Lab: Precipitation & Ionic Compounds

In this lab you will observe the formation and practice writing the formulas of various ionic compounds. There are nine different solutions offering a combination of 4 cations and 5 anions. You will mix all 20 combinations and observe which ones make an ionic compound precipitate. To do this, use a 4×6 well plate. Position the well plate with 4 wells across the top and 6 wells along the side (you will NOT use the last row). In each well, you place 5 drops of the cation solution and 5 drops of the anion solution, as indicated on the mixture template below.

A. The purpose of this part of the lab is to observe some chemical reactions resulting in ionic compounds and to determine the formulas and names of the compounds from the reactants (cations and anions).

B. Materials
   - Dropper bottles containing:
     - *Solutions* of $Fe(NO_3)_3$ [Fe^{3+}], $Ba(NO_3)_2$ [Ba^{2+}], $AgNO_3$ [Ag^{+}], $Pb(NO_3)_2$ [Pb^{2+}], for the different cations. The NO_3^- ions are needed for electrical neutrality and do not participate in the reactions.
     - Solutions of K_2CO_3 [CO_3^{2-}], K_2SO_4 [SO_4^{2-}], KI [I^-], KOH [OH^-], and KF [F^-], for the different anions. The K^+ ions are needed for electrical neutrality and do not participate in the reactions.
   - 24-well plate
   - stir stick (optional)
   - Wash bottle with distilled water

C. Procedure:
   i. Obtain the solutions with the 4 different cations and 5 different anions.
   ii. Use the mixture template at right to determine the solutions to put into each well of the well plate.
   iii. Put 5 drops of each cation solution into each well in its column in the well plate and 5 drops of each anion solution into each well in its row. Ions can be added in either order, but
   iv. Stir each well to fully mix the solutions, rinsing stir stick in distilled water between each well.

Mixture Template: Cations and Anions.

		Cations			
		Fe^{3+} Iron (III)	Ba^{2+} Barium	Ag^{+} Silver	Pb^{2+} Lead (II)
Anions	CO_3^{2-} Carbonate				
	SO_4^{2-} Sulfate				
	I^- Iodide				
	OH^- Hydroxide				
	F^- Fluoride				
	Empty				

D. You will find 12-15 different combinations that show a precipitate, indicating that a reaction has occurred. A precipitate has formed if the well has turned cloudy, gelatinous, or has crystals. On Data Table 1, make notes about the appearance of each cell. On Data Table 2, **only for combinations of cations and anions that form a precipitate**, write in the ions, the formula of the compound, its name, and the color and texture of the precipitate. IF A COMBINATION DOES NOT FORM A PRECIPITATE, DO NOT INCLUDE IT ON THE TABLE.

E. **Remove this cover sheet** and hand in only the data tables and questions and answers on the next sheet.

Lab [25 pts]
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NAME_____
Lab Partner(s) _____
Period_____Date _____

Mixture Observations Template. **IMPORTANT: Do not place liquid on this paper. Place solutions in well plate only.** Use this table to make notes about the color and appearance ("texture") of any precipitate. Fill this table in first, then transfer the information to Table 2 when you are done. Any combination that is transparent (even if colored) is considered to be "no reaction" and should not be included in Table 2.

Data Table 1: Properties of Precipitates from various Cations and Anions. [5 pts]

		Cation Formulas & Names			
		Fe^{3+} Iron (III)	Ba^{2+} Barium	Ag^{+} Silver	Pb^{2+} Lead (II)
Anion Formulas & Names	CO_3^{2-} Carbonate				
	SO_4^{2-} Sulfate				
	I^- Iodide				
	OH^- Hydroxide				
	F^- Fluoride				

Data Table 2: Formulas & Names of Precipitates [12 pts]

Cation	Anion	Formula	Name	Precipitate Description

Questions

1. [2 pts] Not all ions behave the same. Certain cations are more likely to precipitate than others. Which cation(s) produced the most precipitates? Which cation(s) produced the least? How many did they each produce?

2. [2 pts] Which anion(s) produced the most precipitates? Which anion(s) produced the least? How many did each produce?

3. [2 pt] For which compound(s) was it *most* difficult to decide if a precipitate formed? Why was it difficult?

4. [2 pts] Which compound(s) contained the most ions? Indicate the number of cations and anions and their charges