Name_____ Class_____ Date _____

Identifying Organic Compounds

Introduction

The most common organic compounds found in living organisms are lipids, carbohydrates, proteins, and nucleic acids. Common foods, which often consist of plant materials or substances derived from animals, are also combinations of these organic compounds. Substances called indicators can be used to test for the presence of organic compounds. An indicator is a substance that changes color in the presence of a particular compound. In this investigation, you will use several indicators to test for the presence of lipids, carbohydrates, and proteins in various foods.

Problem

What are the major types of organic compounds in some common foods?

Pre-Lab Discussion

Read the entire investigation. Then, work with a partner to answer the following questions.

1. What is an indicator? How are indicators used in this experiment?

_____

_____

_____

_____

2. What is the purpose of using distilled water as one of your test substances?

_____

_____

3. What is the controlled variable in Part C?

_____

4. What is the purpose of washing the test tubes thoroughly?

_____

_____

5. You have added Sudan III stain to each of the test tubes. What change indicates the presence of lipids?

_____

_____

Materials *(per group)*

10 test tubes
test-tube rack
test-tube holder
masking tape
glass-marking pencil
10-mL graduated cylinder
Bunsen burner or hot plate
iodine solution
20 mL honey solution
20 mL egg white and water mixture
20 mL corn oil
20 mL lettuce and water mixture
20 mL gelatin and water solution
20 mL melted butter
20 mL potato and water mixture
20 mL apple juice and water mixture
20 mL distilled water
20 mL unknown substance
10 dropper pipettes
paper towels
600-mL beaker
brown paper bag
Sudan III stain
biuret reagent
Benedict's solution

Safety

Put on a laboratory apron and safety goggles. Be careful to avoid breakage when working with glassware. Always use special caution when using any laboratory chemicals, as they may irritate the skin or cause staining of the skin or clothing. Never touch or taste any chemical unless instructed to do so. Use extreme care when working with heated equipment or materials to avoid burns. Wear plastic gloves when handling eggs or egg whites or tools that have been in contact with them. Wash hands thoroughly after carrying out this lab. Note all safety alert symbols and review their meanings on page 8.

Procedure

Part A. Testing for Lipids

1. Place 9 test tubes in a test-tube rack. Use masking tape to make labels for each test tube. Write the name of a different food sample (listed in Materials) on each masking-tape label. Label the ninth test tube "distilled water."

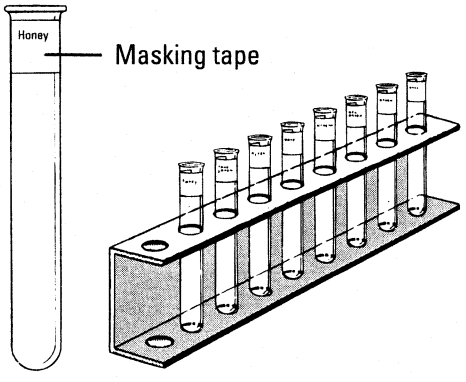

Figure 1

Name_____ Class_____ Date _____

2. Use a graduated cylinder to transfer 5 mL of distilled water into the test tube labeled "distilled water." Use a glass-marking pencil to mark the test tube at the level of the water. Mark the other test tubes in the test-tube rack at the same level.
3. Use a separate dropper pipette to fill each of the other test tubes with 5 mL of the substance indicated on the masking-tape label. Add 5 drops of Sudan III stain to each test tube. Sudan III stain will dissolve in lipids and stain them red.
4. Gently shake the contents of each test tube. **CAUTION:** *Use extreme care when handling Sudan III to avoid staining hands or clothing.* In the Data Table, record any color changes and place a check mark next to those substances testing positively for lipids.
5. Wash the test tubes thoroughly but leave the labels on.
6. For another test for lipids, divide a piece of a brown paper bag into 10 equal sections. In each section, write the name of one test substance, as shown in Figure 2.

Honey	Egg white	Corn oil	Lettuce	Gelatin
Butter	Potato	Apple juice	Distilled water	Unknown

Figure 2

7. In each section, place a small drop of the identified food onto the brown paper. With a paper towel, wipe off any excess pieces of food that may stick to the paper. Set the paper aside until the spots appear dry—about 10 to 15 minutes.
8. Hold the piece of brown paper up to a bright light or window. You will notice that some foods leave a translucent spot on the brown paper. The translucent spot indicates the presence of lipids.

Part B. Testing for Carbohydrates

1. Sugars and starches are two common types of carbohydrates. To test for starch, use the same dropper pipettes to refill each cleaned test tube with 5 mL of the substance indicated on the masking-tape label. Add 5 drops of iodine solution to each test tube. Iodine will change color from yellow-brown to blue-black in the presence of starch.
2. Gently shake the contents of each test tube. **CAUTION:** *Use extreme caution when using iodine as it is poisonous and can also stain hands and clothing.* In the Data Table, record any color changes and place a check mark next to those substances testing positive for starch.

3. Wash the test tubes thoroughly.

4. For a sugar test, set up a hot-water bath as shown in Figure 3. Half fill the beaker with tap water. Heat the water to a gentle boil. **CAUTION:** *Use extreme care when working with hot water. Do not let the water splash onto your hands.*

5. While the water bath is heating, fill each cleaned test tube with 5 mL of the substance indicated on the masking-tape label. Add 10 drops of Benedict's solution to each test tube. When heated, Benedict's solution will change color from blue to green, yellow, orange, or red in the presence of a simple sugar, or monosaccharide.

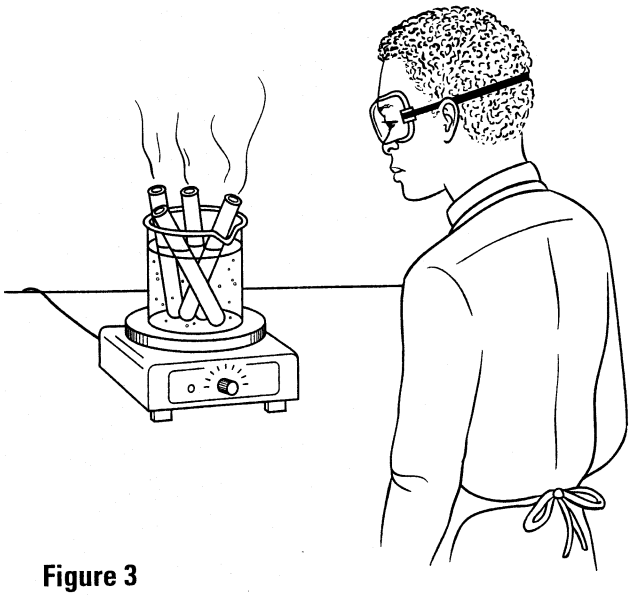

Figure 3

6. Gently shake the contents of each test tube. **CAUTION:** *Use extreme caution when using Benedict's solution to avoid staining hands or clothing.*

7. Place the test tubes in the hot-water bath. Heat the test tubes for 3 to 5 minutes. With the test-tube holder, remove the test tubes from the hot-water bath and place them back in the test-tube rack. **CAUTION:** *Never touch hot test tubes with your bare hands. Always use a test-tube holder to handle hot test tubes.* In the Data Table, record any color changes and place a check mark next to any substances that test positive for a simple sugar.

8. After they have cooled, wash the test tubes thoroughly.

Part C. Testing for Proteins

1. Put 5 mL of the appropriate substance in each labeled test tube. Add 5 drops of biuret reagent to each test tube. **CAUTION:** *Biuret reagent contains sodium hydroxide, a strong base. If you splash any reagent on yourself, wash it off immediately with water. Call your teacher for assistance.*

2. Gently shake the contents of each test tube. Biuret reagent changes color from yellow to blue-violet in the presence of protein. In the Data Table, record any changes in color and place a check mark next to any substances that test positively for protein.

3. Wash test tubes thoroughly.

Part D. Testing an Unknown Substance for Organic Compounds

1. Obtain a sample of an unknown substance from your teacher and pour it into the remaining test tube. Repeat the tests described in Parts A, B, and C of the Procedure to determine the main organic compounds in your sample. Record your results in the Data Table.

2. Wash the test tube thoroughly.

3. Wash your hands with soap and warm water before leaving the lab.

Name_____ Class_____ Date _____

Data Table

Substance	Lipid Test		Carbohydrate Test				Protein Test	
	Sudan color	Lipids present (✓)	Iodine color	Starches present (✓)	Benedict's color	Sugars present (✓)	Biuret color	Proteins present (✓)
Honey								
Egg white								
Corn oil								
Lettuce								
Gelatin								
Butter								
Potato								
Apple juice								
Distilled water								
Unknown								

Analysis and Conclusions

1. **Classifying** Which test substances contain lipids?

_____

2. **Classifying** Which test substances contain starch?

_____

3. **Classifying** Which test substances contain simple sugar?

_____

4. **Classifying** Which test substances contain protein?

_____

5. **Observing** Which test substances did not test positive for any of the organic compounds?

_____

6. **Drawing Conclusions** People with diabetes are instructed to avoid foods that are rich in carbohydrates. How could your observations in this investigation help you decide whether a food should be served to a person with diabetes?

_____

_____

_____

7. **Inferring** Your brown lunch bag has a large, translucent spot on the bottom. What explanation could you give for this occurrence?

_____

_____

8. **Drawing Conclusions** What conclusion could you make if a positive test for any of the organic compounds occurred in the test tube containing only distilled water?

_____

_____

_____

9. **Drawing Conclusions** A very thin slice is removed from a peanut and treated with Sudan III stain. Then a drop of Biuret reagent is added to the peanut slice. When you examine the peanut slice under a microscope, patches of red and blue-violet are visible. What conclusions can you draw from your examination?

_____

_____

_____

Going Further

Test each food from a school lunch for the presence of lipids, starch, single sugars, and proteins. Construct a data table to summarize your findings.

CLAIM → EVIDENCE → REASONING

- CLAIM: What is your answer?
- EVIDENCE: What is your proof? Cite your data!
- REASONING: Explain why.

Unknown # _____ is _____ because

_____

_____

_____.

CLAIM → EVIDENCE → REASONING

- CLAIM: What is your answer?
- EVIDENCE: What is your proof? Cite your data!
- REASONING: Explain why.

Unknown # _____ is _____ because

_____

_____

_____.

LAB: Identifying Organic Compounds

- LIPIDS: Sudan Test Strips
  - positive = red
  - negative = pink
- STARCHES: Iodine
  - positive = black, dark purple
  - negative = yellow, orange, red
- SUGARS: Benedict's Solution
  - positive = yellow, orange
  - negative = blue
- PROTEINS: Biuret Solution
  - positive = purple
  - negative = blue, any other color