# North Carolina Science Olympiad Food Science (B) Regional Event 2007 (120 total points)

- I) (25 pts) You work as a food science product developer for a company that makes refrigerated biscuit dough (canned, that you buy in the grocery store and bake at home). Three types of biscuit dough are made at the plant - buttermilk, low-fat and cinnamon raisin.
  - 1) (2 pts) You have been asked to improve the quality of the buttermilk biscuits and have ordered and used a new the baking powder in the formula. Customers say that after baking, the new formula biscuits are "heavy and gummy" compared to the old formula. You want to find out if they are correct. What two tests would you run?
    - a) \_\_\_\_Strength and moisture of raw dough
    - b) \_\_\_\_Moisture and density of raw dough
    - c) \_\_\_\_Strength and moisture of cooked biscuit
    - d) \_\_\_\_Moisture and density of cooked biscuit
  - 2) You test samples cut from old and new formula biscuits using a ruler and scale and average the results. You find the following:

Sample	Width (mm)	Height (mm)	Length (mm)	Weight (grams)	
			-		(g/cm <sup>3</sup> )
Old formula	20.0	20.3	20.2	4.11	
New formula	19.8	20.5	20.4	4.49	

a) What test did you run? \_\_\_\_\_ (2 pts)

- b) Find result for test for each set of samples (3 pts per sample). Show work below and put answers in the table above. Deduction for significant figure errors.
- 3) If customers also complained about the biscuit cans exploding on the shelf or if they dropped it in the cart too hard, which of the following would you suspect to be the problem(s) (2 pts)?
  - a) \_\_\_\_Not enough gas was produced in the dough in the can
  - b) \_\_\_\_\_Too much gas was produced in the dough in the can
  - c) \_\_\_\_Not enough gas was produced when heating
  - d) \_\_\_\_\_Too much gas was produced when heating
- 4) What gas would baking powder produce?\_\_\_\_\_ (3 pts)
- 5) You decide to run tests on your old and new samples of "baking powder" to see if the new ingredient acts similar to the old ingredient to help with identifying the problem. You will find samples, labeled New and Old, at the main stations. Use as many of the following test procedures as needed to identify the samples.

Sample	Water reaction	Lemon juice reaction	lodine reaction
Old			
New			

Each sample will take one cup and one tsp of sample. After completion, empty contents in sink, rinse cup and place in trash can.

- (1) Label cups. Place 5 cc (approx. 1 tsp) sample in cup. Add 60 mL (¼ cup) water. Note reaction on chart.
- (2) Continue with testing in cup. Run either or both of the following experiments.
- b) Lemon Juice
  - (1) Add 3 mL lemon juice with dropper. Note reaction in table.
- c) lodine test
  - (1) Add 1 drop iodine reagent to cup. Do not shake. Note reaction in table.

From your results, what would you expect you received as the new ingredient (10 pts)? d) Cornstarch

- e) Alum
- f) Baking soda
- g) Double acting baking powder
- (20 pts) You work for a testing lab that has received samples from a sports drink company. They are looking for the best way to process and package their drinks with optimum flavor and nutrition without refrigeration. The same amount of vitamin C and flavor is added to all drinks. These bottles are to be sold during daytime outdoor sports events every weekend for the summer. Three different packaging processes have been tested for making the drinks and samples were sent to the testing lab. Samples were processed as described below and stored to simulate the summer sales season. Product was taken at day 1, day 20 and day 40 and placed in a dark refrigerator until testing for vitamin C content.

Samples from **process A** are made by heating the drink, adding vitamin C and bottling it into a clear plastic. The second type of process, **process B**, has the vitamin C added before heating and is bottled in a clear plastic bottle. Using the test procedure given, your job is to test the samples from each process at day 1, and after storage for 20 and 40 days without refrigeration and send a report to the company answering the following questions.

1) When you ran the vitamin C tests, what was the indicator in the solution? (2 pts)

2)	What reaction occurred in the test?		
		(4 pts)	
3)	How did you determine your endpoint?	· · ·	_ (2 pts)
4)	What is the chemical name of vitamin C?		(3 pts)
5)	Which process would you recommend if the product is consumed before day	5?	lf
	it was consumed after day 40? (4 pts)		
6)	If the samples had been held in a dark refrigerator during the sales season,	would your e	endpoint
	at day 40 take more or less drops of the indicator?	(5 pts	5)

## Vitamin C Test

### Materials:

6 small cups pipettes Samples Indicator reagent

#### Method:

- 1. Go to a central station and obtain cups and label them as in chart below. Return to bench.
- 2. Pipette 10 mL of each sample into labeled cups.
- 3. Add 10 drops of starch solution to each cup.
- 4. Use water to fill the cup to <sup>1</sup>/<sub>4</sub> to 1/3 full. Stir to combine.
- 5. While swirling, add iodine solution drop by drop. Swirl the solution until all evidence of the iodine is gone. The end point is when the solution is completely deep blue.
- 6. Clean up area by emptying liquids into sink, placing all cups in trash can and wiping down all surfaces.

Process	Day	# drops
А	1	
А	20	
А	40	
В	1	
В	20	
В	40	

### **III)** (10 pts)

- 1) Fill in the following blanks.
  - a) There are <u>Calories/gram of fat</u>.
  - b) There are \_\_\_\_ Calories/gram of carbohydrate
  - c) There are \_\_\_\_Calories/gram of protein
  - d) There are \_\_\_\_Calories/gram of water
- 2) Use the nutritional label given for information to answer the following questions:
  - a) Calculate the Calories in one serving of this product.
    (1) Calories from Fat\_\_\_\_\_
    - (1) Calories from Fat\_\_\_\_
    - (2) Calories from Protein \_\_\_\_
    - (3) Total Calories in one serving \_\_\_\_\_
  - b) What percent of the carbohydrate Calories come from fiber? \_\_\_\_\_
  - c) If the daily value of iron is 18 mg per day, calculate the amount (in mg) of iron in one bar of this product. \_\_\_\_\_

#### IV) True of False (10 pts)

- 1) \_\_\_\_\_ A calorie is the amount of heat required to raise the temperature of 1 gram of water 1°C.
- 2) \_\_\_\_\_ Hexoses contain six carbon atoms, twelve hydrogen atoms and six oxygen atoms.
- 3) \_\_\_\_ Pectin is a gum found in fruits.
- 4) \_\_\_\_\_ Amylopectin is a branched form of glucose.
- 5) \_\_\_\_\_ Lipids contain carbon, hydrogen and nitrogen.
- 6) Maillard Browning occurs when a carbohydrate and protein are heated.
- 7) \_\_\_\_ Essential amino acids are made by the body.
- 8) \_\_\_\_The main component of a potato is glucose.
- 9) \_\_\_\_\_ Three fatty acids combine with a glycerol backbone to form a lipid.
- 10) \_\_\_\_\_ Trans fats are formed when oil is heated to high temperatures.

<b>Nutrition Facts</b>		
Serving Size 1 bar (48g) Servings Per Container 12		
Amount Per Serving Calories from Fa		
% Daily Value*		
Total Fat 8g 13%		
Saturated Fat 2.5g 14%		
Trans Fat Og		
Cholesterol Omg 0%		
Sodium 70mg 3%		
Potassium 165mg 5%		
Total Carbohydrate 26g 9%		
Dietary Fiber 5g 18%		
Sugars 11g		
Protein 8g 16%		
Vitamin A 0% • Vitamin C 0%		
Calcium 2% • Iron 10%		

V) (55 pts) You work for the North Carolina Department of Agriculture in the food testing lab. A consumer brings in samples labeled "100% apple juice" for you to test. The consumer thinks some of the samples may contain some food starch and some others may not even be apple juice, but contain cane sugar, food coloring and/or starch. It is your job to identify any samples that are not 100% apple juice and identify samples containing other ingredients. You have the following samples and testing materials:

Company Applause Johnny Applejuice Apple-a-day Dapple

You have at your disposal all the needed equipment and reagents for the Biuret, Benedict's, and Iodine tests. There are central stations where you will find items for the following tests. All solutions are found at each bench station. Please label all glassware with sample identifier and your initials. Please wear protective eyewear and aprons. DO NOT TASTE ANY SAMPLES.

#### Results Table

After tests, please record results in individual test sheets, then complete the following table and questions, then tell us which label is correct:

	Biuret	Benedict's	lodine	100% Apple Juice? (yes or no) (20 pts)
Sample	Pos (+), Neg (-)	-/+	-/ +	
Applause				
Johnny Applejuice				
Apple-a- day				
Dapple				

1.	What main type of sugar does apple juice contain?	_ (3 pts)	
2.	What is the type of sugar in cane sugar?	_ (2 pts)	
3.	What component does the Biuret test measure?	(3 pts)	
4.	What metal salt is used in the Biuret reagent to form a complex?	(3 pts)	
5.	What component does the Benedict's Test meaure?	(3 pts)	
6.	. If a company added cane sugar to the apple juice, how could you find this adulteration?		
	How?		
		_ (5 pts)	
7.	What metal salt is used in the Benedict's test?	_ (3 pts)	
8.	What component does the lodine Test measure?	_ (3 pts)	
9.	Did you run all the tests? Why or why not?		
		(10  ntc)	
		1 117 111 1	

# **Biuret Test**

### Materials:

4 small cups pipettes Juices Biuret reagent \*\*\*\*must wear glasses/goggles, apron and gloves to handle!

### Method:

- a. Go to a central station and obtaincups. Return to bench and label cups with sample names.
- 7. Measure 10 mL of each sample into cups with plastic pipettes.
- 8. From the Biuret bottle, add 5 drops of Biuret solution to each labeled tube with plastic pipette. Gently swirl contents of tube.
- 9. Wait 10 minutes.
- 10. Observe and record results in the table.
- 11. Clean up area by emptying liquids into container- NOT DOWN SINK, place all cups into disposal box and wipe down all surfaces.

### **Results of Biuret Test**

Sample	Color After Addition of Biuret Solution to Sample	Positive or Negative Result
Applause		
Johnny Applejuice		
Apple-a-day		
Dapple		

# **Benedicts's Test**

### Materials:

4 cups Styrofoam container and cup Juices Benedicts's Solution Hot water pipettes

### Method:

- 1. Go to a central station and obtain cups and Styrofoam items. Label sample cups with sample names using marker.
- 2. Using pipette, add 10 mL of each unknown solution to corresponding test tube.
- 3. Add 10 drops Benedict's solution to each unknown.
- 4. From hot water dispenser, fill Styrofoam cup ½ full of hot water and carry to bench space. Pour into Styrofoam container.
- 5. At bench, place cups in container of hot water for 5 minutes.
- 6. Observe and record results in the following table.
  - a. Yellow, orange or red are positive reactions.
- 7. Place waste in designated waste container.
- 8. Pour water down sink and dispose of Styrofoam in trash.

Sample	Color of Solution	Positive or Negative Result
Applause		
Johnny Applejuice		
Apple-a-day		
Dapple		

### **Results of Benedict's Test**

# **Iodine Test**

### Materials:

4 test tubes

pipettes

Juices

Iodine Solution

#### Method:

- 1. Obtain test tubes at central station.
- 2. Return to bench. Place test tubes in rack at your bench area.
- 3. With plastic pipettes, pipette 40 drops each unknown solution into corresponding test tubes.
- 4. Add 1drop iodine to test tube for each unknown. Do not shake or swirl.
- 5. Observe and record results in the following table under step 1.
  - a. Blue or blue/black color is positive result
- 6. Place waste in designated container and dispose of glassware in glass box.

Sample	Color of Solution	Positive or Negative Result
Applause		
Johnny Applejuice		
Apple-a-day		
Dapple		

## **Results of Iodine Test**