**Solubility and Precipitates Lab**

**Introduction**:

Today we will be investigating the **solubility**, or the ability to be dissolved, of various chemical compounds when they are combined together. If they are soluble, they can be referred to as **aqueous** (aq), meaning they can be broken down in water. On the other hand when two substances are unable to be dissolved together a solid, often cloudy substance will form. This solid substance is known as the **precipitate**.

In our experiment, we will be dealing with double replacement reactions in which the two metals will be replacing one another. Using the rules of solubility, we can determine the state of matter of each product we form.

*Solubility Rules*

1. *All elements in Column 1A (alkali metals) and ammonium (NH4) are soluble.*
2. *All compounds containing nitrate (NO3) are soluble*
3. *All compounds containing Column 7A elements (Halogens) with metals are soluble EXCEPT with silver, mercury and lead*
4. *All compounds containing sulfate (SO4) are soluble except with barium, strontium, lead, calcium, silver and mercury.*
5. *All carbonates (CO3), hydroxides (OH), oxalates (C2O4) and phosphates (PO4) are insoluble unless they have an alkali metal/ammonium.*

For example when NaOH combines with AgNO3 we get:

NaOH(aq) + AgNO3(aq) 🡪 NaNO3(aq) + **AgOH(s)**

According to Rule #5, because OH is present without an alkali metal, it is insoluble.

**Materials**:

* Well Plate
* Chemicals
* White Piece of Paper

**Procedure**:

Design your own procedure with the following in mind.

* Each lab station will have two chemicals for you to test. There are 12 chemicals total.
* You will be rotating to a new lab station with your well plate after two minutes.
* Your goal is to determine if a precipitate forms from the two substances you combine together. The rules of solubility are provided on this lab sheet.
* Some of the precipitates will be difficult to see on the black lab station.
* You need to explain this to someone who is entering the class for the first time.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
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3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Pre-Laboratory Questions:**

1. Predict the products (and their state of matters) in this equation below. What type of reaction is this?

AgNO3(aq) + KI(aq) 🡪 type: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Which solubility rule allowed you to determine there was a precipitate present in #1? \_\_\_\_\_\_\_\_\_\_\_
2. How can you tell a precipitate has formed in your well plate? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Why do you think the white piece of paper could be a necessary tool for determining whether a precipitate has formed or not? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Data and Observations:**

Fill out the data table below. In the first row and column, write the substances you are testing. Since there are 12 substances, you put 6 in the top row and 6 in the first column. In each of the boxes, indicate whether a precipitate has formed or not.

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| --- | --- | --- | --- | --- | --- | --- |
| Substances |  |  |  |  |  |  |
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**Post-Laboratory Questions:**

1. Look at your first column of data. Use this information to write balanced equations for each of the six substances you tested with it, and determine which of the two products is the precipitate (if any). Include the rule that allows you to be sure of this.

* 1: (Rule: \_\_\_)
* 2: (Rule: \_\_\_)
* 3: (Rule: \_\_\_)
* 4: (Rule: \_\_\_)
* 5: (Rule: \_\_\_)
* 6: (Rule: \_\_\_)

1. Kidney stones are a huge problem in middle-aged people due to a surplus of insoluble mineral build up. Using relevant vocab, explain why these kidney stones form, and why they can pose as a problem.