

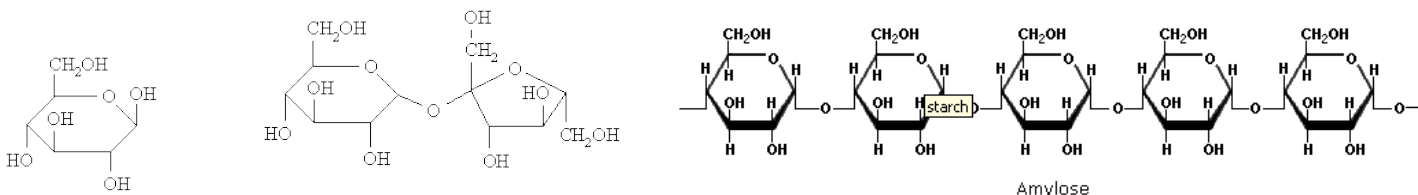
Carbohydrates Identification Lab

Name _____ Date _____ Block _____

Purpose: To identify carbohydrates using Lugol's and Benedict's chemical tests.

Background: Scientists use a combination of biology and chemistry for their understanding of life and life processes. The foods you eat are made of organic compounds. You can perform chemical tests to learn what foods contain carbohydrates, lipids, and/or proteins. Carbohydrates are an energy source or are used in making cell structures. The first tests you will be doing will be designed to specifically test for carbohydrates a.k.a sugars. These are also called **saccharides**. Carbohydrates are often classified according to the number of saccharide units they contain. Carbohydrates are molecules that contain the atoms **Carbon (C)**, **Hydrogen (H)** and **Oxygen (O)** at a 1:2:1 ratio. (Example: glucose- $C_6H_{12}O_6$, table sugar - $C_{12}H_{24}O_{12}$)

- **Saccharide** is a term derived from the Latin for sugar (origin = "sweet sand")
- A **monosaccharide** contains a single carbohydrate
- A **disaccharide** contains two carbohydrate units
- A **polysaccharide** contains many carbohydrates, examples are starch and cellulose.



monosaccharide
glucose

disaccharide
sucrose

polysaccharide
starch

The methods you will use in this investigation are a series of **tests**, for the chemical properties of carbohydrates. Each will test for a specific chemical or physical property. Saccharides which **have that property** give a **positive** reaction with that reagent(s), whereas those saccharides that do not have that property give a negative, or no reaction with that reagent or test.

**Benedict's
Reagent**

a positive reaction indicates the presence of a **reducing sugar (monosaccharide)** the precipitate may vary in color from green to orange, but a **strong reaction is brick red.**

Iodine

a positive reaction indicates the presence of a **starch (polysaccharide)**
- a strong reaction is an **blue-black color**

Pre-lab Questions: Use the background information and your notes to help you answer the following question:

1. What are the three categories of carbohydrates discussed in your text-book and notes?

2. What does "mono" mean? _____

3. What does "di" mean? _____

4. What does "poly" mean? _____
5. What does "saccharide" mean? _____
6. Why are the prefixes "mono", "di", and "poly" and the base "saccharide" good to use when describing the three types of carbohydrates?

7. What are the three ELEMENTS present in all carbohydrates?

8. What two chemicals are used to test for carbohydrates?

9. What color is Benedict's solution? _____
10. What color is iodine? _____
11. What color does Benedict's solution become when it is added to a monosaccharide and heated?

12. Does iodine change color when you add it to a monosaccharide? [yes] [no]
13. Does Benedict's solution change color when it is heated with a disaccharide? [yes] [no]
14. Does iodine change color when it is added to a disaccharide? [yes] [no]
15. Does Benedict's change color when it is heated with a poly-saccharide? [yes] [no]
16. What color does iodine become when it is mixed with a poly-saccharide? _____
17. What substance would you predict as the result if neither test (Benedict's or Iodine) showed a positive result for saccharides (a "double negative result")? _____


Materials:

- | | | |
|---|---|--|
| <input checked="" type="checkbox"/> test tubes | <input checked="" type="checkbox"/> disaccharide solution | <input checked="" type="checkbox"/> apple juice |
| <input checked="" type="checkbox"/> sharpie | <input checked="" type="checkbox"/> polysaccharide solution | <input checked="" type="checkbox"/> oat solution |
| <input checked="" type="checkbox"/> Iodine solution | <input checked="" type="checkbox"/> powdered sugar solution | <input checked="" type="checkbox"/> honey solution |
| <input checked="" type="checkbox"/> Hot water bath | <input checked="" type="checkbox"/> Benedict's solution | <input checked="" type="checkbox"/> test tube rack |
| <input checked="" type="checkbox"/> monosaccharide solution | <input checked="" type="checkbox"/> Table Sugar solution | |

Procedures:

Benedict's Test

1. Number three clean test tubes 1, 2, and 3. Using a clean dropper for each tube, add the following:



| Tube 1 | Tube 2 | Tube 3 |
|--|--|--|
| 20 drops of monosaccharide solution | 20 drops of disaccharide solution | 20 drops of polysaccharide solution |
| 20 drops of <i>Benedict's</i> solution | 20 drops of <i>Benedict's</i> solution | 20 drops of <i>Benedict's</i> solution |

- Place the three test tubes into the **hot water bath** for approximately **(5) five minutes**.
- Remove the tubes from the hot water bath. **CAUTION: WATER AND TEST TUBES ARE VERY HOT.**
- Observe the **color changes** in the solution.
- Record the color of the solutions in the tubes in the column marked "Benedict's Color after Heating".

6. **KEY TO IDENTIFICATION**

| Color | STAYS blue - | blue/green (trace) + | green (little sugar) ++ | yellow (some sugar) +++ | orange/red (much sugar) ++++ |
|-----------------------|-----------------------------|----------------------------|-------------------------------|-------------------------------|------------------------------------|
| Type of saccharide | di- or poly- or NO sugar | mono | mono | mono | mono |

Iodine Test

- Number three clean test tubes 1, 2, and 3. Using a clean dropper for each tube, add the following:



| Tube 1 | Tube 2 | Tube 3 |
|--|--|--|
| 20 drops of monosaccharide solution | 20 drops of disaccharide solution | 20 drops of polysaccharide solution |
| 4 drops of Iodine solution | 4 drops of Iodine solution | 4 drops of Iodine solution |

- Mix the contents of each tube by gently swirling.
- Observe the **color changes** in the solutions.
- Record the color of the solutions in the tubes in the column marked "Iodine Color".

DATA TABLE:

| Results of Tests with Known Carbohydrates | | | |
|--|----------------------------------|---|-------------------------|
| Test Tube Number | Carbohydrate Type in solution | Color after heating Benedict's Reagent | Color after Iodine Test |
| 1 | Monosaccharide | | |
| 2 | disaccharide | | |
| 3 | polysaccharide | | |

CHEMICAL TESTS – CARBOHYDRATES

Having tested the carbohydrates and using the results from your tests, you are now ready to test some known carbohydrates. With your results you will be able to classify your carbohydrates as mono- di- or polysaccharides .

Procedure:

BENDICT'S TEST

1. Number five (5) clean test tubes: 1,2,3,4,5.
2. Using a clean dropper add the following to each test tube:



| Tube 1 | Tube 2 | Tube 3 | Tube 4 | Tube 5 |
|--------------------------------------|---|---|---|--|
| 20 drops of honey solution | 20 drops of liquid oats solution | 20 drops of table sugar solution | 20 drops of apple juice solution | 20 drops of powdered sugar solution |
| <u>20 drops of Benedict's</u> | <u>20 drops of Benedict's</u> | <u>20 drops of Benedict's</u> | <u>20 drops of Benedict's</u> | <u>20 drops of Benedict's</u> |

3. Place the five test tubes into the **hot water bath** for approximately **five (5) minutes**.
4. Remove the tubes from the hot water bath. **CAUTION: WATER AND TEST TUBES ARE VERY HOT.**
5. Observe the **color changes** in the solution.
6. Record the color of the solutions in the tubes in the column marked "Benedict's Color after Heating".

IODINE TEST

7. Number five (5) clean test tubes: 1,2,3,4,5.
8. Using a clean dropper add the following to each test tube:



| Tube 1 | Tube 2 | Tube 3 | Tube 4 | Tube 5 |
|-----------------------------------|---|---|---|--|
| 20 drops of honey solution | 20 drops of liquid oats solution | 20 drops of table sugar solution | 20 drops of apple juice solution | 20 drops of powdered sugar solution |
| <u>4 drops of Iodine</u> | <u>4 drops of Iodine</u> | <u>4 drops of Iodine</u> | <u>4 drops of Iodine</u> | <u>4 drops of Iodine</u> |

9. Mix the contents of each tube by gently swirling.
10. Observe the **color changes** in the solutions.
11. Record the color of the solutions in the tubes in the column marked "Iodine Color".
12. Use your results to correctly classify each sugar solution as **a mono-, di-, or polysaccharide**.

Results of Tests with Carbohydrates

| Test Tube Number | Carbohydrate Type in solution | Color after heating Benedict's Reagent | Color after Iodine Test | Identified as monosaccharide disaccharide polysaccharide |
|------------------|-------------------------------|--|-------------------------|---|
| 1 | Honey | | | |
| 2 | Oats | | | |
| 3 | Table sugar | | | |
| 4 | Apple Juice | | | |
| 5 | Powdered Sugar | | | |

Conclusion:

You are given an unknown substance. You know it is a saccharide. Describe the test(s) that you would run to determine if it is a monosaccharide, disaccharide or a polysaccharide. Use your own words and be specific in the steps you would take to perform each test. **Look back at your lab for help. BE SPECIFIC!!!!!!!!!!**