EXPERIMENT 5

Physical and Chemical Changes – Part 1

INTRODUCTION

Matter undergoes many changes. In some cases only the form of the substance (such as physical state, size of particle, or temperature) is changed, but not the identity of the substance. Paper is torn, ice melts, water evaporates, and salt dissolves. These are called physical changes, changes in the form of a substance, but not in its chemical nature. In other cases different substances with new characteristic properties are formed. Wood burns, metals tarnish, dynamite explodes. These are called chemical changes, because they change the original substances into other substances by a reorganization of the atoms. Heat, light, electricity and solution are often instrumental in starting chemical changes. In many cases, too, they are produced during chemical changes.

PROCEDURE

1. Students will work individually for this experiment. Except for the laboratory handout, remove all books, purses, and such items from the laboratory bench top, and placed them in the storage area by the front door. For laboratory experiments you should be wearing closed-toe shoes. Tie back long hair, and do not wear long, dangling jewelry or clothes with loose and baggy sleeves. Open you lab locker. Put on your safety goggles, your lab coat, and gloves.

PART A – HEATING NICHROME METAL

2. Obtain a nichrome wire, with handle, from the back counter of the lab room, or from drawer 025. Observe the color and luster of the metal and record any observations in your Data Table. Holding the handle, place the nichrome wire in your burner flame for about 30 seconds. Do not put the handle in the flame, it may melt. Remove the nichrome wire and allow it to cool. Record any observations of the cooled nichrome wire in your Data Table. Save the nichrome wire for step 4.

PART B – HEATING COPPER METAL

3. Obtain a piece of copper wire from the cart and observe the color and luster of the metal. Record any observations in your Data Table. Obtain a pair of crucible tongs from drawer 040 at the back of the lab room, and use it to hold the copper wire in your burner flame for about 30 seconds without letting it melt. Remove the copper wire and allow it to cool. Record any observations of the cooled copper wire in your Data Table. The copper wire may be disposed of in the trash can when you are through.

PART C – NICHROME METAL WITH HYDROCHLORIC ACID

4. Once again, record any observations of the nichrome wire in your Data Table. Place about 3 milliliters of dilute hydrochloric acid into a medium test tube. Put the nichrome wire into the hydrochloric acid. Observe carefully for any signs of chemical action. Record any observations in your Data Table. Remove the nichrome wire, flush it with water, and dry it. The nichrome wire may now be returned to the back of the lab room. Save the test tube of hydrochloric acid for step 5.
PART D – ZINC METAL WITH HYDROCHLORIC ACID

5. Obtain a piece of zinc metal from the cart, and a wood splint from the back counter of the lab room, or from drawer 035. Record any observations of the zinc in your Data Table. Ignite your laboratory burner so that later in this step you can light the end of the wood splint. Put the zinc metal into the hydrochloric acid. Observe carefully for any signs of chemical action. Record any observations in your Data Table.

CAUTION: Let the action continue for several minutes, keeping the top of the test tube covered with your thumb.

Light the end of the wood splint with your burner flame. With the test tube sitting in your test tube rack, remove your thumb and bring the flaming end of the burning splint to the mouth of the test tube. Record any observations in your Data Table.

6. The gas was one product of the reaction between zinc and hydrochloric acid (hydrogen chloride). There is a second product of the reaction dissolved in the water. Allow the zinc to react completely away. You may use this time to answer the Post Lab questions. Pour the water from the test tube into an evaporating dish and cover it with a watch glass. If the liquid contains solid, black particles, filter them out through a piece of filter paper in a glass funnel before adding the liquid to the evaporating dish. Place the evaporating dish on a ceramic-centered wire gauze, supported by an iron ring on a ring stand. Place a burner below the evaporating dish so that when the burner is lit, the tip of the inner cone just reaches the bottom of the ceramic-centered wire gauze. Light the burner and gently boil heat the solution. Continue to heat the evaporating dish until all of the liquid is gone. Record any observations in your Data Table.

7. The crystals can be washed down the sink, and any unreacted zinc metal can be disposed of in the trash can.

8. Clean and wipe dry your laboratory work area and all apparatus. When you have completed your lab report have the instructor inspect your working area. Once your working area has been checked your lab report can then be turned in to the instructor.
## DATA TABLE

### PART A

<table>
<thead>
<tr>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nichrome Before Heating</td>
</tr>
<tr>
<td>Nichrome After Heating</td>
</tr>
</tbody>
</table>

### PART B

<table>
<thead>
<tr>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper Before Heating</td>
</tr>
<tr>
<td>Copper After Heating</td>
</tr>
</tbody>
</table>

### PART C

<table>
<thead>
<tr>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nichrome Before Being Added to Acid</td>
</tr>
<tr>
<td>Nichrome After Being Added to Acid</td>
</tr>
<tr>
<td><strong>PART D</strong></td>
</tr>
<tr>
<td>------------------------------------</td>
</tr>
<tr>
<td>Zinc Before Being Added to Acid</td>
</tr>
<tr>
<td>Zinc After Being Added to Acid</td>
</tr>
<tr>
<td>Gaseous Product Appearance</td>
</tr>
<tr>
<td>Gaseous Product Action with Burning Splint</td>
</tr>
<tr>
<td>Dissolved Product Appearance in Solution</td>
</tr>
<tr>
<td>Dissolved Product Appearance after Boiling</td>
</tr>
</tbody>
</table>
POSTLAB QUESTIONS

1. What change occurs when nichrome is heated, chemical or physical?
_________________________________________________________________________________

2. What is the evidence for your answer to question 1?
_________________________________________________________________________________
_________________________________________________________________________________

3. What change occurs when copper is heated, chemical or physical?
_________________________________________________________________________________

4. What is the evidence for your answer to question 3?
_________________________________________________________________________________
_________________________________________________________________________________

5. What change occurs when nichrome is added to hydrochloric acid, chemical or physical?
_________________________________________________________________________________

6. What is the evidence for your answer to question 5?
_________________________________________________________________________________
_________________________________________________________________________________

7. What change occurs when zinc is added to hydrochloric acid, chemical or physical?
_________________________________________________________________________________

8. What is the evidence for your answer to question 7?
_________________________________________________________________________________
_________________________________________________________________________________

9. What is the name of the gas that is evolved in the reaction between zinc and hydrochloric acid (hydrogen chloride)?
_________________________________________________________________________________

10. What is the name of the crystals that are produced in the reaction between zinc and hydrochloric acid (hydrogen chloride)?
_________________________________________________________________________________
11. Classify each of the following as an example of a compound \((C)\), mixture \((M)\), or element \((E)\).

(a) ethanol, \(C_2H_5OH\)  
(b) iron, Fe  
(c) brass, Cu & Zn  
(d) sucrose, \(C_{12}H_{22}O_{11}\)  

12. State whether the following properties are typical of a metal \((M)\) or nonmetal \((N)\).

(a) poor electrical conductor  
(b) high melting point  
(c) lustrous solid  
(d) reacts with metals  

13. Indicate whether these observations are most likely evidence for physical change \((P)\) or chemical change \((C)\).

(a) steam condenses to a liquid on a cool surface  
(b) baking soda dissolves in vinegar, generating bubbles  
(c) dry ice (carbon dioxide) sublimes  
(d) steel wool forms small blue-black beads upon heating  
(e) mercury cools to \(-40^\circ C\) forming a solid