

Pre-lab: Experiment 8 Double Displacement

Format & Clarity of the Report: See lab report checklist. You are graded on how you format the lab and record your data, not just data collection.

Before class starts: Read the lab for the week carefully before you start writing your pre-lab. The purpose, introduction, and procedure should be neatly written in your lab book before class starts. Keep the introduction and the purpose separate. Pre-lab questions need to be correctly answered.

Spacing: You will probably use 2 pages for your purpose and procedure, 2 pages for the data table, and results table, 1 page for the questions, 1 page for the NIE work sheet. If you allot an appropriate amount of space, you will not have to mix labs together if you have to do more than one in a week. It makes life neater!

Purpose: You will explore some common reactions that occur in aqueous solutions. You will make general observations that occur in common double displacement reactions. Part 1 needs a purpose, part 2 does not.

Introduction: YOU ARE NOT WRITING AN INTRODUCTION!

You need to read the lab carefully. You can't prepare for this during lunch, and you definitely can't do this lab without reading it at least twice. You are verifying the solubility chart and reaction profile for double displacement reactions. When you do each test, you will need to take detailed observations. Think about your results. Are you surprised by this result, or was it an expected result? Put the solubility table given in the lab instructions in the **Data Table** section.

Pre-lab question: None-Only Post-lab questions

Part 1: Procedure: As I said before, this lab requires forethought and a little planning. Here are some suggestions. First, read the procedure carefully. Make sure you have space to write your observations. This is an OBSERVATION lab.

Observing Double Displacement Reactions

- Get a beaker for slops; a 250 or 400 mL beaker should do nicely. You are going to be working with cations of metals, which cannot go down the sink.
- Wash your hands after this class.
- All waste solutions will eventually go in the inorganic waste bottle.
- Clean your test tubes carefully between each solution. You do not want any residual solution from the previous reaction to interfere with your new set of reactions.
- Rinse with distilled water.
- The solutions to be used are kept under the hood. You don't have to use the volumes mentioned in the lab, just keep the volumes of the solutions the same. Watch your concentrations. Some of the solutes are the same, but the concentrations are different.
- It is **important** to use the correct color of litmus and to wet it with distilled water, not tap water.
- Do not write the net ionic equations for the reactions as observations.

Qualitative Observations/Data Collection: Your observations should be written in the observation section of your lab report.

- You will record the appearance of solution **before** you do any reactions with them [don't write yellow without a reference to a solution].
- You will also record the appearance of the resulting reaction (or lack there of).
- What happens in each of the reactions, [did the reactions take a long time? Did a precipitate (ppt) form? Did the color of the solution change? Was a gas evolved? Did the test tube get hot?]
- DON'T USE BALANCED EQUATIONS FOR OBSERVATIONS. THEY ARE CONCLUSIONS.

- Report any errors or difficulties that came up when carrying out the procedure (not waiting long enough for a reaction to take place.)
- CHECK THE BOARD! THERE MIGHT BE EXTRA REACTION COMBINATIONS!

There are a lot of observations. So, what is an observation? Good observations: The solution in the test tube bubbled. A brown ppt formed in the test tube. The solution was clear blue and turned cloudy upon addition of NaOH. Bad observations: green; rxn occurred; test tube bubbled; clear; white; $\text{KNO}_3 + \text{AgCl}$ (a conclusion!). Really bad observations: writing down nothing at all.

Data Tables: Sample observation tables: These are not complete; they are samples. This means you should have good titles and organization. Clearly the space that is allotted is not enough for you to write in. Plan well.

Double Displacement Reactions: Observations

	Solution A	Solution B	Observations: did they react? What did the solutions look like before and after?
1	WtOH	PrNx	Addition of concentrated wiretap hydroxide produced a fluorescent pea green cloud from two clear solutions, an odor of substantiated corruption and allegations of malfeasance emanated from the tube.
2	WwCf	CB	Mixed a solution of Williewonka Chocolatefactory with a solution of Charliebucket. Chocolate fumes and Oommpa Loompas songs emanate from an orange glowing solution.

Calculations: No calculations for this lab

Graph: No graph

Results Tables:

- Have good titles and organization. These tables serve as models. Plan well.
- Notice that the **data table** above only lists observations.
- The **results table** below draws conclusions based on those observations.
- Write the correct molecular, ionic, and net ionic equation for the reactions in which you observed evidence of a reaction properly.
- Indicate formation of a gas, formation of a solid, relative temperature change, color change, odor etc for the reactants and the products. [Most students see 10 possible reactions out of the 14 presented]

Rxn	conclusion	Molecular, Ionic, and Net ionic equations
1	WtNx gas was formed.	$\text{WtAp}_{(aq)} + \text{PrNx}_{(aq)} \rightarrow \text{WtNx}_{(s)} + \text{PrAp}_{(aq)}$ $\text{Wt}^+_{(aq)} + \text{Ap}^-_{(aq)} + \text{Pr}^+_{(aq)} + \text{Nx}^-_{(aq)} \rightarrow \text{WtNx}_{(g)} + \text{Pr}^+_{(aq)} + \text{Ap}^-_{(aq)}$ $\text{Wt}^+_{(aq)} + \text{Nx}_{(aq)} \rightarrow \text{WtNx}_{(g)}$

Questions:

1. A gedanken question: You test the conductivity of aqueous barium hydroxide, aqueous sulfuric acid, and an equi-molar mixture of the two. You repeat the experiment with a solution of barium chloride, a solution of sodium sulfate, and an equi-molar mixture of the two
 - a. What do you expect would happen when the solution of aqueous barium hydroxide is tested? Why?
 - b. What do you expect would happen when the aqueous sulfuric acid is tested? Why?
 - c. What do you expect would happen when the solution of an equi-molar mixture of the two is tested? Why?
 - d. What do you expect would happen when a solution of barium chloride is tested? Why?
 - e. What do you expect would happen when a solution of sodium sulfate is tested? Why?

- f. What do you expect would happen when an equi-molar mixture of the two is tested? Why?
2. You observed several double displacement reactions. How do the reactions performed in the lab compare to the solubility rules? Do they support the solubility rules? Give specific examples of how your data supports the rules. For example: Did the chloride ion behave as expected? What is the evidence of this? (hint-your observations!)
 3. What criteria (compounds or ions present in solution) determines if a reaction is a gas former? [HINT: look at the solubility chart!]
 4. Using the solubility charts, which of the other anions would form precipitates with iron(III) ions.
 5. Using the solubility charts, which of the other anions would also form precipitates with barium ions?
 6. What is the difference between a strong acid and a weak acid?
 7. Using the solubility rules, predict the products and write the balanced molecular, ionic, and net ionic (including phase symbols) for the following reactions.
 - a. Mix aqueous cobalt (III) nitrate with aqueous sodium sulfide.
 - b. Mix aqueous phosphoric acid with aqueous potassium hydroxide.
 - c. Mix aqueous ammonium phosphate with aqueous calcium chloride.
 - d. Mix aqueous potassium bicarbonate with aqueous hydrochloric acid.
 8. Often, solubility rules are used as tests for ions. For example, if you have an unknown salt that you suspect is sodium carbonate or sodium nitrate, you could test the salt with acid. If the addition of acid to the salt causes fizzing, you could presume that the salt contains carbonate because all carbonates react with acid to yield carbon dioxide. Using the solubility chart and thinking about the reactions that you did in the lab; how would you distinguish between:
 - a. Na_2SO_4 and NaCl
 - b. NaCl and NaNO_3
 - c. NaHCO_3 and FeCl_3