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Activity # 14

Name _____

Date _____

Date due _____

Activities 10c and 10d - Performing More Examples of Chemical Reactions

Purpose

To perform a number of different chemical reactions, determine what the reactants and products are and write a balanced chemical equation for each one.

Overall Procedure

1. There are three parts to this experiment. Start at Part 1 and work though the lab until all three parts are finished.

2. Before you start a part, carefully read over the whole procedure for that part. Make sure you follow all safety instructions!

Part 1 - A Single Replacement Reaction

Procedure

1. Obtain a test tube rack and one 18 x 150 mm (large) test tube.

2. Go to the "Materials for Part 1" station and obtain a piece (~30 cm.) of bare copper wire. Take this wire back to your lab station along with a small piece of steel wool and clean the wire off with the steel wool. Return the steel wool when you are finished with it.

3. Put on safety goggles! Take your test tube to the "Materials for Part 1" station and fill it about 2/3 full with 0.1 M silver nitrate ($AgNO_3$) solution from the beaker or bottle there. Take your test tube back to your lab station and put it in your test tube rack. **NOTE:** ***Silver nitrate solution can stain your skin or clothes. Wash any spills or splashes immediately with plenty of cold water. If you get any solution in your eyes, immediately rinse them for 15 to 20 minutes and inform your teacher!***

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4. The two reactants in this reaction are copper ($Cu_{(s)}$) and silver nitrate solution ($AgNO_{3(aq)}$). Note the appearance of these two reactants in table 1-1 below:

Table 1-1 Copper and Silver Nitrate Before the Reaction

Reactant	Appearance Before Reaction
$Cu_{(s)}$	
$AgNO_{3(aq)}$	

5. Wrap the copper wire around a pen or pencil to make a coil out of it. Make sure the coil will fit inside the test tube. Make a hook on the top of the coil. (*See the diagram to the right.*) Take the pen or pencil out of the coil and put the coil in the test tube with the $AgNO_3$ solution. Observe what happens to the coil and to the solution right away, at 15 minutes later and near the end of the period. Note the observations in table 1-2 below. Start Part 2 as you're waiting for this one to react.

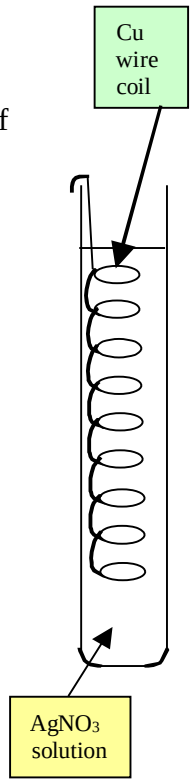

Table 1-2 - Copper in Silver Nitrate Solution

Time	Appearance of Wire	Appearance of Solution
Right after Cu is put into solution		
15 minutes after Cu is put into solution		
near the end of the period		

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6. When you have made your last observation, place the test tube with all contents in a spot designated by the teacher. Do not dump anything out! The silver crystals can be recovered and made into silver.

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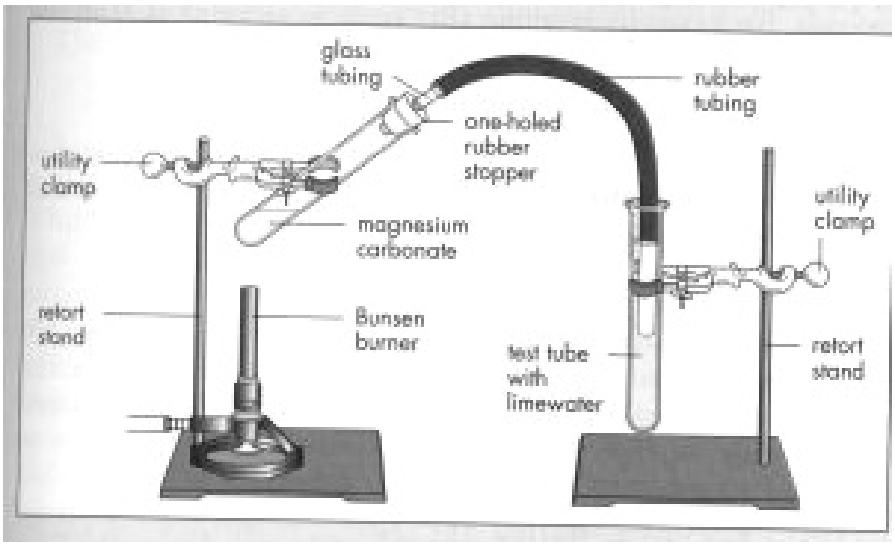
Part 2 - Decomposition of Magnesium Carbonate

Procedure

1. Obtain:

   a Bunsen burner
   two ring stands
   two burette clamps
   two 18 x 150 mm (large) test tubes
   one stopper and rubber hose assembly

2. Set up your equipment as shown in the diagram below:



3. Put on safety goggles!

4. Take the test tube on the left off, take it to the "Materials for Part 2" station, and add enough solid **magnesium carbonate** to fill the test tube about 1/4 full. Take it back to your lab station and securely clamp it back into the assembly so it is at an angle and so that the Bunsen burner fits underneath it. Insert the rubber stopper (*with the rubber hose coming off*) into the end of the test tube.

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5. Unclamp the second test tube (*the one on the right of the diagram*) and take it to the "Materials for Part 2" station. Fill it about 2/3 full of **limewater** solution, and take it back to your lab station.

6. Reclamp the test tube with the limewater onto the ring stand, straight up and down, and place the end of the rubber hose into it so it goes right into the limewater. (*See the diagram above*.)

7. Observe the appearance of the magnesium carbonate and the limewater and record it in table 2-1 below:

Table 2-1 - Magnesium Carbonate and Limewater Solution Before Reaction

Material	Appearance Before Reaction
magnesium carbonate	
limewater solution	

8. Make sure yourself and everyone around you has goggles on.

9. Light the Bunsen burner and adjust it to a small flame. Gently heat the test tube with the magnesium carbonate. Make sure to distribute the heat evenly underneath the magnesium carbonate by moving the flame along the sides of the test tube. Do not overheat the clamp!

10. Continue heating for several minutes, constantly observing the contents of both test tubes. Watch for any change in the amount of magnesium carbonate left in the test tube after several minutes of heating. Watch for bubbles and/or a change in the appearance of the limewater solution. Record all your observations in table 2-2 below:

Table 2-2 - Magnesium Carbonate Test Tube and Limewater Solution After Reaction

The test tube with the...	Observations after heating
magnesium carbonate	
limewater solution	

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11. After you have made observations, ***remove the hose from the limewater solution*** and shut off the Bunsen burner.

12. Remove the test tube with the limewater from the clamp, dump the limewater down the sink and rinse the test tube out until it's clean. Take the clamp that had the limewater test tube off of the ring stand and put it and the ring stand back in their proper place.

13. ***When the test tube with the magnesium carbonate is cool enough to touch***, take it out of the clamp and clean out the solid material. You may need a test tube brush to help you. When the test tube is clean, put it back.

14. When the clamp is cool enough, take it off of the ring stand and put the clamp, ring stand and Bunsen burner back in their proper place. Put the stopper and rubber hose assembly back in the box you got it from. Clean up your lab bench and wash your hands.

Part 3 - Double Replacement Reactions

Procedure

1. Obtain a test tube rack with six (6) 18 x 150 mm. (large) test tubes. Make sure the test tubes are clean. Take them back to your lab bench. (*NOTE: You could use the test tube rack from Part 1 if you still have it one your lab bench. Try not to disturb the test tube from Part 1.*)

2. Put on your safety goggles! ***Most of the solutions in this part of the lab are poisonous or corrosive. Silver nitrate solution can stain your skin or clothes. Wash any spills or splashes immediately with plenty of cold water. If you get any solution in your eyes, immediately rinse them for 15 to 20 minutes and inform your teacher!***

3. Label the test tubes with the numbers 1 to 6.

4. Bring your rack with 6 labeled test tubes to the "Materials for Part 3" station and add enough of each of the following solutions to fill it's test tube to a depth of about 2 cm.. The solutions in each test tube are to be as follows:

Test tube #	Solution
1	**iron (III) chloride**
2	**sodium hydroxide**
3	**sodium chromate**
4	**silver nitrate**
5	**sodium carbonate**
6	**calcium chloride**

When you have finished adding the solutions to your test tubes, bring them back to your lab bench.

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5. Observe the appearances of the solutions in test tube #1 and test tube #2 and record your observations under the "Appearance before Reaction" column in table 3-1 below.

6. Pour the contents of test tube #1 into test tube #2. Observe the results and record them in the "Observations after Mixing" column in table 3-1 below:

Table 3-1 - Reaction Between Iron (III) Chloride and Sodium Hydroxide

Test tube #	Reactant	Appearance Before Reaction	Observations After Mixing
1	iron (III) chloride		
2	sodium hydroxide		

7. Observe the appearances of the solutions in test tube #3 and test tube #4 and record your observations under the "Appearance before Reaction" column in table 3-2 below.

8. Pour the contents of test tube #3 into test tube #4. Observe the results and record them in the "Observations after Mixing" column in table 3-2 below:

Table 3-2 - Reaction Between Sodium Chromate and Silver Nitrate

Test tube #	Reactant	Appearance Before Reaction	Observations After Mixing
3	sodium chromate		
4	silver nitrate		

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9. Observe the appearances of the solutions in test tube #5 and test tube #6 and record your observations under the "Appearance before Reaction" column in table 3-3 on the below.

10. Pour the contents of test tube #5 into test tube #6. Observe the results and record them in the "Observations after Mixing" column in table 3-3 below:

Table 3-3 - Reaction Between Sodium Carbonate and Calcium Chloride

Test tube #	Reactant	Appearance Before Reaction	Observations After Mixing
5	sodium carbonate		
6	calcium chloride		

11. Dump all the contents of the test tubes into the drain or waste container as directed by your teacher. Rinse all the test tubes out and put them and the test tube racks back in their proper places.

12. Clean up your lab bench and wash your hands with soap and water.

****

Questions

1. Look at Tables 1-1 and 1-2 on page 2 of this lab. A slight blue colour in the solution would indicate that copper (II) nitrate has been formed. Was there any hint of blue colour? ____

   Given that the *reactants* and **copper** and **silver nitrate** and that one of the *products* is **copper (II) nitrate**, what do you think the crystals that grow on the wire are made of? (*HINT: The copper has joined up with the nitrate, what does that leave by itself?*)

   Answer_____

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2. Use the Periodic Table and Ion Chart to determine the correct formulas for the *reactants* and the *products*. The formula for copper is just "Cu" and the formula for silver is just "Ag". Put the names and the formulas for reactants and products in the correct place in the following table. Don't get reactants and products mixed up!

	Reactants		Products	
Names				
Formulas				

3. Use the bottom row of this table to write a ***balanced* chemical equation** for the reaction between **copper** and **silver nitrate**.

_____

4. Look at Tables 2-1 and 2-2 on page 4 of this lab. The only *reactant* in this reaction is the **magnesium carbonate**. The limewater was just to test the gas coming off.
*When limewater turns cloudy, it means that **carbon dioxide** gas could be present.*

Did the limewater turn cloudy (milky)? _____. Was carbon dioxide

(CO_2) one of the *products* of this reaction? _____.

5. The other *product* of this reaction was **magnesium oxide**. Determine the correct *formulas* for magnesium carbonate, carbon dioxide and magnesium oxide using the Periodic Table and the Ion Chart and write them in the table below:

	Reactant	Products	
Names	magnesium carbonate	carbon dioxide	magnesium oxide
Formulas			

6. Use the bottom row of this table to write a ***balanced* chemical equation** for the decomposition of magnesium carbonate into carbon dioxide and magnesium oxide.

_____

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7. Look at Table 3-1 on page 6 of this lab. The *reactants* in test tubes 1 & 2 in Part 3 are

   _____ and _____

   The *products* of this reaction are **iron (III) hydroxide** and **sodium chloride.** The iron (III) hydroxide forms a "slurry" or "gel-like" product in the test tube. The sodium chloride remains dissolved in solution.

8. Use the Periodic Table and the Ion Chart to determine the correct *formulas* for both the *reactants* and the *products* in this reaction. Put all the information in the following table:

Reactants and Products in Test Tubes 1 & 2 of Part 3

	Reactants		Products	
Names				
Formulas				

9. Use the last row of the table just above this to help you write a balanced chemical equation for the reaction between the solutions in Test Tube #1 and #2 in Part 3.

   _____

10. Look at Table 3-2 on page 6 of this lab. The *reactants* in test tubes 3 & 4 in Part 3 are

    _____ and _____

    The *products* of this reaction are **silver chromate** and **sodium nitrate.** The silver chromate forms a reddish solid (precipitate) in the test tube. The sodium nitrate remains dissolved in solution.

Questions are continued on the next page…

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11. Use the Periodic Table and the Ion Chart to determine the correct *formulas* for both the *reactants* and the *products* in this reaction. Put all the information in the following table:

Reactants and Products in Test Tubes 3 & 4 of Part 3

	Reactants		Products	
Names				
Formulas				

12. Use the last row of the table just above this to help you write a balanced chemical equation for the reaction between the solutions in Test Tube #3 and #4 in Part 3.

_____

13. Look at Table 3-3 on page 7 of this lab. The *reactants* in test tubes 5 & 6 in Part 3 are

_____ and _____

The *products* of this reaction are **calcium carbonate** and **sodium chloride.** The calcium carbonate forms a white solid product (precipitate) in the test tube. The sodium chloride remains dissolved in solution.

14. Use the Periodic Table and the Ion Chart to determine the correct *formulas* for both the *reactants* and the *products* in this reaction. Put all the information in the following table:

Reactants and Products in Test Tubes 5 & 6 of Part 3

	Reactants		Products	
Names				
Formulas				

15. Use the last row of the table just above this to help you write a balanced chemical equation for the reaction between the solutions in Test Tube #5 and #6 in Part 3.

_____

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Summary

Write a short paragraph summarizing what you did in this experiment. This must be done in complete sentences with proper usage and spelling. Your summary should be brief and to the point but should contain the following:

purpose of the experiment
the three main ***types*** of reactions you did in this lab (You can get these from the titles of Parts 1, 2 and 3.) (*You do **not** need to list the reactants and products for every reaction. This was already done in the questions.*)
what general new information you have learned from this experiment?
what questions you might have as a result of doing this experiment
what you personally felt about this experiment (be honest!)

You may use the rest of this page to write your summary. Hand in this whole hand-out to the teacher when it is complete. Make sure your name is on the top of the front page!