

**Topic:** Macromolecule Lab

**Summary:** Students experiment with different unknown substances and test if they are composed of different macromolecules.

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

**Standards:** CA Biology 1h. *Students know* that most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors.

**Time Length:** 120 minutes

**Materials:**

- Unknowns #1 – 8
- 9 glass beakers
- Hot plate
- Test tube brushes
- Benedict's solution
- Iodine
- Goggles
- 9 glass pipettes
- Filter paper – per group
- Test tube rack – per group
- 8 test tubes – per group
- 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 seven different food products, and use salt as your control group. The seven food products can include butter, vegetable baby food, sugar water, corn syrup, applesauce, 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 purpose of the incubator is to evaporate the water contents from the filter paper. If you do not have an incubator, you can use heat lamps. Remind the students not to touch the heat lamps because they can burn their skin.
- 6) 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) Students are to perform the lipid test first. Have students divide the filter paper into eight regions with a pencil/pen. The regions should be numbered 1 through 8. Students then go to each of the unknowns and place one drop onto the corresponding section of the filter paper. They then should place the filter paper into the incubator. The incubator should be turned on until the end part of the period.
- 3) 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.
- 4) 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.
- 5) 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.
- 6) 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 the trashcan since lipids may clog your sinks.
- 7) Near the end of the period, students are to take out their filter paper from the incubator. The students should look through the paper with light in the background. Students are looking for oil or grease on the numbered sections.
- 8) 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.

**Evaluation:** The sugar and starch color fields are worth 4 points. The data table is worth a total of 15 points, with each column being worth 5 points. The conclusion statements are worth 16 points, two for each question. This assignment is worth a total of 35 points.

## Macromolecule Lab

### Purpose:

Test eight unknown samples for the presence of lipids and carbohydrates.

**Hypothesis:** If I test an unknown substance with Benedict's solution and Iodine, then I can find out if it is composed of carbohydrates.

### Materials:

- Unknowns #1 – 8
- 8 numbered test tubes
- Filter paper
- Benedict's solution
- Iodine solution
- Goggles
- Hot plate
- Test tube holders
- Pipettes

### Lab Safety:

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 before the experiment.

Unknowns	Color	Texture	Viscosity
1			
2			
3			
4			
5			
6			
7			
8			

### Test for lipids

1. Create eight sections on the filter paper using a pencil and number 1-8.
2. Place one drop of each unknown solution on top of the number and let soak in.
3. Place your filter paper in the incubator. You will not need to pull it out until the last part of the period.
4. After you have finished the other two tests, *record your data in the data table* on page two under the lipid test column. Lipids do not evaporate and their residue causes a greasy spot that remains on the paper. Hold the paper up to the ceiling lights to see if there are any see through sections.

Test for sugars (monosaccharides)

Monosaccharide 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.

Tube #1 \_\_\_\_\_

Tube #2 \_\_\_\_\_

Tube #3 \_\_\_\_\_

Tube #4 \_\_\_\_\_

Tube #5 \_\_\_\_\_

Tube #6 \_\_\_\_\_

Tube #7 \_\_\_\_\_

Tube #8 \_\_\_\_\_

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 monosaccharides test column, how much sugar is in each unknown.

Test for starch (Polysaccharides)

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) will turn any compound yellowish/brownish.

Tube #1 \_\_\_\_\_

Tube #2 \_\_\_\_\_

Tube #3 \_\_\_\_\_

Tube #4 \_\_\_\_\_

Tube #5 \_\_\_\_\_

Tube #6 \_\_\_\_\_

Tube #7 \_\_\_\_\_

Tube #8 \_\_\_\_\_

The darker it is, the more starch is present. Record in the data table under the polysaccharide test column how much starch is in each unknown.

**Analysis - Data Table:**

On the next page, record the color changes in the sugars tests, starch tests and lipid observations. State how much of each substance is in each unknown.

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

Unknowns	Lipid Test	Monosaccharide Sugar Test	Polysaccharide Starch Test
1			
2			
3			
4			
5			
6			
7			
8			

**Conclusion:**

Write the types of solutions from the board into their corresponding unknown column. State why you think the unknown is that solution based upon evidence from the sugar/ starch/lipid tests.

Unknown #1 \_\_\_\_\_ because \_\_\_\_\_

\_\_\_\_\_

Unknown #2 \_\_\_\_\_ because \_\_\_\_\_

\_\_\_\_\_

Unknown #3 \_\_\_\_\_ because \_\_\_\_\_

\_\_\_\_\_

Unknown #4 \_\_\_\_\_ because \_\_\_\_\_

\_\_\_\_\_

Unknown #5 \_\_\_\_\_ because \_\_\_\_\_

\_\_\_\_\_

Unknown #6 \_\_\_\_\_ because \_\_\_\_\_

\_\_\_\_\_

Unknown #7 \_\_\_\_\_ because \_\_\_\_\_

\_\_\_\_\_

Unknown #8 \_\_\_\_\_ because \_\_\_\_\_

\_\_\_\_\_