

Keeping it in the Family

CONCEPTS

Families

Balancing Chemical Equations

Types of Reactions

OBJECTIVE

Mixing solutions, students will be able to identify similar chemical and physical properties indicating a group/family of elements; balance chemical equations; identify reaction type.

Solution containing silver ions (silver nitrate) will be mixed with salts (potassium chloride, potassium bromide, potassium iodide), drop wise, in various proportions to determine the properties of the precipitate formed. Students will analyze the proportion that provides the best precipitate. Using prior knowledge of writing balanced chemical equations, students should write balanced chemical equations and compare the equation to their data (theoretical vs. actual). Lastly, students will determine the type of reaction that is the focus of this lab (double displacement). When discussing theoretical vs. actual, can focus on sources of error.

MICHIGAN MERIT CURRICULUM REQUIREMENTS

C1.1E - Describe a reason for a given conclusion using evidence from an investigation.

C1.1D - Identify patterns and relate them to theoretical models.

C4.9A - Identify elements with similar chemical and physical properties using the periodic table.

C5.2A - Balance simple chemical equations applying the conservation of matter.

C5.2B - Distinguish between chemical and physical changes in terms of the properties of the reactants and products.

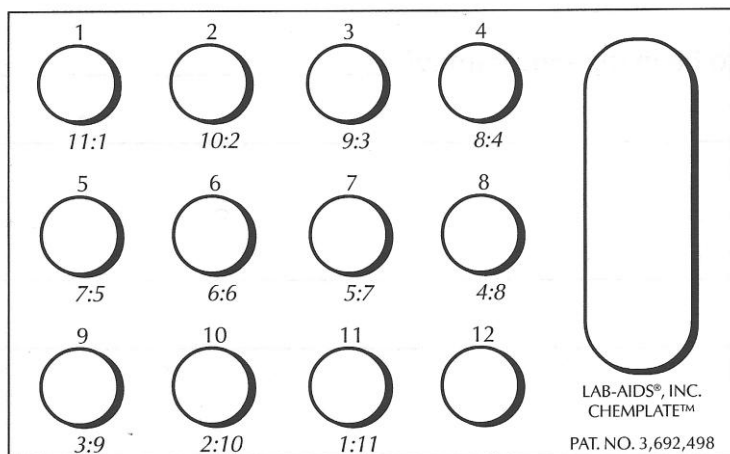
MATERIALS

For each group of 2 to 3 students:

- Solutions of silver nitrate, potassium chloride, potassium bromide, potassium iodide, and potassium sulfide.
 - The solutions have the same molarity and the total number of drops is always 12. Therefore, each drop contains the same number of ions.
 - Students must be very accurate with the number of drops into each well.
- Clear well plates with 12 wells
- Toothpicks

PROCEDURE

- Use the well plate to mix the ions in proportions from 11:1 to 1:11 in wells 1-11 (see diagram of well plate. It is important to hold the bottle in a vertical position to add the drops consistently. If using disposable pipettes, be sure to use consistent drops. Notice that the total number of drops is always 12.



- Add drops of silver nitrate and potassium chloride as directed in the diagram, beginning with 11 drops of silver nitrate and 1 drop of potassium chloride.
- Use a toothpick to mix the solutions in the wells.
- Record all data on the Data Chart. (Note the proportion to record is the simplified proportion that provides the best precipitate.)
- Dispose of the chemicals in the well plate as instructed by your teacher.
- Rinse the well plate thoroughly and dry it.
- Repeat steps 2 through 7 with silver nitrate and potassium bromide.
- Repeat steps 2 through 7 with silver nitrate and potassium iodide.
- Repeat steps 2 through 7 with silver nitrate and potassium sulfide.

Number of drops of each solution that forms the greatest amount of precipitate		Properties of precipitate formed	Proportion
Silver nitrate 6	Potassium chloride 6	Silver chloride: milky white precipitate	1:1
Silver nitrate 7	Potassium bromide 5	Silver bromide: white precipitate	1:1
Silver nitrate 6	Potassium iodide 6	Silver iodide: whitish precipitate	1:1
Silver nitrate 8	Potassium sulfide 4	Silver sulfide: black precipitate	2:1

Balance the chemical equations for the reactions:

1. silver nitrate and potassium chloride yields silver chloride and potassium nitrate

2. silver nitrate and potassium bromide yields silver bromide and potassium nitrate

3. silver nitrate and potassium iodide yields silver iodide and potassium nitrate

4. silver nitrate and potassium sulfide yields silver sulfide and potassium nitrate

Analysis:

Which of the elements appear to be in the same family? Why?

Chlorine, bromine, and iodine - proportions is 1:1

What type of reaction(s) took place?

Double displacement

What family of elements is the focus of this lab activity?

Halogens

What are the possible sources of error in this lab activity?

Drops are not consistent in size.

Name: _____ Class: _____ Date: _____

Keeping it in the Family

PURPOSE

When combining silver nitrate with various salts, a precipitate is formed. A precipitate is a solid. In this activity you will combine a solution containing silver ions (silver nitrate) with salts (potassium chloride, potassium bromide, potassium iodide), drop wise, in various proportions to determine the properties of the precipitate formed.

Groups which are located in the columns of the Periodic Table form compounds with similar formulas and physical properties. You will be able to determine the elements that are in the same family and the formulas of the compounds they form.

Using prior knowledge of writing balanced chemical equations, you will write balanced chemical equations and compare the equation to their data (theoretical vs. actual).

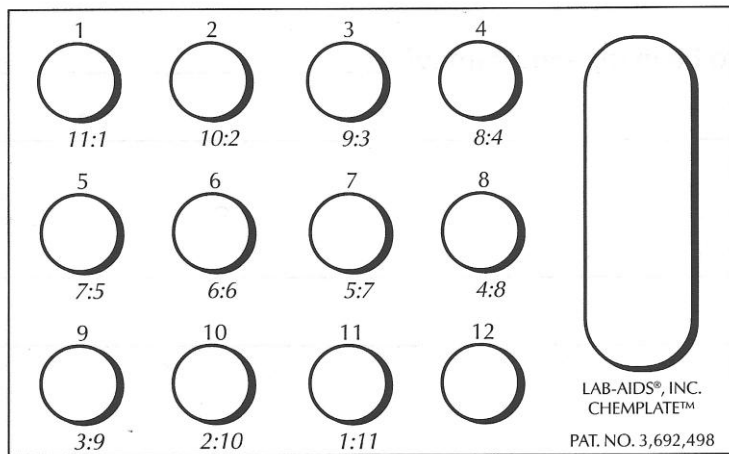
MATERIALS

For each group of 2 to 3 students:

- Solutions of silver nitrate, potassium chloride, potassium bromide, potassium iodide, and potassium sulfide.
 - The solutions have the same molarity and the total number of drops is always 12. Therefore, each drop contains the same number of ions.
 - Students must be very accurate with the number of drops into each well.
- Clear well plates with 12 wells
- Toothpicks

PROCEDURE

1. Use the well plate to mix the ions in proportions from 11:1 to 1:11 in wells 1-11 (see diagram of well plate. It is important to hold the bottle in a vertical position to add the drops consistently. If using disposable pipettes, be sure to use consistent drops. Notice that the total number of drops is always 12.



2. Add drops of silver nitrate and potassium chloride as directed in the diagram, beginning with 11 drops of silver nitrate and 1 drop of potassium chloride.
3. Use a toothpick to mix the solutions in the wells.
4. Record all data on the Data Chart. (Note the proportion to record is the simplified proportion that provides the best precipitate.)
5. Dispose of the chemicals in the well plate as instructed by your teacher.
6. Rinse the well plate thoroughly and dry it.
7. Repeat steps 2 through 7 with silver nitrate and potassium bromide.
8. Repeat steps 2 through 7 with silver nitrate and potassium iodide.
9. Repeat steps 2 through 7 with silver nitrate and potassium sulfide.

Number of drops of each solution that forms the greatest amount of precipitate		Properties of precipitate formed	Proportion
Silver nitrate	Potassium chloride		
Silver nitrate	Potassium bromide		
Silver nitrate	Potassium iodide		
Silver nitrate	Potassium sulfide		

Balance the chemical equations for the reactions:

1. silver nitrate and potassium chloride yields silver chloride and potassium nitrate

2. silver nitrate and potassium bromide yields silver bromide and potassium nitrate

3. silver nitrate and potassium iodide yields silver iodide and potassium nitrate

4. silver nitrate and potassium sulfide yields silver sulfide and potassium nitrate

Analysis:

Which of the elements appear to be in the same family? Why?

What type of reaction(s) took place?

What family of elements is the focus of this lab activity?

What are the possible sources of error in this lab activity?
