**TEACHER GUIDE**

***“Who took Jerell’s iPod?”***

**Purpose**

The purpose of this laboratory is to engage students in a problem involving organic compounds and provide an environment in which they must use science literacy skills and lab skills to solve the problem

**Objectives**

1. List the characteristics of lipids, proteins, carbohydrates, and nucleic acids.
2. Predict which organic compounds can be found in various foods.
3. Test substances for presence of lipids, carbohydrates, and protein.
4. Interpret indicator data and tell which organic compounds are found in various foods.
5. Explain unexpected results in the data.
6. Demonstrate lab safety techniques.
7. Demonstrate correct lab technique.

**Standards**

11.A.4a Formulate hypotheses referencing prior research and knowledge.

11.A.4b Conduct controlled experiments or simulations to test hypotheses.

11.A.4c Collect, organize and analyze data accurately and precisely.

11.A.4e Formulate alternative hypotheses to explain unexpected results

12.A.4b Describe the structures and organization of cells and tissues that underlie basic life functions including nutrition, respiration, cellular transport, biosynthesis and reproduction

**Preparation Guide (class of 8 students)**

You will need the following materials

* (45-50) small plastic cups
* (4) 10ml graduated cylinders
* (4) stirrers (can be plastic spoons or toothpicks)
* 16-20ml of Biuret Reagent
* 4-5ml Iodine- (Potassium Iodide) solution for starch testing
* (20) glucose test strips
* 4 brown paper bags
* Box of gloves
* 10-15ml vegetable oil
* 10-15ml corn starch (or potato starch)
* 10-15ml dextrose (“Equal”)
* 10-15ml egg whites (or unsweetened gelatin)
* masking tape
* markers (for labeling)
* (5-10) Q-tips

Set-up procedure

* Separate students into partnerships
* At each partner station you will need
  + A piece of brown paper divided into 5 sections
  + 5 plastic cups for carb tests: each with a toothpick and 1ml of the following: vegetable oil, starch, egg whites, glucose, and water.
  + 5 plastic cups for protein test: each with a toothpick and 1ml of the following: vegetable oil, starch, egg whites, glucose, and water.
  + Vial with dropper of Biuret’s Reagent
  + Vial with dropper of Iodine
  + Glucose test strip kit (can be shared between groups)
  + Paper towels
* Set up a separate station to be shared as follows (for lipid test):
  + 5 plastic cups each with a Q-tip: each with a plastic spoon and 1ml of the following: vegetable oil, starch, egg whites, glucose, and water.
  + One student from each group will bring their brown piece of paper, apply the appropriate substances, return to their station, and set the paper aside to dry as they test for carbs and protein

**Time**

* Pre-Lab- 5min
* Lab- 25min
* Post-Lab- 5min
* Clean up- 5min

**Safety precautions**

Students should at least wear gloves while performing tests for carbohydrate and proteins; goggles are also recommended. You may also want to keep the Biuret reagent and iodine solution at your desk and have students come to pick it up when they need it.

**Pre-Lab Discussion Guide *–*** *adapted from Doherty, Waldron, and Spindler*

* Read the introduction and description of organic compounds (ask student)
* Page 1 -- First Table
  + Include distinctions between different types of carbohydrates-- monosaccharides (e.g. glucose), disaccharides (e.g. sucrose), polysaccharides (e.g. starch, glycogen, cellulose).
  + Protein functions include:
    - enzymes (e.g. digestive enzymes such as lactase; but some enzymes are RNA, e.g. in ribosomes)
    - structural (e.g. collagen)
    - transport proteins (e.g. across cell membranes or hemoglobin in blood)
    - some hormones (e.g. insulin)
    - receptor molecules for hormones, neurotransmitters, etc.,
    - antibodies
    - muscle contraction
  + Encourage students to give multiple characteristics, e.g. sugars are sweet; starch comes from plants, mainly from grains and potatoes; protein abundant in muscle which is what most meat and fish foods are.
  + Lipids feel greasy because nonpolar molecules slip past each other (and your fingers) more easily than polar groups.
* Page 1 -- Second Table
  + concentrated sources of specific types of organic compounds are storage parts of plant or animal (often to provide nutrients for growing embryo); vegetable oil from seeds, protein from egg whites, glucose from starch (e.g. from potatoes or grains)
* Read about indicators (ask a student to read)

**Post-Lab Discussion Guide -** *adapted from Doherty, Waldron, and Spindler*

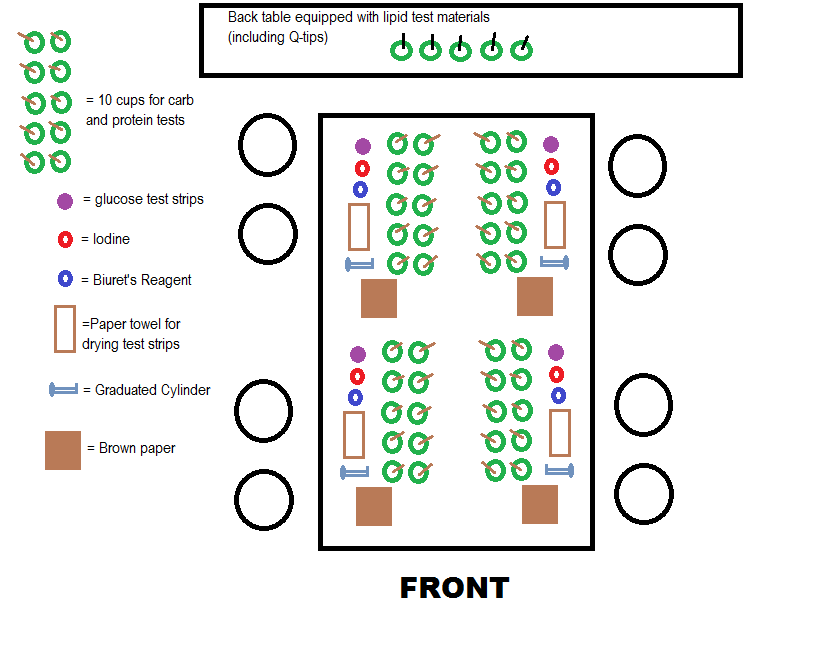
* Share and discuss results (Follow Questions page-4)
* Page 3 – Instruction 4. Why do drugstores sell glucose test strips? What are they used for? Brief discussion of diabetes
* Some sample food data for comparison

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Food | Sugars | Glucose (most data missing) | Starch (some data missing) | Total carbohydrates | Protein | Fat |
| Vegetable oil (corn oil) | 0 | 0 | 0 | 0 | 0 | 218 |
| Dried egg whites | 1.5 |  |  | 2 | 23 | 0 |
| Gelatin, unsweetened | 0 | 0 | 0 | 0 | 6 | 0 |
| Pretzels | 1 |  | 42 | 47.5 | 5.5 | 2 |
| Butter | 0 | 0 | 0 | 0 | 2 | 184 |
| Jellies | 11 |  |  | 15 | 0 | 0 |
| Low-fat vanilla yogurt | 34 |  | 0 | 34 | 12 | 3 |
| White beans (canned) | 1 |  |  | 55.5 | 19 | 1 |
| Kidney beans (canned) | 5 | 0 | 23 | 41 | 13 | 1.5 |
| Burritos with beans and cheese | 2 | 0 | 7 | 48 | 10 | 8.5 |
| Toasted white bread | 2 |  |  | 24.5 | 4 | 2 |

**Special Notes**

* Make sure each student has: lab packet, goggles, gloves, and a writing utensil
* The preparation procedures connote plastic cups with substances already added. This means that the students only need to add the water
* The water can be added to all 5 cups by simply filling the 10ml graduated cylinder and pouring 2ml into each cup (the amounts do not need to be exact).

**Diagram of set-up**



**\*note: Glucose test strips can be shared among groups if there are not enough for each group to have their own set.**

**\*\*Set up shows lab stations for 4 different groups. This same model would be replicated 7 times for a class of 28**