Activity # 12

Activity 10b - Chemical Reactions vs. Physical Changes

DO NOT WRITE ON PAGES 1-7 OF THIS LAB. RECORD OBSERVATIONS AND DO QUESTIONS ON PAGES 8-13 GIVEN ON A SEPARATE HANDOUT

Purpose

In this experiment you will observe a variety of changes. For each change you will carefully examine the energy involved and the products. You will then try to classify each change as a chemical reaction or a physical change.

Materials and Equipment

See the list on page 215 of Science Probe. Add a small jar of **calcium** pieces stored in oil.

Procedure

1. Read through these three procedures before you start. (Your teacher may go over it with you.)

2. Get a pair of safety goggles for each person. ***You must wear these throughout the lab!*** You may also wear a lab jacket or apron.

3. There are **four (4)** different parts to this experiment. You must do all four parts but ***you do not have to start at Part 1***. Start at whichever part your teacher assigns you. You can then continue to do the other parts (it doesn't matter which order) until you have done all four. In this way crowding and line-ups will be minimized. ***When you do each part, look through this handout to find the procedure for that part and follow the directions***. Materials for each part will be available in the lab. Your teacher will show you where all the equipment and materials are.

Part 1 - Heating Metals in a Flame

Record all results for Part 1 in "Table 1" on page 8 of this handout.

Read through all the steps (1-27) of Part 1 before you start it!

1. Get a bunsen burner, a gas lighter a pair of tongs (**not** plastic coated!) and a ceramic gauze pad and bring them to your lab station.

2. Go to the station labeled "Part 1 Materials" and pick up a small piece of each of the following and bring them to your lab station:
   steel wool
   copper wire
   wire solder
   magnesium ribbon
   nichrome wire

3. Take a piece of steel wool and polish each of the pieces of metal.

4. Take the piece of **copper** and record its properties and appearance (eg. colour, shininess, malleability etc.) in the "Appearance of Reactants" column in **Table 1 on page 8** of this handout next to "copper".

5. All students in the group must put on goggles now!

6. Light the bunsen burner and adjust it to a small blue flame. Put the ceramic gauze pad on the lab bench near the burner.

7. Pick up the copper with the tongs and hold the end of it in the flame for 10-20 seconds. Note the colour of the flame under the "Observations" column in Table 1 (*in the row for copper*)

8. Place the hot piece of copper on the gauze pad and note its appearance under the "Appearance after Procedure" column. Note anything else you might see in this column. Place the piece of copper aside to cool. Make sure no one touches it until it's cool!

9. Take the piece of **wire solder** and record its properties and appearance (eg. colour, shininess, malleability etc.) in the "Appearance of Reactants" column in **Table 1 on page 8** next to "wire solder".

10. All students in the group must make sure goggles are on!

11. Pick up the wire solder with the tongs and hold the end of it in the flame until a change occurs. Be careful, it may drip on the table! If it melts, try to let it drip on the gauze pad. Do not touch the hot metal with your hands! Record what happens in the "Observations" column (*in the row for wire solder*).

12. Observe what's left after the change and record what you see under the "Appearance after Procedure" column (*in the row for wire solder*).

13. Take the piece of **magnesium ribbon** and record its properties and appearance (eg. colour, shininess, malleability etc.) in the "Appearance of Reactants" column in **Table 1 on page 8** below next to "magnesium ribbon".

14. All students in the group must make sure goggles are on!

15. Pick up the magnesium ribbon with the tongs and hold the end of it in the flame until a change occurs. ***Do not look directly at the piece of magnesium when it's in the flame! You may harm your eyes!*** Record what happens in the "Observations" column (*in the row for magnesium ribbon*).

16. Observe the white material that's left after the change and record what you see under the "Appearance after Procedure" column (*in the row for magnesium ribbon*). When you have finished observing it, put the white material in the garbage can. (make sure it is cool first!)

17. Take the piece of **nichrome wire** and record its properties and appearance (eg. colour, shininess, malleability etc.) in the "Appearance of Reactants" column in **Table 1 on page 8** next to "nichrome wire".

18. All students in the group must make sure goggles are on!

19. Pick up the nichrome wire with the tongs and hold the end of it in the flame for about 20 seconds. Record what happens in the "Observations" column (*in the row for nichrome wire*).

20. Place the hot nichrome wire on the gauze pad and record what you see under the "Appearance after Procedure" column (*in the row for nichrome wire*). If there appears to be no change, make a note of that. When you have finished observing it, put the nichrome wire aside to cool.

21. Take a small piece of **steel wool** and record its properties and appearance (eg. colour, shininess, malleability etc.) in the "Appearance of Reactants" column in **Table 1 on page 8** next to "steel wool".

22. All students in the group must make sure goggles are on! Make sure **everyone** stands back from the bunsen burner when you do the next procedure!

23. Pick up the steel wool with the tongs and hold the end of it in the flame until an obvious change occurs. Record what happens in the "Observations" column (*in the row for steel wool*)

24. Place the hot steel wool on the gauze pad and record what you see under the "Appearance after Procedure" column (*in the row for steel wool*). When you have finished observing it, put it aside to cool. After it is cool, wet it with water and put it in the garbage can.

25. Clean off the copper and the nichrome wire with steel wool and bring them back to the "Part 1 Materials" station.

26. Return the bunsen burner and the gauze pad to the storage place or give them to a group who is ready to start Part 1.

27. Clean up your lab table. If time permits and this is not your last part, go to another part and follow the procedure for it. If this is your last procedure for the period, wash your hands.

Part 2 - Metal in Acid

Record all results for Part 2 in "Tables 2a & 2b" on page 9 of this handout.

Read through all the steps (1-11) of Part 2 before you start it!

1. Get a test tube rack with two 18 x 150 mm (large) test tubes and a pair of goggles for each partner.

2. Put on your safety goggles. Go to the station for "Part 2 Materials" with one test tube and use the pipette there to put in enough **dilute hydrochloric acid** to fill it to about 2 cm. from the bottom. Take the test tube back to your lab bench and place it in the test tube rack.
NOTE: Hydrochloric acid is corrosive to skin, eyes and clothing. Wash spills and splashes off your skin and clothing immediately, using plenty of water. If you get acid in your eyes, immediately rinse for 15 to 20 minutes at the eye-wash station and inform your teacher.

3. Also pick up a wood splint and some matches at the "Part 2 Materials" station.

4. Ask your teacher for some pieces of **magnesium** and take them back to your lab bench.

5. Describe the appearance of the **magnesium** and the **hydrochloric acid** in the "Appearance before Reaction" column in **Table 2a on page 9**.

6. Make sure everyone close to you has goggles on.

7. Put the pieces of magnesium into the test tube with the hydrochloric acid and observe the change. Feel the bottom of the test tube to see if it is getting warm.

8. Place an empty test tube upside down (inverted) over the mouth of the test tube with the reaction in it to collect any gas which might be formed. (*See figure 10.6 on page 216 of Science Probe text.*)

9. Light a wood splint and test the gas in both test tubes with a burning splint. A "pop", remember, indicates the presence of hydrogen gas.

10. Go the the "Observations" column of **Table 2b on page 9** and record what happened when you put the magnesium in the hydrochloric acid and when you lit the gas with a burning splint. There are two separate changes here. Make sure you put the right observation in the right place.

11. Add water to the test tube and dump the contents down the sink, flushing with more water. Rinse both test tubes out and put them in the test tube rack. Keep them if you are doing part 3 or part 4 next. If not, put them back. If you are doing part 3 or part 4 next, keep the wood splint. If not, make sure the wood splint is out and return unburned portions (if not too short) to the "Part 2 Materials" station. Short pieces of wood splint are to be rinsed with water and put in the waste basket. If this is your last procedure for the period, wipe the lab bench and wash your hands.

Part 3 - Materials in Water

Record all results for Part 3 in "Table 3" on page 10 of this handout.

Read through all the steps (1-11) of Part 3 before you start it!

1. Obtain a test tube rack and three 18 x 150 mm (large) test tubes and pair of safety goggles for each partner and bring these back to your lab bench. (*You may already have some of this equipment if you have just finished another part. In that case, just get what you need.*)

2. If you don't already have a wood splint and a match, go to the "Part 2 Materials" station and get these.

3. Add water to a depth of about 2 cm. in two of the test tubes. Leave the third one empty.

4. To the first test tube, add a small piece of paper. Observe the results in the "Observations" column in **Table 3 on page 10** .

5. Put on your safety goggles, get a small piece (~ 10 cm. long) of paper towel, bring it to the teacher and ask for a piece of **calcium** metal. Bring the calcium metal, on the paper, back to your lab bench. Do not touch it with your hands.

6. Make sure everyone around you has goggles on.

7. Wipe the oil off of the calcium with your paper towel and put the calcium in the water in your second test tube. Observe the results and record them quickly in Table 3 on **page 10**.

8. Collect the gas by taking the empty test tube and inverting it over the mouth of the test tube with the reaction. (*See figure 10.6 on page 216 of Science Probe text*.)

9. Light the splint and test the gas in both test tubes with a burning splint. A "pop" indicates that hydrogen gas is present.

10. Record your results in the "Observations" column in **Table 3 on page 10,** in the appropriate places.

11. Add water to the test tubes and dump the contents down the sink, flushing with more water. Rinse all three test tubes out and put them in the test tube rack. Keep them if you are doing part 2 or part 4 next. If not, put them back. If you are doing part 2 or part 4 next, keep the wood splint. If not, make sure the wood splint is out and return unburned portions (if not too short) to the "Part 2 Materials" station. Short pieces of wood splint are to be rinsed with water and put in the waste basket. If this is your last procedure for the period, wipe the lab bench and wash your hands.

Part 4 - Catalyzed Decomposition of Hydrogen Peroxide

Record all results for Part 4 in "Table 4" on page 10 of this handout.

Read through all the steps (1-10) of Part 4 before you start it!

1. Obtain a test tube rack and one 18 x 150 mm (large) test tube and pair of safety goggles for each partner and bring these back to your lab bench. (*You may already have some of this equipment if you have just finished another part. In that case, just get what you need.*)

2. If you don't already have a wood splint and a match, go to the "Part 2 Materials" station and get these.

3. Put on your goggles and bring an empty test tube to the "Part 4 Materials" station. With the pipette there, add 3% hydrogen peroxide to the test tube to a depth of about 2 cm. Take this test tube back to your lab bench and put it in the test tube rack.
NOTE: Hydrogen peroxide is corrosive to your skin and to your eyes. Wash spills and splashes off your skin and clothing immediately, using plenty of water. If hydrogen peroxide gets into your eyes immediately rinse for 15 to 20 minutes in the eye-wash station and inform your teacher.

4. Go back to the "Part 4 Materials" station, take a piece of scrap paper and fold it in half. Open it again and to the center, add a small pinch (about the size of a pea) of black **manganese dioxide** powder and bring it back to your lab bench.

5. Make sure everyone around you has goggles on their eyes. Move any books or other material away from the test tube rack. Make sure the test tube with the hydrogen peroxide is in the test tube rack. Do NOT hold it in your hand as you are doing the next procedure.

6. Have one partner light the wood splint, let it burn for a few seconds and blow out the flame to obtain a "glowing splint".

7. Add the black manganese dioxide from the paper to the test tube with the hydrogen peroxide by pouring it down the fold in the paper. Observe the reaction.

8. Test the gas in the test tube with the glowing splint. If a glowing splint re-lights, that means oxygen gas is present in larger quantities than in air.

9. Record all your results in the "Observations" column in **Table 4 on page 10** in the appropriate places.

10. Add water to the test tube and dump the contents down the sink, flushing with more water. Rinse the test tubes out, clean it with soapy water and a test tube brush. Rinse it again and put it in the test tube rack. Keep them if you are doing part 2 or part 3 next. If not, put them back. If you are doing part 2 or part 3 next, keep the wood splint. If not, make sure the wood splint is out and return unburned portions (if not too short) to the "Part 2 Materials" station. Short pieces of wood splint are to be rinsed with water and put in the waste basket. If this is your last procedure for the period, wipe the lab bench and wash your hands.

The data tables start on the next page ....

Activity # 29

Activity 10b - Chemical Reactions vs. Physical Changes

Name _____

Date _____

Date due _____

Data and Observations

Table 1 - Heating Metals in a Flame

(Put all observations for Part 1 in this table.)

Reactant	Appearance of Reactants	Observations	Appearance After Procedure
copper			
wire solder			
magnesium ribbon			
nichrome wire			
steel wool			

Table 2a - Reactants in Part 2

Record Observations from Part 2-Procedure 5

Reactant	Appearance Before Reaction
magnesium	
hydrochloric acid	

Table 2b - Observations in Part 2

(Record results of Part 2 - Procedure 10 (7 & 9) in this table.)

Procedure	Observations
7 - When Mg is put into HCl	
9 - When the gas is tested with a burning splint	

Data tables are continued on the next page....

Table 3 - Adding Paper and Calcium to Water

(Record Observations from Part 3 - Procedures 4, 7 & 9 in this table.)

Procedure	Observations
4 - Adding paper to water	
7 - Adding calcium metal to water	
9 - Testing the gas produced when calcium is added to water	When a burning splint is added to the gas...

Table 4 - Observations in Part 4

(Record results of Part 4 - Procedures 7 & 8 in this table.)

Procedure	Observations
7 - Adding manganese dioxide to hydrogen peroxide	
8 - When the gas is tested with a glowing splint	When a glowing splint is added to the gas...

The Questions for this lab start on the next page...

Questions

You can answer these questions right on this paper

1. Look at your class notes on **chemical** and **physical** changes (p. 213-214 in Text.)

   a) What are some things which tell you that a change may be a **chemical change**?

   _____

   _____

   _____

   b) What are some things which tell you that a change may be a **physical change**?

   _____

   _____

2. Look at **Table 1 on page 8** of this lab. For each metal heated, decide whether you think each change is **chemical** or **physical**. **Give reasons** to back up each of your answers.

Metal Heated	Chemical or Physical Change?	Reasons for your Choice
copper		
wire solder		
magnesium ribbon		
nichrome wire		
steel wool		

3. If a metal had a **chemical change** in Part 1, which gas in the air was it reacting with?

   Answer _____

4. Look a **Tables 2a & 2b** on page 9 and answer the following questions:

   a) When magnesium is put into hydrochloric acid, do you think the change is **chemical** or **physical**? _____ .

   b) Give some **reasons** for your answer to "a". _____

   _____

   _____

   c) When the gas formed in Part 2 was lit with a burning splint, was change **chemical** or **physical**? _____.

   d) Give some **reasons** for your answer to "c". _____

   _____

   _____

   e) What is the name of the gas that forms when magnesium reacts with hydrochloric acid?

   Answer _____

5. Look at **Table 3 on page 10** and answer the following questions:

   a) When paper is put into water, do you think the change is **chemical** or **physical**? _____ .

   b) Give some **reasons** for your answer to "a". _____

   _____

   c) When calcium metal is put into water, do you think the change is **chemical** or **physical**? _____ .

d) Give some **reasons** for your answer to "c". _____

_____

e) What gas is formed when calcium reacts with water? _____

6. Look at **Table 4 on page 10** and answer the following questions:

a) When manganese dioxide is put into hydrogen peroxide, do you think the change is **chemical** or **physical**? _____ .

b) Give some **reasons** for your answer to "a". _____

_____

_____

c) Manganese dioxide (the black powder used in Part 4) was NOT a reactant, but a **catalyst** in this experiment. Look up the word "**catalyst**" in a Chemistry textbook or a dictionary and put the meaning down here:

catalyst - _____

_____

d) What gas do you think is produced when hydrogen peroxide decomposes in Part 4? (*HINT: What was it's effect on a glowing splint?*)

Answer _____

7. Name or describe three common **physical changes** that take place in your home.

1. _____
2. _____
3. _____

8. Name or describe three common **chemical changes** that take place in your home.

1. _____
2. _____
3. _____