



Food Science Event Division B

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Outline

- Introduction to Food Science
- Explanation of Rules
- Examples Activities
- Examples of Quizzes
- Common Mistakes
- References
- Questions

Introduction to Food Science

- "Food Science is the discipline in which biology, physical sciences, and engineering are used to study the nature of foods, the causes of their deterioration, and the principles underlying food processing" (www.ift.org)
- The Science Olympiad Food Science Event is intended to test students' knowledge of laboratory methods and general topics in Food Chemistry

Introduction to Food Science

- Food can be broken down into 3 major classes of components

- Carbohydrates
- Lipids
- Proteins

And include

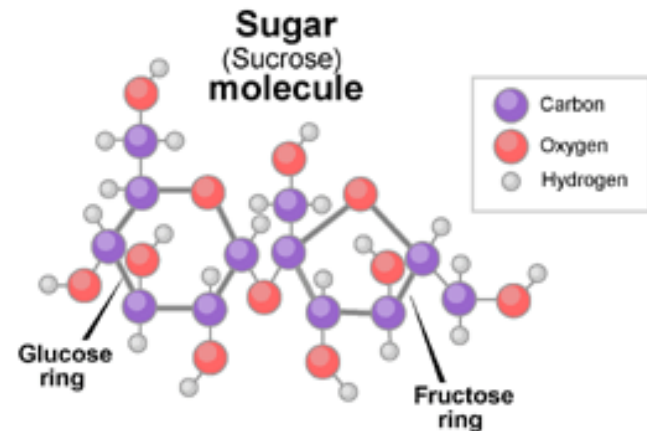
- Water

Introduction to Food Science

■ Carbohydrates

○ Sugars and starches

- Structures
- Bonds
- Flavor attributes

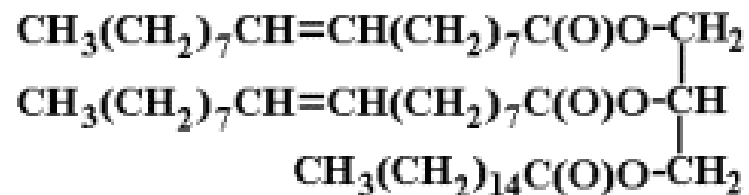


Disaccharide	Description	Component monosaccharides
sucrose	common table sugar	glucose + fructose
lactose	main sugar in milk	galactose + glucose
maltose	product of starch hydrolysis	glucose + glucose
trehalose	found in fungi	glucose + glucose

Introduction to Food Science

■ Lipids (fats)

- Structures
- Saturation levels
- Melting points



C18:1

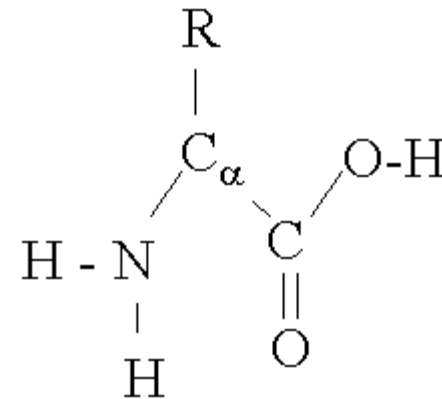
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Introduction to Food Science

■ Proteins

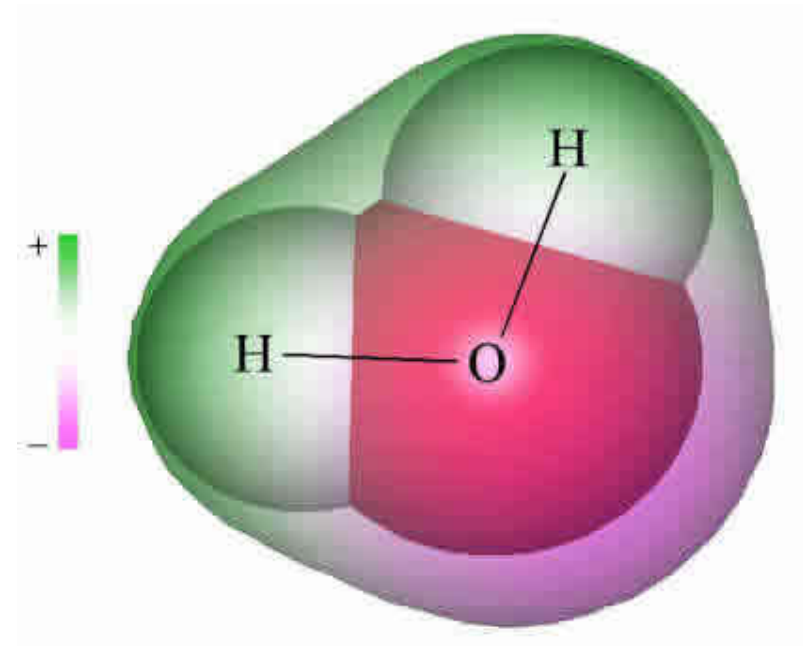
- Structures
- Levels of folding
- Amino acid components



Introduction to Food Science

■ Water

- Water activity (free water)
- Moisture content
- Concentrations



[Event Parameters]

- Event Parameters
 - Hands-on activities
 - Interpretation of experimental data
 - Observations of previously set-up experiment (Set-up by supervisors)

[Event Parameters]

- Students should be able to perform simple chemical/physical tests such as density, moisture content, and percent composition
 - Density: measurement of mass and volume
 - Moisture content: could include data or determination through drying

[Event Parameters]

- Students should be able to measure mass, volume, temp, and pH
 - Mass: use of balance
 - Temperature: use of digital or conventional thermometer
 - Volume: measurement could involve use of ruler, string, glassware, and water displacement
 - pH: use of Universal pH paper

[Event Parameters]

- Distinguish between lipids, carbohydrates, and proteins
- Characterize carbohydrates as starches or sugars
- Determine caloric value of food
- Determine amount of iron in breakfast cereal
- Differentiate between baking soda and powder based on chemical reaction
- Determine melting points of fats
- Rank Vitamin C content
- Determine moisture content
- Determine density
- Determine percentage of constituent in food
- Answer questions pertaining to foods label

Examples Activities

- Distinguishing between lipids, carbohydrates (sugars and starches), and proteins

- Biurets solution: proteins
- Brown paper: fats will stain (Div B)
- Benedicts solution: sugars
- Iodine: starches

In Div C students should understand how and why these reagents work.

Example Activities

- Calorimeter to determine caloric value
 - This can be done by burning a food sample with home-made calorimeter set-up by supervisor. The amount of heat added can be converted to the caloric value of the food
- Iron in cereal
 - This can be done by grinding up cereal with water and mixing with a large magnet and magnetic stirrer. The iron collects on the magnet and can then be weighed and quantified.

Example Activities

- Baking soda vs. Baking powder
 - Baking soda: sodium bicarbonate
 - Baking powder:
sodium bicarbonate + acid + starch
- Melting points of fats
 - For this experiment the procedure will be given. Students may be expected to monitor fats at different temperatures to determine melting point.

Example Activities

- Vitamin C content: explained in rules
- Moisture Content:
 - Students would be given a sample of a food product and then a sample of the same amount of food product after it has been dried (all moisture removed). They would need to use these numbers to determine the amount of moisture in the undried sample.
- Density:
 - Students can determine the density of solid or liquid food products by taking the mass over the volume. The volume of an irregularly shaped solid can be determined with a graduated cylinder using the displacement method.

Example Activities

- Percentage of carbohydrates or protein in sample of skim milk (would be given procedure):
 - For this students would need to use an acid to coagulate the protein in the sample. This could then be measured by filtering it out. The carbohydrate can be determined by determining the amount of moisture in the milk, the remainder of non-protein material would then be carbohydrate.
- Food labels:
 - Here students would be expected to determine missing numbers on a food label.
 - Example will be shown later.

Examples of Quiz Questions

- Questions/Activities may also cover topics such as:
 - Leavening agents
 - Food additives
 - Vitamins and minerals
 - Caloric value
- Topics can include:

Examples of Quiz Questions

- Which of the following is NOT a carbohydrate?
 - Sugar
 - Starch
 - Cellulose
 - Amino acid
- Which of the following contribute caloric intake in the human diet? (may be more than one answer)
 - Lipids
 - Minerals
 - Water
 - Proteins
- Rank the following in terms of moisture content from highest (1) to lowest (4).
 - Maple Syrup
 - Potato chips
 - Dried Fruit
 - Fresh produce

Fresh Produce>Maple Syrup>Dried Fruit>Potato Chips

Examples of Quiz Questions

Different amounts of energy are supplied by proteins, carbohydrates, and fats. Carbohydrates and proteins provide 4 calories per gram and fat provides 9 calories per gram. You have a food product that has 5 grams of carbohydrates, 10 grams of protein, and 4 grams of fat per serving.

- What is the total calorie content of one serving of this food product?
 - $5 * 4 = 20$
 - $10 * 4 = 40$
 - $4 * 9 = 36$
 - $36+20+40 = \mathbf{96 \text{ calories}}$
- What percentage of the calories are from fat?
 - $4 * 9 = 36$
 - $36/96 = 0.375$ or **37.5%**

Nutrition Labels

■ Method

- $15\text{g} - (10\text{g Carb} + 1\text{g Protein}) = \mathbf{4\text{g Fat}}$
- $4\text{g Fat} \times 9\text{cal/g} = \mathbf{36\text{ calories from fat}}$
- $36 + (10\text{g Carb} \times 4\text{ cal/g}) + (1\text{g Prot} \times 4\text{ cal/g}) = \mathbf{80\text{ calories}}$

Product: Cookies

Nutrition Facts

Serving Size: 15 g Net Weight: 60 g
Servings Per Container: 4

Amount Per Serving

Calories: ____ Calories from Fat: ____

Total Fat: ____ g

Cholesterol: 5mg

Sodium: 70mg

Total Carbohydrate: 10g

Dietary Fiber: 0g

Sugars: 4g

Proteins: 1 g

Calories per gram:

Fat 9 • Carbohydrate 4 • Protein 4

Common Mistakes

- 1. Students need to be sure to be aware of and record labels where appropriate and to record data in appropriate spots.
- Students should be able to follow directions appropriately.
- 3. Students should know how to use a balance and how to tare it.
- 4. Students should be familiar with glassware such as graduated cylinders and beakers
- 5. Students should read over the entire lab and understand exactly what is asked for before beginning the experiment.

References

- Check out www.soinc.org/events/foodscience/index.htm for recommended websites.
- Text Books:
 - Essentials of Food Science (Vickie A. Vaclavik and Elizabeth W. Christian)
 - Food Chemistry 3rd Edition (H.D. Belitz, W. Grosch, P. Schieberle, and M.M. Burghagen)
 - Understanding Food Science & Technology 1st Edition (Peter Murano)
- The Journal of Chemical Education (JCE) article “[Resources in Food Chemistry](#)”, JCE, Vol. 77, No. 10, Pages 1256-1267, October 2000 by Erica K. Jacobsen has been made available to Science Olympiad on the internet. The article lists: Classroom Activities; Examples of Food Chemistry; Single Topics; and Software Publications.



Questions??