

Initial 5 knowns/unknowns

1. The initial 5 solutions are $\text{Pb}(\text{NO}_3)_2$, KI , K_2CO_3 , HNO_3 , and $\text{Ba}(\text{NO}_3)_2$. If these are not the solutions on the simulation page, refresh the page. They may not be in this order.
2. Before you begin adding chemicals, click on record your observations – a blue link at the top right of the screen. Then use the arrows to make the background black.
3. Perform the reaction in the required wells by mixing one drop of each solution. For each reaction performed, make observations with both the white and black background and then select the pencil and record your observation for that well.
4. When all of the reactions have been performed click on knowns/unknowns – a blue link at the top right of the screen. The same chemicals will now appear in randomly assigned droppers labeled 1 – 5. The goal is to determine the identity of 1 – 5 using the reaction observations of the knowns and the unknowns.
5. Before you begin adding chemicals, click on record your observations – a blue link at the top right of the screen. Then use the arrows to make the background black.
6. Perform the reaction in the required wells by mixing one drop of each solution. For each reaction performed, make observations with both the white and black background and then select the pencil and record your observation.
7. Compare the results of the known and unknown reactions. You can alternate between the results by selecting knowns/unknowns – a blue link at the top right of the screen.
8. When you have matched all of the unknown chemicals to a known formula, click on check your results – a blue link at the top right of the screen.
9. Click on the number of the unknown that corresponds to each compound listed on the left and then click check results.
10. Click on prepare for print. Enter your name and print this to pdf for submitting to the drop box on D2L.
11. Repeat this portion until you have a fully correct result and are confident in your ability to perform the experiment and correctly identify unknown chemicals using your results. To repeat with the initial chemicals you will need to refresh your page. You will only submit your final correct result for this portion of the lab.

Alternative 5 knowns/unknowns

On the honor code, this portion can only be completed once. If you make a mistake while adding chemicals, feel free to clean all the wells and add the chemicals again, but once you select check your result the result must be printed and submitted as your final result to be graded.

1. Click on new problem – a blue link at the top right of the screen. This should give you a different set of five solutions than the original 5.
2. Perform the reaction in the required wells by mixing one drop of each solution.
3. When all of the reactions have been performed select record your observations – a blue link at the top right of the screen. Alternatively, you can opt to record each one as you go, just make sure you select record your observations before you start using the pencil or they won't be recorded.
4. Click on knowns/unknowns – a blue link at the top right of the screen. This will change the chemicals available to the unknowns labeled 1 – 5.
5. Perform the reaction in the required wells by mixing one drop of each solution and record the results for each in the simulation program.
6. When all of the reactions have been performed select record your observations – a blue link at the top right of the screen.
7. Click on check your results – a blue link at the top right of the screen.

8. Click on the number of the unknown that corresponds to each compound listed on the left and then click check results.
9. Click on prepare for print. Enter your name and print this to pdf for submitting to the drop box on D2L.
10. Repeat for up to 3 results if you do not correctly identify the unknowns on your 1st and/or 2nd try.

Chemical Equations:

For the 5 initial known chemical solutions - $\text{Pb}(\text{NO}_3)_2$, KI , K_2CO_3 , HNO_3 , and $\text{Ba}(\text{NO}_3)_2$ write the balanced molecular equation, complete ionic equation, and net ionic equation for each reaction that resulted in a precipitate or production of a gas. There should be 4 total. Make sure that all equations are balanced and include states for each reactant and product.

1. Reaction that produced the yellow solid.

- a. Balanced Molecular Equation

- b. Complete Ionic Equation

- c. Net Ionic Equation

2. Reaction that produced the bubbles.

- a. Balanced Molecular Equation

- b. Complete Ionic Equation

c. Net Ionic Equation

3. Reaction that produced one of the white solids.

a. Balanced Molecular Equation

b. Complete Ionic Equation

c. Net Ionic Equation

4. Reaction that produced the other one of the white solids.

a. Balanced Molecular Equation

b. Complete Ionic Equation

c. Net Ionic Equation

Instructions for simulation

Five Droppers (Beral pipets) contain the solutions.

Cotton Swab(s)

Pencil

48-Well Plate, viewed from above

Black Arrows to move a black background behind the plate.

Operations:

Click on a dropper to position it over the plate.

Click on a well to position the dropper over it.

Click again to deliver a drop of solution into that well.

Empty and Clean a Cell:

Click on the cotton swab.

Click twice on the cell you want to clean.

Record an Observation about a Cell:

Click on the cell.

Click on the pencil.

You are asked to type an observation for that cell:

X = no observation

G = gas bubbles

W = white precipitate

Y = yellow precipitate

B = black or gray precipitate

Click on record your observations to view them.