Organic Food Lab =)

Problem: What test are used to discover if certain organic molecules are present in food? Could these test be used to identify an unknown food?

Background:

We will be studying various systems in the body that use the basic units in food. To determine which molecules are present in food, scientists have devised various test to detect whether there is ***sugar, starch, protein, or fat.*** These tests rely on the specific chemical properties of the compound being tested. An example is the test for fats. The test employs a fat soluble dye. If there is no fat, there is no color when you add the dye. Another test for fats would be by just using a brown paper bag. If the food creates an oil spot then there is fat, if there is no spot, there is no fat.

In your lab today, you will be testing various known compounds, using the 4 different tests described in the procedures. Then you will receive an unknown solution and a list of possible substances it could be. Your mission, if you choose (and yes you do choose) to accept it, will be to identify your unknown and report the results of the known substances for each test.

Hypothesis: N/A

Procedures:

I. Sugar Test ---> Benedicts Test

Benedict's reagent test for the presence of a certain chemical group found in simple sugars (glucose, fructose, etc.) and some more complex double sugars (maltose, lactose, found in milk). These sugars will give a positive test with the Benedicts reagent. These reactions will undergo a color change when there is sugar present. These color changing reactions are called **COLORIMETRIC ASSAYS**.

Color of solution with food/benedicts	**Meaning of Color**
BLUE	No sugar content
GREEN/YELLOW GREEN	Small amount sugar present
ORANGE/BRICK RED	Large amount of sugar present

1. Take 4 test tubes and fill each of the tubes with about 1cm of each of the following and make a table like the following on your paper:

Tube #	**TUBE 1**	**TUBE 2**	**TUBE 3**	**TUBE 4**
Food type	Tap water	Egg white solution	Corn syrup solution	Glucose solution
Initial Indicator color				
Final color				

2. Add the Benedict's Solution to each of the test tubes (about to 3cm full in the tube).
3. Carefully place in the boiling hot water bath…They are HOT!!!
4. Wait for 3 minutes….then remove from the water bath with test tube clamps and place in your test tube rack.
5. Record your results in the data table.
6. Clean your test tubes with the test tube brushes.

II. Starch Test ----> Iodine Test

Starch is a polysaccharide composed of hundreds of glucose subunits joined in long chains. Iodine is a yellow-brown solution, but will turn dark blue or black in the presence of starch.

1. On each of the following materials, place a drop of Iodine solution

Food type	Potato Slice	Small piece of Kleenex	Starch Solution	Water
Initial Indicator Color				
Final color after Iodine				

2. Record your data in a table like the one above.
3. Answer the following question:
   Starch and cellulose (paper) are both glucose polymers. Does the Iodine test differentiate (Tell the Difference) between the two?
4. Clean up and throw away the food from this step.

III. Protein Test ---> NaOH & $CuSO_4$ Test

Proteins are made up of small subunits called amino acids. These amino acids link together by making special covalent bonds called peptide bonds. These peptide bonds react very nicely with copper ions under the right conditions to make a very pretty and attractive blue color. This part of the experiment is hazardous….so for this test:

WEAR GOGGLES, GLOVES AND A LAB APRON!!!!

1. Retrieve 3 test tubes and make sure they have been thoroughly washed and rinsed
2. Make a table like the one below and fill each test tube to about 3 cm full with each of the following substances:

Tube #	**TUBE 1**	**TUBE 2**	**TUBE 3**
Food type	Tap water	Egg white solution	Corn syrup solution
Initial color			
Final color			

3. Fill all the tubes with about 2 cm worth of 10% NaOH. ***BE VERY CAREFUL WITH THIS STEP…NaOH IS A VERY STRONG BASE!!!***
4. Mix each tube by tapping the bottom of the tube slightly with the side of your finger.
5. Add five (5) drops of 1% $CuSO_4$ (copper sulfate) solution
6. Mix again and record the color change in the table.
7. Circle the Food that should have the positive result for protein.
8. Clean your test tubes carefully.

IV. Fat Test ---> Sudan Test

A fat molecule is made up of three long fatty acid chains joined to a glycerol molecule. Sudan is a black dye that stains oils because fats are not soluble in water (Remember that lipids are very water-hating…hydrophobic). So to dissolve fats, you need to place them in another solution that is also hydrophobic, like alcohol. With the Sudan test, if a substance has fat content, it will retain its black color after being rinsed with water.

1. Make a table as the one below and place on drop of each substance on a piece of filter paper:

Food type	Tap water	White Flour	Butter/Oil
Initial color			
Final color			

2. Draw a circle around each drop and label each one on the filter paper to help you locate them
3. Submerge the paper in the sudan dye solution for 1 minute
4. Rinse the paper with water to remove the excess dye.
5. Observe and record the color of the spots you made
6. Circle the Food that should have fat content.
7. Clean up and throw away your filter paper.

V. Unknown Testing!!!

Each pair of inquisitive students will receive an unknown sample dissolved in water. You and your partner will perform the tests listed above in addition to any other physical observations you can make such as color, odor, clear or opaque, texture, etc. to help you figure out what is your unknown. Record your results in a table similar to the one below

	UNK 1	UNK 2	UNK 3	UNK 4	UNK 5	UNK 6
SUGAR						
STARCH						
PROTEIN						
LIPID						
GUESS WHAT IT IS						