Lab #1
Observing and Inferring

Grade Level Indicators:
*Explain how scientific inquiry is guided by knowledge, observations, ideas and questions.
*Distinguish between observations and inferences given a scientific situation.

Summary:
Goal of this lab is to observe several "chemical" phenomena and then hypothesize explanations for each phenomenon.

Materials/Equipment:
- safety goggles
- watch glass
- insulated gloves
- universal indicator
- zinc
- butane lighter
- aqueous solutions of:
  - 0.1 M silver nitrate, AgNO₃
  - 0.1 M sodium hydroxide, NaOH
  - saturated calcium acetate, Ca(C₂H₃O₂)₂
  - 3% hydrogen peroxide, H₂O₂
  - 3.0 M hydrochloric acid, HCl
- 100 mL beaker
- 250 mL beaker
- 1000 mL beaker
- wash bottle
- stirring rods
- copper wire, Cu
- wash bottle
- magnetic stirrer
- magnetic stir bar
- dry ice, CO₂
- distilled water
- water trough
- funnel
- 250 mL filtration flask

Student Prior Knowledge:
Throughout the day you continually use your senses to observe the world. You hear a horn beep outside your house in the morning, you smell food as you walk by the school cafeteria, and you see the principal and your friend walking towards you and your friend is wearing blue jeans with numerous holes in them. For each of these previous observations you could make an inference. The horn beeping is your friend telling you he is waiting for you outside, the smell of food means for lunch today they have made chocolate chip cookies, or your friend walking with the principal means those holey jeans got him in trouble again. Observations, followed by the development of a hypothesis, are the first steps in the scientific method. Experiments are then designed and carried out to test the hypothesis under controlled conditions. If the results of the initial experiment support the hypothesis, additional testing is done to further check the hypothesis. If however, the experimental results do not support the original hypothesis, then the hypothesis must be changed or modified. When the results of multiple experiments support the hypothesis, it can then become a theory. A theory is a hypothesis that is supported by the results of repeated experiments.

In this experiment you will observe a series of chemical phenomenon demonstrated by your teacher. You will then formulate hypothesis to explain your observations.

Safety
- Always wear safety goggles and lab aprons when working in the lab.
- Know the location of the emergency shower, eyewash station, fire blanket and fire extinguisher and the procedures for using them.
- If you get a chemical in your eyes, immediately flush the chemical out at the eyewash station while calling to your teacher.
- Call your teacher in the event of a spill. Spills should be cleaned up promptly according to your teacher's direction.
- Other safety precautions are noted in each lab procedure.
Instructional Procedures:

Your teacher will perform the demonstrations. Record your observations in the table provided on page three. After observations are completed for all procedures you are to write one hypothesis that could explain the behavior that you observed.

1. Place a piece of dry ice and a piece of ice on separate watch glasses. Observe what happens with time. **CAUTION:** Be careful in handling dry ice it may cause frostbite. Hypothesize the behavior shown by the dry ice.

2. Fill a large test tube ½ to ¾ full with a 0.1 M silver nitrate solution. Twist a strand of copper wire around a pencil and then carefully add the wire in the test tube and observe what happens with time. **CAUTION:** Silver nitrate solution should be handled with caution because silver nitrate is an oxidizing agent and can leave black stains on skin and clothing. Hypothesize what is appearing on the copper wire and/or what is happening to the solution.

3. Place several pieces of dry ice in a plastic wash bottle half-filled with distilled water. Observe what happens when the jet assembly of the wash bottle is replaced and tightened. **CAUTION:** Be careful in handling dry ice it may cause frostbite. Hypothesize the behavior shown by the wash bottle after the addition of dry ice.

4. Observe what happens when the starch and water mixture is stirred inside a 250 mL beaker with the glass stirring rod with a quick motion and then with a slow motion. Then use the glass stirring rod to pull a small portion above the beaker and then allow it to empty back into the beaker. Hypothesize the behavior shown by the starch and water mixture.

5. Observe what happens when 50 mL of saturated calcium acetate and 50 ml of ethyl alcohol in a 250 mL beaker. **CAUTION:** Ethyl alcohol is flammable. Hypothesize the behavior shown by the two mixtures when mixed together.

6. Add a very small amount of manganese (IV) oxide powder to a large test tube ½ to ¾ full with a 3 % hydrogen peroxide solution and observe what happens. Then observe what happens when a glowing wood splint is inserted into the mouth of the test tube. **CAUTION:** Manganese (IV) oxide should be handed with caution because it is an oxidizing agent. Hypothesize the behavior shown by the hydrogen peroxide solution when manganese dioxide is added.

7. Add 600 to 700 mL of freshly boiled distilled water to a 1000 ml beaker and add a magnetic stirrer. Observe what happens next. With the magnetic stir spinning add 15 to 20 drops of universal indicator and then add drop-by-drop 0.1 M sodium hydroxide. Then add three additional squirts of 0.1 M sodium hydroxide. Then observe what happens when 5 or 6 pieces of dry ice are added to the solution. **CAUTION:** Sodium hydroxide solution should be handed with caution because sodium hydroxide is very corrosive. Be careful in handling dry ice it may cause frostbite. Hypothesize the behavior shown by the water solution when the dry ice was added.

8. Put 10-15 g of mossy zinc into a 250-mL filter flask (Erlenmeyer-shaped flask with a sidearm). Add 120 mL of 3 M HCl to the mossy zinc in the flask and immediately stopper with a rubber stopper. Attach rubber tubing to the side arm of the flask. Fill a water trough half full of “soapy-water”. Place the free end of the rubber tubing with the funnel under the water in the water trough. Bubbles should start coming out of the end of the funnel in the water trough. Collect the bubbles on the end of your hand and light the bubbles with a butane lighter with your arm extend away from your body. **CAUTION:** Hydrochloric acid is corrosive. Hypothesize the behavior shown by the hydrochloric acid solution when zinc metal is added.

“The great tragedy of science — the slaying of a beautiful hypothesis by an ugly fact.”

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T. H. Huxley (1825-1895), British biologist.
<table>
<thead>
<tr>
<th>Procedure Number</th>
<th>Observations (2 points/procedure)</th>
<th>Hypothesis (3 points/procedure)</th>
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