

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

l) (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) | <hr style="border: none; border-top: 1px solid black; margin-bottom: 5px;"/> (g/cm ³) |
|-------------|------------|-------------|-------------|----------------|--|
| 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 | Iodine 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.

Participant's names _____

- (1) Label cups. Place 5 cc (approx. 1 tsp) sample in cup. Add 60 mL ($\frac{1}{4}$ 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) Iodine 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

- II) (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? _____ If 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 endpoint at day 40 take more or less drops of the indicator? _____ (5 pts)

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 ¼ 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 |
|---------|-----|---------|
| A | 1 | |
| A | 20 | |
| A | 40 | |
| B | 1 | |
| B | 20 | |
| B | 40 | |

III) (10 pts)

- 1) Fill in the following blanks.
 - a) There are ___ Calories/gram of fat.
 - 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 _____
 - (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. _____

| Nutrition Facts | |
|-------------------------------|-------------------------|
| Serving Size 1 bar (48g) | |
| Servings Per Container 12 | |
| Amount Per Serving | |
| Calories _____ | Calories from Fat _____ |
| % Daily Value* | |
| Total Fat 8g | 13% |
| Saturated Fat 2.5g | 14% |
| Trans Fat 0g | |
| Cholesterol 0mg | 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% |

IV) True or 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.

Participant's names _____

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 | Iodine | 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 measure? _____ (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 Iodine Test measure? _____ (3 pts)
9. Did you run all the tests? _____ Why or why not? _____ (10 pts)

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 obtain cups. 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 | | |

Benedict's Test

Materials:

4 cups
Styrofoam container and cup
Juices
Benedict'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 $\frac{1}{2}$ 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.

Results of Benedict's Test

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

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 1 drop 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.

Results of Iodine Test

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