MAINE MOBILE BIOLAB
STUDENT HANDOUT

Name:	

What's in a Change?

The terms "physical change" and "chemical reaction" are thrown around a lot in science class, but what do each of these terms really mean?

During a physical change a new substance is not created. At the molecular level, the molecules you start with will not change. This means that the material you start with is the same as the material you end up with. Even though the material is the same, it might have undergone a change in size by crushing or cutting it, or a change in state of matter, starting as a solid but melting to a liquid. Sometimes we can observe a physical change when molecules dissolve in one another. For example, when we dissolve sugar in water, the water and sugar molecules are unchanged, but are now suspended next to one another.

Chemical reactions are different because the materials that go in are different from the materials that come out. This means that the starting materials, or reactants, can combine and rearrange themselves to make entirely new products. We can tell those new products apart because they will have different properties than the materials we started with. These changes can be indicated by a change in color, change in temperature, change in smell, formation of a gas, or formation of a precipitate. A precipitate is a product that is insoluble in the liquid, like when lemon is added to milk, and the milk curdles. Precipitates can make the liquid turn cloudy, and if left in the liquid long enough, they will fall to the bottom of the reaction vessel.

While clues like change in smell and formation of a gas can be useful to indicate a chemical reaction, the only way to tell for sure is to test the properties of the reactants and the products. These properties can be physical (like the way it looks) or chemical (how it reacts with other substances). If a new substance is created, it will have different physical and/or chemical properties from the reactants.

In the activities below, we will observe two combinations of materials: amylose ($(C_6H_{10}O_5)_n$) with water (H_2O), and acetic acid (CH_3COOH) with calcium carbonate ($CaCO_3$). We will make observations to help us tell the difference between a physical change and a chemical reaction.



QUICK CHECK: If the reactant has the same properties as the product of an interaction, did a physical or chemical change occur? Why?

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PART 1—Amylose ($(C_6H_{10}O_5)_n$) and Water (H_2O)

Observing Physical and Chemical Properties of Products

1. View the amylose ($(C_6H_{10}O_5)_n$), iodine (I_2), and water (H_2O) and record physical observations in Table 1 under "Physical Properties."
2. With the scoopula, add a small scoop of amylose to one small square bottle.
3. With the graduated cylinder, measure 5mL of water. Pour this into the same bottle. Swirl to mix.
4. Record your physical observations of the product in Table 2 under "Physical Properties."
5. With the orange pipette, add 1 drop of iodine to the bottle. Swirl to mix.
6. Observe the reaction with iodine. Record the observed color in Table 2 under "Observed color with Iodine."

Observing Physical and Chemical Properties of Reactants

7. Take one test tube and label it "W" for water.
8. With the pipette labeled with blue tape, add 2mL of water to tube "W."
9. With the orange-labeled pipette, add one drop of iodine to tube "W."
10. Observe the iodine's reaction with the water. Record the observed color in Table 1 under "Observed color with iodine."
11. With the scoopula, sprinkle a small amount of amylose into the white weigh boat.
12. Using the pipette labeled with the orange tape, add 4-5 drops of iodine to the white weigh boat next to the amylose.
13. Tilt the weigh boat to combine the iodine and amylose. Observe the interaction and record the observed color in Table 1 under "Observed color with iodine".

Table 1	Physical Properties		Chemical Properties
Reactant	Color	State of Matter	Observed color with iodine?
Amylose ($(C_6H_{10}O_5)_n$)			
Iodine (I_2)			N/A
Water (H_2O)			

QUICK CHECK:

Can you still see the amylose when it is added to the water? When combined what did it make?
(Hint: Think of other times a powder is added to water, what is created?)

Table 2	Physical Properties		Chemical Properties
Product	Color	State of Matter	Observed color with iodine?
Amylose ($(C_6H_{10}O_5)_n$) + Water (H_2O) = **unknown**			

QUICK CHECK:

When iodine is added to the amylose and water solution, does the product have similar chemical properties to either of the reactants?

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PART 2 – Calcium Carbonate ($CaCO_3$) and Acetic Acid (CH_3COOH)

Observing Physical and Chemical Properties of Reactants

1. View the solid calcium carbonate rock ($CaCO_3$) and the acetic acid (CH_3COOH) and record your physical observations in Table 3 under "Physical Properties."
2. Take two test tubes and label one "A" for acetic acid and the other "C" for calcium carbonate.
3. With the green pipette, add 2mL of limewater into each test tube ("A" and "C").
4. With the yellow pipette, add 1mL of acetic acid to tube "A." Record your observations in Table 3 under "Color observed with limewater."
5. Add the small piece of calcium carbonate rock to tube "C." Record your observations of the liquid in Table 3 under "Observed color with limewater."

Observing Physical and Chemical Properties of Products

6. Take a new test tube and label it "U" for the unknown product.
7. With the green pipette, add 2mL of limewater to tube "U."
8. With the graduated cylinder, measure 10mL of acetic acid. Pour this into the remaining empty small bottle.
9. Place the non-stoppered end of the tubing mechanism into test tube "U" so it sits within the limewater.
10. With the scoopula, add a small scoop of *powdered* calcium carbonate to the small bottle. Immediately cover it with the rubber stopper, and view tube "U."
11. Record your observations for "Observed color with limewater" in Table 4. What was produced?
12. If necessary, add more acetic acid and powdered calcium carbonate to the small bottle to observe the physical properties of the unknown product.

Table 3	Physical Properties		Chemical Properties
Reactant	Color	State of Matter	Observed color with limewater?
Calcium carbonate rock ($CaCO_3$)			
Calcium carbonate powder ($CaCO_3$)			N/A
Acetic acid (CH_3COOH)			

QUICK CHECK:

Compare the unknown products to the reactants. Does the unknown product have different properties than the reactants? What type of change occurred: chemical or physical? Why?

Table 4	Physical Properties		Chemical Properties
Product	Color	State of Matter	Observed color with limewater. What was produced?
Acetic acid (CH_3COOH) + Calcium carbonate ($CaCO_3$) = **unknown**			

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