

Topic: Carbohydrate Lab

Summary: The goal of this lab is to give students real evidence for the presence of monomers and polymers in food. Students experiment with different unknown substances and test if they are composed of different macromolecules.

Goals & Objectives: Students will be able to identify monomer and polymer carbohydrates molecules in common food substances.

NGSS Standards: *HS-LS1-6.* Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

Time Length: 90 minutes

Prerequisite Knowledge: what is monomer and polymers of a carbohydrate, lab safety, and how to write a CER paragraph.

Materials:

- | | | |
|---------------------|-----------------------|---------------------------------|
| • Unknowns #1 – 4 | • Benedict’s solution | • Filter paper – per group |
| • 5 glass beakers | • Iodine | • Test tube rack – per group |
| • Hot plate | • Goggles | • 8 test tubes – per group |
| • Test tube brushes | • 5 glass pipettes | • Test tube holders – per group |

Lab Set-up:

- 1) Place hot plates, 2-3 preferred, next to a window for ventilation purposes. Place the 500 mL beakers full of water on the hot plate. Turn it on high. It should be boiling at the start of lab.
- 2) Unknowns – select four different food products. The food products can include butter, vegetable baby food, sugar water (sucrose in water), applesauce, flour in water (or starch in water), etc.
- 3) Place unknowns in a different location in the room, spaced out to prevent crowding of students. Place the unknown foods in numbered beakers. The unknown substances should be in liquid form. Place a glass pipette in each beaker. You can melt the butter by placing the beaker onto hot plate; do not burn the butter.
- 4) Place a pipette and beaker of Iodine in a third location. Students should drop Iodine into their test tube over a paper towel/cardboard, as Iodine can stain your tables/floor.
- 5) The test tube rack and test tubes should be placed on the students’ desks.

Procedures:

- 1) Students are to work with a lab partner for the lab, but they should fill out their own lab report, i.e. this handout. Students are to wear their goggles for the duration of the lab. The test tube rack should stay at their desks for the duration of the lab.
- 2) The partners now separate, and one partner will perform the sugar tests with the hot bath and the other partner will perform the starch tests with the Iodine. Students are to work with one unknown test tube at a time.
- 3) Sugar station – students are to put about 2 mL of the unknown material into the test tube. Then they need to put about 1 mL of Benedict’s solution into the test tube. Students should then put the test tube into the hot bath. The test tube should face away from students since materials could bubble or spray out during heating. Students should remove the test tube using a test tube holder and return the test tube to the test tube rack at their desk.
- 4) Starch station – students are to put 2 mL of unknown into the test tube. Students bring the test tube to the Iodine station and place 4-5 drops of Iodine into their solution. They need to swirl the Iodine to mix in the solution. They then need to return to their desk and put the test tube into the rack.
- 5) Students will need to wash their test tubes during the middle of the lab using water and a brush. Students should dispose of unknowns in proper disposal containers.
- 6) If your periods are an hour long, you need to use two periods/days to perform this lab. Place the filter paper in a particular location for students to observe next period. Make sure you clean up or place food materials so ants will not invade your classroom overnight.

Accommodations: Students who are not able to participate can record the data. Students with an IEP can do four unknowns or take the handout home if they need extra time.

Editable DOCX File and Answer Key:

Available at www.ngsslifescience.com

Carbohydrate Assay Lab

Purpose:

Test four unknown samples for the presence of carbohydrate sugars and starches.

Hypothesis: If _____.

Materials:

- Unknowns #1 – 4
- 4 numbered test tubes
- Pipettes
- Benedict's solution
- Iodine solution
- Goggles
- Hot plate
- Test tube holders

Lab Safety:

Wear safety goggles the entire time during lab. Do not smell or taste any lab materials. **Do not put the Iodine or a test tube with Iodine into the hot bath.** Iodine stains, please be careful. Test tubes are fragile and can break easily.

Procedures:

Write down the properties of each unknown test tube BEFORE you start the experiment.

Unknowns	Before Color	Predict if it has Sugar and/or Starch
1		
2		
3		
4		

Test for sugars (monomer / dimer assay)

Sugar molecules may contain structures that react with Benedict's solution and produce a color change.

1. One at a time, add one "squeeze" from the pipette (~ 2 mL) of an unknown into the appropriate test tube.
2. Add one "squeeze" from the pipette (~ 1 mL) of Benedict's solution into the tube.
3. Put the test tube into the hot bath and wait two minutes. Carefully pull out the tube with a test tube holder and give them a little shake side to side.
4. *Record the color below.* Repeat for all the unknowns.

Unknowns	Color Change
1	
2	
3	
4	

For sugars, a negative reaction is no color change or the color blue. Green means a small amount of sugar is present. Yellow means there is a medium amount of sugar. Orange means there is a lot of sugar. Dark orange / brown means it contains mostly sugar. Record in the data table, under the sugar column, how much sugar is in each unknown.

Test for starch (polymer assay)

1. One at a time, add one “squeeze” from the pipette (~ 2 mL) of unknown into a test tube.
2. Add two drops of iodine into the tube.
3. *Record the color change below* and repeat for all the unknowns.

Iodine (yellowish in water) will turn starch compounds brownish.

Unknowns	Color Change
1	
2	
3	
4	

The darker the brown color is, the more starch is present. Record in the data table under the starch column predicting how much starch is in each unknown.

Analysis - Data Table:

Below, record the amount of color changes in the sugars tests and starch tests. State how much of each substance is in each unknown by ranking the number of pluses.

Answer with: + + + (a lot) + + (some) + (a little) – (none at all).

Unknowns	Sugar Observation	Starch Observation
1		
2		
3		
4		

Conclusion:

Write a 5 sentence Claim Evidence Reasoning paragraph predicting which unknown(s) are the control group for the sugar and starch.
