

Energy from Sugar

Student Worksheet

Name _____

Overview: Sugar! It gives you energy and we'll prove it today. You'll make a chemical reaction that produces carbon dioxide gas and use limewater to prove it.

What to Learn: You should understand that the presence of heat in the test tube with sugar indicates that energy is being released. You'll also see how limewater can be used as an indicator to test for the presence of carbon dioxide.

Materials

- Granulated white sugar ([MSDS](#))
- Distilled water
- Test tube rack
- 2 test tubes
- One-hole rubber stopper
- Measuring spoon
- 90° bend glass tubing
- Test tube clamp
- Potassium permanganate (KMnO_4) ([MSDS](#))
- Sodium hydrogen sulfate (NaHSO_4) ([MSDS](#)) **Sodium hydrogen sulfate is very toxic. Respect it, handle it carefully and responsibly. Do not take it for granted.**
- Measuring syringe
- Calcium hydroxide, $\text{Ca}(\text{OH})_2$ ([MSDS](#)) to add to H_2O to make limewater ([MSDS](#))

NOTE: Be very careful when handling the sodium hydrogen sulfate – it's highly corrosive and dangerous when wet. Handle this chemical only with gloves, and be sure to read over the MSDS before using.

Lab Time

1. In a clean, dry test tube place the following:
 - a. 3 spoonfuls of potassium permanganate (KMnO_4). When finished, cap chemical and wash measuring spoon.
 - b. 2 spoonfuls of sodium hydrogen sulfate (NaHSO_4). If it is clumped together, tap gently to disperse. When finished, cap chemical and wash measuring spoon.
 - c. 1 spoonful of white granulated sugar.
 - d. 10 milliliters of distilled water
2. Place the short end of the 90° elbow glass tubing into a one-hole stopper and place the stopper on the test tube. Put in test tube rack.
3. Prepare limewater by placing 5-10 milliliters of water into a clean, dry test tube and adding a tiny sprinkling of limewater, $\text{Ca}(\text{OH})_2$. Use measuring spoon to stir. The solution should remain clear. Caution: Limewater is caustic! Be careful!
4. Put the test tube containing potassium permanganate, sodium hydrogen sulfate, sugar, and water into a test tube clamp. Insert the long end of the 90° glass tube into the limewater solution. Place the test tube into clamp the test tube holder so that the test tube is almost horizontal, but tilted slightly so the solution

does NOT flow out the hole. If some of the solution drips out, you must re-do the experiment. Gently put your hand on the test tube and record your results.

5. Hold the test tube with the limewater solution and observe.
6. To clean, first separate the liquids from the solids by pouring the solution through a coffee filter. Throw away solids in an outside trash can. Liquids may be rinsed down the drain with plenty of water.

Cleanup: Clean everything thoroughly after you are finished with the lab. After cleaning with soap and water, rinse thoroughly. Chemists use the rule of “three” in cleaning glassware and tools. After washing, chemists rinse out all visible soap and then rinse three times more.

Storage: Place all chemicals, cleaned tools, and glassware in their respective storage places.

Disposal: Dispose of all solid waste in the garbage. Liquids can be washed down the drain with running water. Let the water run awhile to ensure that they have been diluted and sent downstream.

Energy from Sugar Data Table

Item/Object	Observations (color, temperature, speed of reaction, etc.)
Potassium permanganate + sodium hydrogen sulfate + sugar	
Limewater solution	

Exercises Answer the questions below:

1. Something peculiar happened to your potassium permanganate solution. What was it, and why did this happen?
2. How was limewater used as an indicator in this experiment?
3. How do you know that carbon dioxide was a gas?
4. One student found that the limewater turned a white color, but then it turned purple. What caused this to happen?

Exercises

1. Something peculiar happened to your potassium permanganate solution. What was it, and why did this happen? (It got warm because of the energy released from the sugar.)
2. How was limewater used as an indicator in this experiment? (Limewater turns cloudy in the presence of carbon dioxide, so the fact that it turned a white color shows that CO_2 was produced.)
3. How do you know that carbon dioxide was a gas? (It bubbled into the solution of limewater.)
4. One student found that the limewater turned a white color, but then it turned purple. What caused this to happen? (He allowed some of the potassium permanganate solution to drip into the limewater solution. Potassium permanganate will color just about anything.)

Closure: Before moving on, ask your students if they have any recommendations or unanswered questions that they can work out on their own. Brainstorming extension ideas is a great way to add more science studies to your class time.