

Ammonia Experiments

Student Worksheet

Name _____

Overview: You will be a mad scientist today, decomposing chemicals and rearranging molecules to make new sights ... and smells!

What to Learn: You should know that a decomposition reaction breaks a complicated molecule into simpler ones, and a double displacement reaction happens when two compounds exchange bonds to form new compounds with different properties.

Materials

- 2 test tubes
- test tube rack
- sodium carbonate, Na_2CO_3 ([MSDS](#))
- ammonium chloride, NH_4Cl ([MSDS](#))
- copper sulfate, CuSO_4 ([MSDS](#))
- water
- test tube stopper
- measuring spoon
- gloves
- goggles

Lab Time

Caution: All chemical vapors are best experienced by “wafting,” a procedure that brings the vapor to you, instead of sticking your nose in the test tube, bringing you to the vapors. Please get in the habit of smelling properly. If ammonia vapors can bring unconscious people back to consciousness, you should probably make sure you are sniffing safely.

1. Put 5 centimeters of water in a clean test tube.
2. Add 2 spoonfuls of sodium carbonate (Na_2CO_3). Cap the sodium carbonate bottle and put it aside.
3. With a clean spoon, add 2 spoonfuls of ammonium chloride (NH_4Cl). Seal the test tube with a stopper and shake.
4. Remove stopper and use a wafting motion with your hand to bring the odor of test tube to your nose. Do not put your nose directly to the end of the test tube. You should smell the gas produced in the reaction. Put this test tube in the test tube holder.
5. Wash your hands, then add 3 centimeters of water to a clean test tube.
6. With a clean spoon, add a spoon tip ($\frac{1}{2}$ of the small end of the spoon) of copper sulfate (CuSO_4) to the water. Cap the copper sulfate bottle and put aside.
7. Put a clean stopper on the test tube and shake to dissolve the crystals. The result should be a pale blue solution.
8. Add $\frac{1}{2}$ of the ammonia solution to the copper sulfate solution. Notice the color change!
9. Disposal: Pour liquids down the drain using plenty of water. Throw solid waste into the outside garbage to prevent filling the house with bad smells.
10. Wash all equipment, including the stoppers and measuring spoons.

Reminder: Always wash your hands or gloves, and your chemistry tools, when switching from one chemical to another to avoid contamination that could affect the experiment adversely.

Store: Put all chemicals away in their proper places to keep them organized and ready to be used again. All tools should be put away as well, but make sure that they have been cleaned and dried before storing them. A rule of thumb in chemistry is always wash something three times.

Ammonia Experiments Data Table

Chemical/Reaction	Observations (Color, texture, smell. Describe it all!)
Sodium carbonate (Na_2CO_3)	
ammonium chloride (NH_4Cl)	
sodium carbonate + ammonium chloride ($\text{Na}_2\text{CO}_3 + \text{NH}_4\text{Cl}$)	
copper sulfate (CuSO_4)	
sodium chloride + copper sulfate ($\text{NaCl} + \text{CuSO}_4$)	

Exercises Answer the questions below:

1. Balance the following equation from today's experiment. Make sure there are the same number of each element on each side of the equation: $\text{Na}_2\text{CO}_3 + \text{NH}_4\text{Cl} \rightarrow \text{NH}_3 + \text{CO}_2 + \text{NaCl} + \text{H}_2\text{O}$
2. When you combined sodium carbonate (Na_2CO_3) and ammonium chloride (NH_4Cl), a smelly gas was produced. What was that gas? How do you know?
3. When you added the ammonia solution to the copper sulfate solution, was there a physical or chemical change? How do you know?
4. Predict the products of the following double replacement reaction between silver nitrate and sodium chloride: $\text{AgNO}_3 + \text{NaCl} \rightarrow ? + ?$

Exercises

1. Balance the following equation from today's experiment. Make sure there are the same number of each element on each side of the equation: $\text{Na}_2\text{CO}_3 + \text{NH}_4\text{Cl} \rightarrow \text{NH}_3 + \text{CO}_2 + \text{NaCl} + \text{H}_2\text{O}$
($\text{Na}_2\text{CO}_3 + 2\text{NH}_4\text{Cl} \rightarrow 2\text{NH}_3 + \text{CO}_2 + 2\text{NaCl} + \text{H}_2\text{O}$)
2. When you combined sodium carbonate (Na_2CO_3) and ammonium chloride (NH_4Cl), a smelly gas was produced. What was that gas? How do you know? (Ammonia, because it has a distinct odor. Also, the other products as seen in the chemical equation were carbon dioxide, sodium chloride, and water. These don't smell.)
3. When you added the ammonia solution to the copper sulfate solution, was there a physical or chemical change? How do you know? (A chemical change, because it turned a dark blue color, indicating it was a completely different chemical.)
4. Predict the products of the following double replacement reaction between silver nitrate and sodium chloride: $\text{AgNO}_3 + \text{NaCl} \rightarrow ? + ?$
($\text{AgNO}_3 + \text{NaCl} \rightarrow \text{AgCl} + \text{NaNO}_3$)

Closure: Before moving on, ask your students if they have any recommendations or unanswered questions that they can work out on their own. Brainstorming extension ideas is a great way to add more science studies to your class time.