

The Lab of Exploring Biomolecules

I. Pre-Lab:

A. Purpose – The purpose of this lab is so that we will be able to identify the three main types of carbohydrates through the use of chemical indicator tests.

B. Hypothesis - If I learn about carbohydrates which are the major source of energy for many organisms, then I will better understand what organisms get their energy from and I can understand what types of carbohydrates are better than others (which ones have more and less sugar).

C. Experiment Planning – The Independent Variable is the Honey, Oats, Table Sugar, Apple Juice, and Powdered Sugar. The Dependent Variable is the color that will result from the testing of the Honey, Oats, Table Sugar, Apple Juice, and Powdered Sugar. The variables that we had to hold constant were the Benedict's solution, Iodine, Honey, Oats, Table Sugar, Apple Juice, and Powdered Sugar. The sample size of the Benedict's solution is 30 drops for testing the Carbohydrates, but for Monosaccharide, Disaccharide, and Polysaccharide tests there were 15 drops. For the Iodine, there is 4 drops. The sample size for the ingredients we are testing would also be 30 drops. There will be two tests for Monosaccharide, Disaccharide, and Polysaccharide using Benedict's for the first test and Iodine for the second. For the Carbohydrates there will be two tests; one with Benedict's solution and one with Iodine.

D. Pre-lab Experiment- For information on this part, look at the procedure for the steps in doing the process and Results for answers to the questions.

II. Materials: Test tubes, test tube racks, Polysaccharide solution, Disaccharide solution, Monosaccharide solution, Droppers, Hot Plate, Apple Juice, Water, Beaker, Benedict's solution, Iodine, Powdered sugar, Table sugar, Oats, Honey, Biology book.



III. Procedure:

Pre-lab Part of Procedure

A. Monosaccharides

1. First, we observed the structural formulas Glucose, Galactose, and Fructose.
2. Then we answered the questions that we were instructed to answer.
3. By looking at the structural formulas Glucose, Galactose, and Fructose we were able to answer the questions.

B. Disaccharides

4. We looked at the model of sucrose. We answered the question on our lab sheet that could be answered by looking at the model and using our book.

C. Polysaccharides

5. We read about the Polysaccharides and looked at the starch molecule.
6. I knew one of the answers off the top of my head but, for the others we had to look them up in the book.
7. We finished our pre-lab part and it was time to go.

Lab-Part

A. Benedict's solution

1. The 300mL beaker full of water was filled for us by our instructor.
2. We put on our goggles and got to work.
3. We grabbed a test tube rack and three test tubes and then labeled the three of them 1, 2, and 3.

4. We added 30 drops of monosaccharide solution into tube 1, and the same for the disaccharide and polysaccharide solution into the correct tubes (2 and 3).
5. I added 15 drops of Benedict's solution into every tube and I was careful when I did it.
6. We placed the test tubes into the boiling water for five minutes.
7. We started the next part while the test tubes were boiling.
8. After the five minutes were up we took out the test tubes and recorded our results.

B. Iodine test

1. We numbered three test tubes 4, 5, and 6.
2. We added 30 drops of monosaccharide solution into tube 4, and the same for the disaccharide and polysaccharide solution into the correct tubes (5 and 6).
3. We added 4 drops of the iodine solution to each test tube, we were careful while pouring the iodine.
4. We let the iodine soak in for a while and then we swirled it exactly the way our instructor demonstrated how to.
5. We observed the change of color and marked down our results.

C. Unknown Carbohydrates

1. We cleaned out all of our test tubes and brought them back to our station.
2. My partner and I put 30 drops of honey, liquid oats, table sugar, apple juice, and powdered sugar into their own test tube. For each one I used a clean dropper.
3. We added 30 drops of Benedict's solution into each test tube.
4. We put the 5 tubes into the boiling water.
5. We had 2 extra tubes so I filled honey and liquid oats into these test tubes.
6. When the rest of the tubes came out, we cleaned them and filled them up again in the correct tubes.
7. We wrote down our results after the test tubes came out of the boiling water.
8. This time instead of using Benedict's solution we used Iodine.
9. We swirled the test tube around to mix the solution and the element around.

10. We put the tubes back in the rack and we recorded our results.

IV. Data and Observations (Results):

Pre-Lab Experiment

Monosaccharides

1. Three elements present in Monosaccharides are Carbon, Oxygen, and Hydrogen.
2. Carbon atoms- 6 Glucose, 6 Galactose, and 6 Fructose.
3. Oxygen atoms- 6 Glucose, 6 Galactose, and 6 Fructose.
4. Hydrogen atoms- 12 Glucose, 12 Galactose, and 12 Fructose
5. Chemical Formula for Glucose- $C_6H_{12}O_6$
6. Chemical Formula for Galactose- $C_6H_{12}O_6$
7. Chemical Formula for Fructose – $C_6H_{12}O_6$
8. There are 2 times as many hydrogen atoms than there are oxygen atoms in the Glucose, Fructose, and Galactose.
9. I observed that glucose and fructose have different shapes.
10. Glucose and Fructose are both monosaccharides because they have the same amount of carbon, hydrogen, and oxygen, but they are arranged in different order.

Disaccharides (double sugar molecules)

11. When two monosaccharide sugar molecules are joined chemically to form a carbohydrate molecule it is called double sugar or disaccharide.
12. By chemically joining a glucose molecule with a fructose molecule, a double sugar called sucrose
13. The common name for this is table sugar.



Polysaccharides (many sugar molecules)

14. When many single sugars are joined chemically, polysaccharides are formed.
15. Starch, glycogen, and cellulose are the three most common polysaccharides in biology.
16. They consist of long chains of glucose molecules joined.
17. The body stores glycogen in a vacuole.
18. Cellulose is the substance that makes up plants' cell walls.

Tube #	Carb Type	Benedict's Color	Iodine Color
1	Monosaccharide	Green/Blue	Dark Blue
2	Disaccharide	Yellow (Top) Orange (Bottom)	Maroon (Dark Red)
3	Polysaccharide	Sky Blue	Brownish Black

Carbohydrate	Benedict's color	Iodine Color	Type of Carbohydrate
Honey-	Orange (top) Clear (bottom)	Red	Monosaccharide
Oats-	Yellow/Orange	Black	Polysaccharide
Table Sugar-	Green	Red	Monosaccharide
Apple-	Orange	Yellow/Orange	Monosaccharide
Powdered-Sugar-	Forest Green	Dark Green/Black	Polysaccharide or Disaccharide

1. In the results there ended up being more Monosaccharides than any other type of Carbohydrate.
2. Using the Benedict's solution and then Iodine, I could see the comparison of colors that they turned out to be and then I could classify them as what type of Carbohydrate they were.

V. Conclusion:

The purpose of this lab was to be able to will identify three main types of carbohydrates through the use of chemical indicator tests. We used test tubes and boiling water to signify if it was a Monosaccharide, Disaccharide, or Polysaccharide. We tested the elements by using Benedict's solution and then boiling it. We also used Iodine and by simply swirling it around in the tube to mix with the element. Using the Monosaccharide solution and adding Benedict's solution, I ended up with an orange color on the top and a clear color on the bottom. Using the Disaccharide solution and then adding Benedict's solution, I received lighter color on the top than I did on the bottom and for Iodine solution I received a Maroon color. I was able to determine that honey, table sugar, and apple juice are momosaccharides, powdered sugar is disaccharides or polysaccharides, and oats are polysaccharides. I can definitely accept my hypothesis because I learned about three main forms of carbohydrates (monosaccharides, disaccharides, and polysaccharides) and what I know as simple and complex carbohydrates. I also learned that carbon, hydrogen,

and oxygen are present in all carbohydrates. I learned that the prefixes “mono” means one, “di” means two, and “poly” means many. I could tell what type of carbohydrate was present when I used the Benedict’s and iodine solutions because I learned that if the blue color changed to green, yellow, orange, or red it was a monosaccharide and if the blue stayed blue it was a disaccharide or polysaccharide. So, if a certain sugar does not change color when tested with Benedict’s solution, I can determine that it is a disaccharide or a polysaccharide because if it turned orange then it would be a monosaccharide. I believe that our lab results are accurate because we were very careful when we conducted this test and we recorded our results immediately. We did not make any mistakes, did not have any accidents, and we did not have any problems while conducting this lab. I did not feel that we had any limitations. I always thought that honey and apple juice was classified like a food and was healthy for you, but now I learned that they are like table sugar. I had always heard about simple carbohydrates not being good for your diet and that complex carbohydrates were better for your health. Through this lab, I learned that I can see the difference between table sugar and oats and how they are classified and how oats would be better for me than table sugar would be. One of the questions that I have after conducting this lab is, “Why did we boil Benedict’s solution, but we did not boil Iodine?” Would Iodine have evaporated, caused an explosion, lost its effectiveness, etc.? Another question that I have is, “Are all polysaccharides the same or are some better for your health than others?” A future experiment that I would like to do is to test other carbohydrates like bread, pasta, and potatoes. I really think that this lab was very helpful and will help me in my everyday life because I will be more aware of carbohydrates and which ones I should not eat a lot of.