

OLD YELLOW!

Introduction:

Two underlying “needs” of the natural world are stability and electrical neutrality. Basically, Newton’s first law of motion reminds us that nature will tend to stay as it is unless it is acted upon by some outside net force. Electric charge creates a force and instability is related to an increase in potential energy. Both of these phenomena are likely to cause changes in matter and the changes that take place in nature do so to remove any net outside force and release energy to provide stability. During the last lab you observed some properties and changes of samples of matter. In this lab you will record detailed observations for use in further exploration of chemical bonding and reactions. The compounds used and the information gathered will be used as the basis for your journey through the processes involved in relatively simple ionic bonding, binary ionic compounds, chemical reactions, and balancing chemical equations. This information will also be needed in determining the eight unlabeled solutions during the Chemistry Finale Mini-lab.

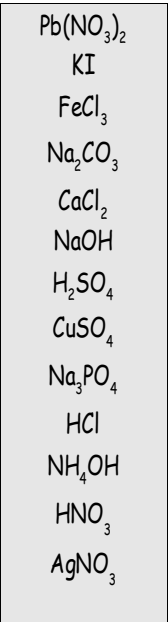
Preliminary Questions:

1. Identify three observations which would cause you to believe a chemical reaction has taken place.
2. Looking at the formulas for each solution, identify one combination of two solutions you think **will not result in a chemical reaction**? Explain your choice.
3. Write the balanced chemical equation for the double displacement reaction of NaOH with Pb(NO₃)₂.

Read the procedure first, then see your teacher to obtain these materials

Reaction template
Reaction surface

13 solutions in dropper bottles
Magnifying glass



Pb(NO₃)₂
KI
FeCl₃
Na₂CO₃
CaCl₂
NaOH
H₂SO₄
CuSO₄
Na₃PO₄
HCl
NH₄OH
HNO₃
AgNO₃

Procedure:

1. Place the reaction surface (overhead transparency) on top of the reaction template (page with X’s).
2. Each group member will need to keep an observation sheet. Simply write down as detailed observations as you can for each combination. Use the row number and column letter to identify each combination. If you observe no reaction simply write **NR**.
3. You may now obtain the 13 solutions. You should be wearing your lab apron and safety glasses until you have finished cleaning up.
4. Follow the instructions on the reaction template so that you combine all 13 solutions in every binary (two at a time) combination. Record as many details about each reaction as you combine the solutions, then go back and look at each column again to see if any other changes may have taken place over time. Please only do one column, or row, at a time so as not to waste any materials if you do not finish before the end of class.
5. **Have your teacher approve your data before continuing.**
6. Dispose of the reaction materials **in the following manner:**
 - a) Place two paper towels flat over the reaction surface and allow the mixture to absorb.
 - b) Carry the reaction surface with towels, to the clean-up area.
 - c) Throw away the towels.
 - d) Rinse the reaction surface with the wash bottle.
 - e) Gently wipe the reaction surface clean and dry.
 - f) Return the reaction surface to you lab area.

Analysis

Part I – Compound formation, formula writing, and compound naming

1. Write the formulas for each of the thirteen solutions used in this lab. Next to each formula write what you think the name of the compound is.
2. Obtain a list of the actual names from your teacher and write the actual names next to your predicted names.
Be sure you have labeled clearly, so you know which are the correct names.
3. Each of these solutions are **binary** compounds dissolved in water, how many different "pieces" (ions) would be required for a **binary** compound?

Have your teacher approve before continuing.

4. One compound at a time, identify each "piece" of each of the thirteen compounds used in this lab. For example: the compound NaCl is composed of sodium and chloride. You should have thirteen sets of "pieces" listed.

Have your teacher approve before continuing.

5. Write a set of "rules" that you think guided where the names of these binary compounds came from.
Suggestion: Use your knowledge of element names, types, location on the periodic table, as well as any similarities among the 13 formulas.

Have your teacher approve before continuing.

6. Like atoms, compounds are electrically neutral. Based on this fact, what must be true about the electrical charge of each "piece" in the compound? Identify what you think the actual charges are (+/-) for each "piece" you listed in #4. Yes you can simply add the + or – to your actual list in #4
7. What force do you think caused these ions to combine and form these compounds?

Have your teacher approve before continuing.

Break for class discussion of chemical stability and bonding.

Part II - #1 is to be done as a group; #2-7 are individual

Chemical reactions and balancing chemical equations

1. Open the file "Yellow Reaction Table". Indicate in the reaction table every combination from the lab and whether or not a reaction was observed. Also include the evidence to support your choice.
2. Look closely at the combinations that resulted in no reaction. There is an "obvious" reason many of these combinations do not react. Look for a pattern by examining the "pieces" of the two solutions involved. What is the pattern? Type your answer in **red** above the table. **NOTE: the pattern fits many, but not all NR's.**

Have your teacher approve before continuing. Save as "Reaction Table" in your period folder.

Part II - #3-7 are to be done individually

3. Each student needs the Old Yellow Reaction Chart (your teacher should have these). Write out all of the combinations involving lead(II) nitrate which resulted in a chemical reaction. Write the combinations first with words, then directly underneath with formulas. The **OLD YELLOW** reaction has been done for you. The result at this point is the reactant side of a chemical equation. You will be writing the product side in the remaining steps. Have your teacher approve before continuing.

Break for class discussion of chemical reactions and balancing equations.

4. **Complete the product side** of each of the lead(II) nitrate chemical equations in words and formulas. Each is a double displacement reaction.
5. **Balance** the lead(II) nitrate chemical equations.

Have your teacher approve before continuing.

6. Identify the proper “state” (*aq* or *s*) of each of the reactants and products. In order to do this you will need to use the table of ionic compound solubility found on the last page of this lab. The *aq* means aqueous, or dissolved in water, and the *s* means a solid. In these types of reactions with substances dissolved in water, the solid is a precipitate, which does not dissolve in water. Place the *aq* or *s* as a subscript following each formula. Ex. $\text{Pb}(\text{NO}_3)_2(\text{aq})$ or $\text{Mg}(\text{OH})_2(\text{s})$
7. What type of chemical reaction is represented by each of the lead(II) nitrate chemical equations?

Compounds containing these ions are insoluble in water unless they also contain these ions, which make them soluble .
carbonate	CO_3^{2-} K ⁺ , Li ⁺ , Na ⁺ , NH ₄ ⁺
hydroxide	OH^- K ⁺ , Li ⁺ , Ba ²⁺ , Na ⁺
oxide	O^{2-}
phosphate	PO_4^{3-} K ⁺ , Na ⁺ , NH ₄ ⁺
silicate	SiO_3^{2-} K ⁺ , Na ⁺
sulfide	S^{2-} K ⁺ , Na ⁺ , NH ₄ ⁺
sulfite	SO_3^{2-} K ⁺ , Na ⁺ , NH ₄ ⁺

Solubility of Common Compounds		
Compounds containing these ions are soluble in water unless they also contain these ions, which make them insoluble .	
ammonium	NH ₄ ⁺	
potassium	K ⁺	
sodium	Na ⁺	
acetate	$\text{C}_2\text{H}_3\text{O}_2^-$	Fe ³⁺ , Al ³⁺ , Hg ₂ ²⁺
chlorate	ClO_3^-	
chloride	Cl^-	Ag ⁺ , Hg ₂ ²⁺ , Pb ²⁺
nitrate	NO_3^-	
sulfate	SO_4^{2-}	Ca ²⁺ , Ba ²⁺ , Pb ²⁺ , Sr ²⁺ , Hg ₂ ²⁺
iodide	I^-	Ag ⁺ , Hg ₂ ²⁺ , Pb ²⁺

Individual Report- Must follow this format. Double-space between sections **(50pts)**

Cover Sheet – separate page

Lab Title, Your name, group, group members, date, class period

Lab Title:

Background Information: In a paragraph use and relate the following terms to provide background information about chemical reactions. (10pts)

chemical change, double displacement, positive ions, negative ions, reactant, product, precipitate, formation of a gas, soluble, insoluble, aqueous, solubility of nitrate

Purpose: State the purpose of the lab. **(3pts)**

Procedure: Summarize the lab procedure in a numbered list include materials used. **(2pts)**

Data & Observations: Attach your *Old Yellow Reaction Chart of the Lead II Nitrate reactions* to the end of the lab report. **(10pts)**

Conclusion: Write the question & answer in COMPLETE SENTENCES!!! (25pts)

1. Based on your data and analysis, which solution do you think is the most reactive? **Provide supporting evidence.**
2. Based on your data and analysis, which solution do you think is the the least reactive? **Provide supporting evidence.**
3. Based on your observations, give 2 reasons why a reaction did not occur for some of the combinations..
Provide supporting examples.
4. What 3 observations provided evidence that a reaction (chemical change) occurred?
5. All of the reactions observed in the lab were double displacement. Double displacement is also called an ion-exchange reaction. Describe the exchange of ions that occurred in the following reaction by predicting the products, then balance the reaction: $\text{NaOH} + \text{AgNO}_3 \rightarrow$
6. According to your data, did a reaction occur for the above reaction.
Provide supporting evidence.
7. Based on your *Old Yellow Reaction Table of $\text{Pb}(\text{NO}_3)_2$ compounds*, what must always be one of the products of a double displacement reaction?
8. What must the other product always be?
9. What was used in the lab to determine 7 & 8 above.
10. Given the reactants of a chemical reaction, describe how you know what elements can go together to predict the products of the reaction.
11. Why do we balance chemical equations and what do we use to balance the equation?
12. If you needed to determine if an unlabeled solution were AgNO_3 or $\text{Pb}(\text{NO}_3)_2$, which one of the remaining eleven solutions would you add to each?
Provide supporting evidence.
13. Write the complete balanced chemical equation for one reaction involving Copper (II) sulfate. Underline the precipitate.

Lab Notebook Scoring (50 pts)

pre-lab (-2 pts/day late) -- 3 pts
Quia pre-lab Quiz (on time only) -- 3 pts
Analysis approval #3 -- 2 pts
Analysis approval #4,6 -- 8 pts
Analysis approval #5 -- 2 pts
Analysis approval #7 -- 2 pts
Analysis #2 -- 2 pts
Analysis #3 -- 6 pts
Analysis #4 -- 11 pts
Analysis #5 -- 11 pts