Carbohydrate Identification

- The following solutions/tests can be used to determine the identity of unknown carbohydrates. We will have a set of unknown carbohydrate samples and access to each of the following solutions and the directions to appropriately test each will be given.

- Starch, glucose, fructose, lactose, sucrose

Benedict's solution (copper (II) sulfate)

- strong **oxidizing agent** that reduces the Cu^{2+} in solution

- the **blue color to disappear and a reddish precipitate** of Copper (I) oxide to form.

- **Positive results will occur with reducing sugars**.

(What is a reducing sugar?)

- **Reducing Sugar**: Capable of being oxidized and causes the reduction of other substances (Aldehyde or Ketone)

- **Non-Reducing Sugar**: Not readily oxidized

- **Oxidation** = gain of oxygen, lose hydrogen, loss of electrons

- **Reduction** = loss of oxygen, gain hydrogen, gain electrons

- **Reducing sugars include <u>all monosaccharides</u> and <u>most disaccharides</u> except sucrose**

- **All polysaccharides are non-reducing sugars**

- Depends on ability of certain types of carbs to undergo oxidation which causes Copper in solution to be reduced

- **Positive test gets rid of bright blue color and turns reddish**

- **Seliwanoff** test depends on ketoses ability to lose water upon treatment with a strong acid.

- The products of this reaction will then react with resorcinol (dihydroxy benzene)to **form red-colored complexes.**

- **Glucose is an aldose** – aldehyde functional group

- **Fructose is a ketose** – ketone functional group

- **Color change from colorless to red is positive for ketoses**

Barfoed's solution (copper (II) acetate) will also oxidize reducing sugars but using time constraints can **differentiate monosaccharides from disaccharides**

- the solution gives a **positive result for monosaccharides in 2-3 minutes** and **takes longer for disaccharides.**

- **Positive results form a dark red precipitate**

- **Iodine** – **starches** are large and complex and have the unique ability to bind iodine molecules to **form intense blue-colored complexes.**

- **Iodine indicates starches**

How would you go about identifying unlabeled samples that you know must be glucose, lactose, sucrose, fructose and starch?

What would you need to know about each of the above named sugars before beginning to identify them?

Which test would you do 1st, 2nd, 3rd… in order to make the best use of your sample and time? *(You want to identify one sample with each test so that you don't have to test it again.)*

Remember* Once you identify a sample you do not have to test it again….

1st test is done on all 5 unknowns– 1 unknown is determined

2nd test is done on 4 unknowns– 1 unknown is determined

3rd test is done on 3 unknowns– 1 unknown is determined

4th test is done on 2 samples – 1 unknown is determined

Remaining unknown is whatever hasn't been determined