

REACTIONS BETWEEN IONS IN SOLUTION

When ionic compounds dissolve in water, they separate into the positively charged metallic ion and the negatively charged nonmetallic(or polyatomic) ion. If two solutions are mixed together, new compounds can form by recombining the positive ions from one compound with the negative ions from the other compound. Some evidence of a chemical change must occur to verify the formation of a new substance, rather than just a mere physical mixing of the two solutions. The identity of any precipitates formed can be determined using the solubility chart provided below. Soluble means that the compound will dissolve in water and NOT precipitate out of solution.

Objective:

to practice; 1) writing formulas 2) naming compounds 3) predicting and verifying products

Procedure:

1. Write formulas for the 8 compounds listed here:

1. sodium phosphate	2. calcium acetate	3. lead (II) nitrate
4. barium chloride	5. ammonium sulfate	6. potassium carbonate
7. copper (II) sulfate	8. potassium iodide	
2. Consider **all** possibilities of reactions between the eight compounds. Prepare a data table to record the results from all possible pair combinations.
3. Mix 1-2 drops of the solutions together on a reaction grid according to the possibilities considered in #2. Avoid skin contact with any of the chemicals used in the lab.
4. Record observations for any chemical changes that occurred when the solutions were mixed. Wash the reaction grid with soap and water, dry with a towel, and return to the stock table.

Results:

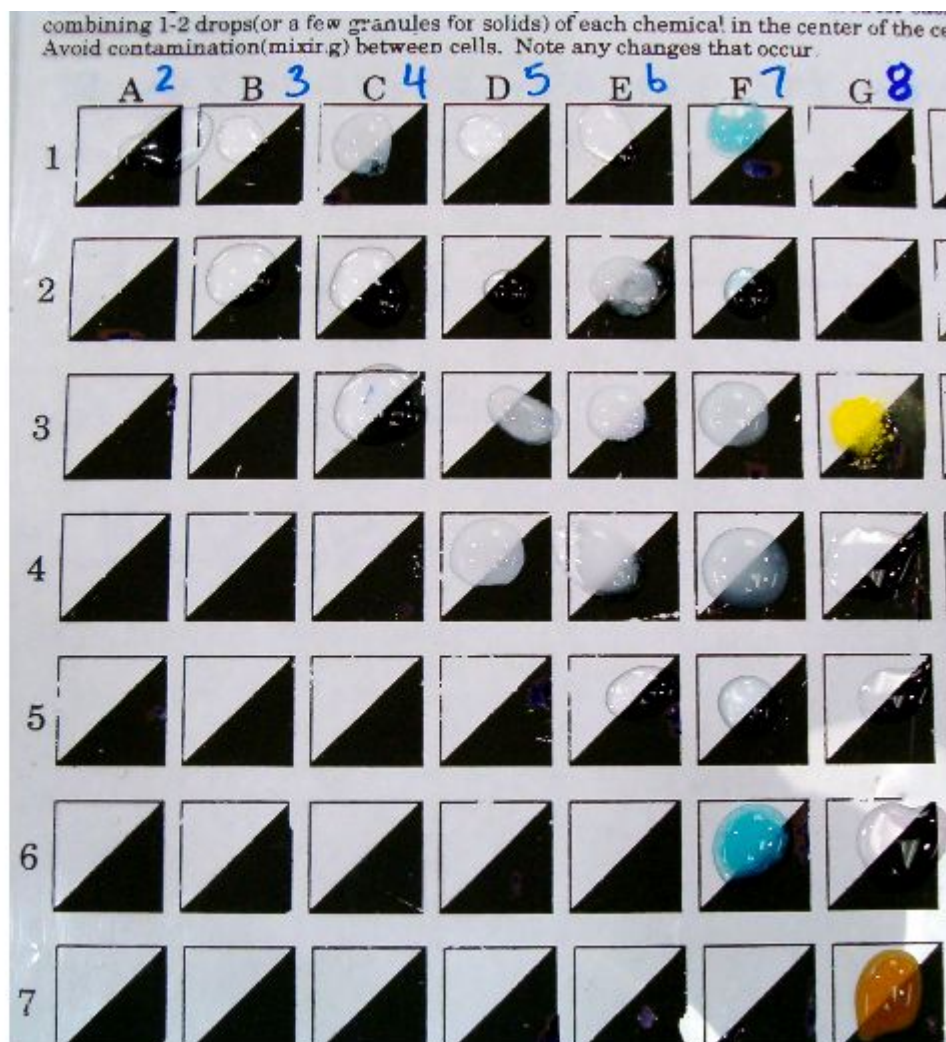
1. For any mixture where a reaction occurred, write a word equation listing the names of the compounds that reacted and the names of the new compounds that could have formed. Remember that a compound must contain a positive ion attached to a negative ion!
2. Write the correct chemical formulas for the two new compounds that could be formed by the reaction.
3. Identify the product that would form a precipitate based upon the solubility rules described below. (**Note:** The only solubility rules needed for the AP Chemistry Exam are that all potassium, sodium, ammonium and nitrate compounds are soluble.)

When working with water solutions, it is helpful to have a few rules concerning which substances are soluble, and which will form precipitates. The more common **solubility rules** are listed below:

1. All common salts of the Group IA(Li, Na, K, etc) elements and the ammonium ion are soluble.
2. All common acetates, nitrates, chlorates and hydrogen carbonates are soluble.
3. All binary compounds of Group VIIA elements(other than F) with metals are soluble, except those of silver, mercury (I), and lead.
4. All sulfates are soluble except those of barium, strontium, lead, calcium, silver, and mercury (I).
5. Except for those in Rule #1, carbonates, hydroxides, oxides, and phosphates are insoluble.

Results from mixing the 8 solutions together in all possible pair combinations

1. Sodium phosphate
2. Calcium acetate
3. Lead (II) nitrate
4. Barium chloride
5. Ammonium sulfate
6. Potassium carbonate
7. Copper (II) sulfate
8. Potassium iodide



Initially, all solutions are clear and colorless, with the exception of copper (II) sulfate, which has a blue color. Solids are formed by new, insoluble compounds that are produced during chemical reactions between two of the original solutions.

Lab Quiz: Ions in Solution

1. A solid formed when two clear solutions mix is called a A)residue B)precipitate C)filtrate D)distillate.
2. Sodium chloride(table salt) is soluble, which means that when it is dropped into water, it will A)separate into ions B)remain a solid C)float on top D)form molecules.
3. The correct chemical formula for the compound sodium phosphate is A) Na_3PO_3 B) Na_3P C) Na_3PO_4 D) NaPO_4 .
4. The correct chemical formula for the compound copper(II) sulfate is A) Cu_2SO_4 B) $\text{Cu}(\text{SO}_4)_2$ C) Cu_3SO_4 D) CuSO_4 .
5. The correct name for the compound BaCl_2 is A)barium chloride B)beryllium chloride C)barium chlorite D)barium chlorate.
6. The correct name for the compound $\text{Pb}(\text{NO}_3)_2$ is A)lead(II) nitrite B)lead(II) nitrate C)lead(II) nitride D)lead(IV) nitrate.
7. When calcium acetate reacts with ammonium sulfate, the name of the new compound formed is A)calcium ammonium B)calcium sulfate C)ammonium calcitate D)acetate sulfate.
8. When BaCl_2 reacts with KI, the formula of the new compound formed is A) BaI B) KCl_2 C) BaI_2 D) BaK .
9. When silver nitrate is mixed with calcium acetate, the result is A)no reaction B)gas bubbles C)a yellow solid D)a blue solid.
10. The ion that reacts to form many different solids is A)potassium B)ammonium C)sodium D)silver.