



Food Science MSO Coaches Clinic

Maiya Yu
MSO Board

What will we cover?



Event Overview

What is Food Science?



Hands On Activities

An overview of the hands on lab component



Content Overview

An overview of the kinds of knowledge your students should try to have



Coaching and Resources

Tools available to support you

Zoom Guidelines

Please keep yourself muted until there is time for questions

Raise hand and wait for acknowledgement to talk

Ask questions after appropriate category

Don't panic if I don't get to your question! I will put together a typed document with answers to all questions and link it in the materials!



1.

Event Overview

What is Food Science?

Materials Allowed

- One 8.5x11 sheet of paper, front and back, which may be in a sheet protector
- Non-programmable, non graphing calculator
- Writing utensil
- Recommended lab equipment
- **Hydrometer**
- **Goggles, apron/labcoat**



Event Format

Two part event: written test and hands-on activities

Focus this year is on sugars/carbohydrates

Two aspects to focus on:

New content

New hands on activities



A decorative network diagram in the top-left corner, consisting of various sized grey circles (nodes) connected by thin grey lines (edges). Some nodes are solid, while others are hollow. The network is dense and irregular, extending from the top-left towards the center of the page.

2.

Hands on Activities



This Year: Three hands-on activities

1. Determine sugar concentration using participant-made hydrometer
2. Determine cold water stage of sugar solution
3. Determine whether or not sample has reducing sugars

We'll go over all three



1. Determine sugar concentration of samples

Hydrometer: uses density to measure dissolved solids
Could potentially recalibrate salinometers from past years

Use sugar solutions to calibrate
Scale, granulated sugar, distilled water
mass/volume solutions, limited to 1-10%

Accuracy requirements at different levels (within 1% at
invitationals and regionals, 0.5% at states and nationals)

2. Determining cold water stage of sugar solution

Students should be aware of safety -- sugar solutions used for this type of test are hot!

Might have students drop solutions, could also have solutions pre-dropped into cold water (although these would probably need to be remade frequently to avoid the stages dissolving)

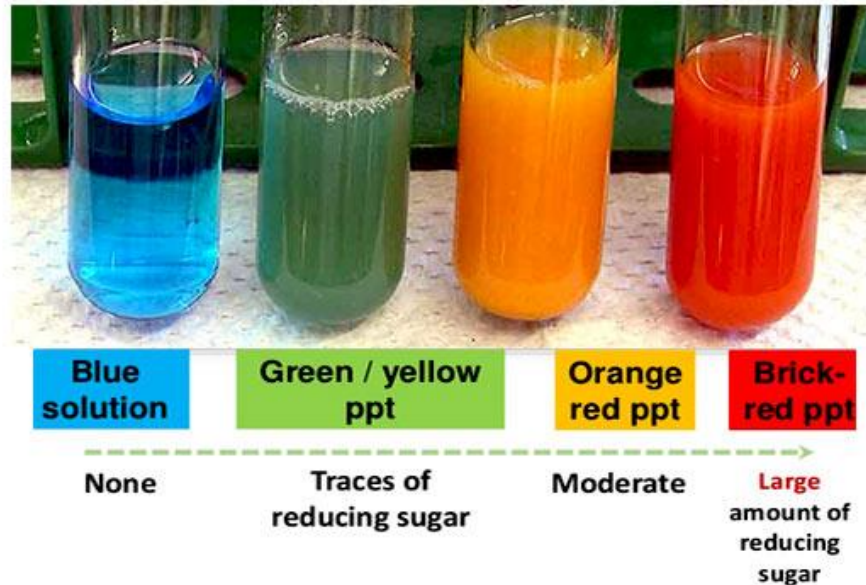
3. Determine whether or not solution has reducing sugars in it

3 aspects to success

- Know what a reducing sugar is
- Know reagents that allow you to identify whether or not there are reducing sugars (most likely Benedict's, but others exist)
- Know what these reagents look like

Benedict's Reagent

Add sample, swirl, heat in cup of hot water for a bit, observe color change



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3.

Content Overview

A non-exhaustive list of things to consider

Types of sugars, sweeteners, enzymes

Sugars: monosaccharides vs polysaccharides

Aldose vs ketose

Number of carbons: triose, tetrose, pentose, hexose...

Structure -- can you identify monosaccharides?

Can you identify polysaccharides? What are common polysaccharides made of?

Ring form vs Fischer projections

Types of sugars, sweeteners, enzymes

Non-sugar sweeteners: modified sugars, sugar alcohols, peptide-based

Enzymes: class of proteins that catalyze reactions, know what enzymes are and know ones that are relevant to sugars (e.g. amylase, lactase, sucrase/invertase)

Food preservation processes

- Drying: Jerky
- Solutes-salt, sugar, acids: Jams, Fermenting, Acidifying
- Freezing: Frozen foods
- Combination: Freeze drying, salting & drying fish

Know why they work!

Testing of foods (sugars, starches, fats, proteins)

Most common:

- Sugars: Benedict's, Tollen's, Fehling's
- Starches: Iodine test
- Fats: Paper test
- Protein: Biuret's

How cooking changes foods chemically

Protein denaturation

Hydration levels -- evaporation

Maillard's reaction -- browning

Heat-accelerated reactions -- leavening

Citric acid cycle

How sugars are broken down/how we get energy

Lots of enzymes involved!

Generation of ATP

Citric acid cycle in context: glycolysis, electron transport chain



Essential fats, vitamins, and proteins

What does it mean to be essential?

What can our bodies make?

What do we need to consume because our bodies can't make it?

Where are these found (food sources)?



New nutrition labeling requirements

What is required?

What is different?

Why were these changes made?

SIDE-BY-SIDE COMPARISON

Original Label

Nutrition Facts

Serving Size 2/3 cup (55g)
Servings Per Container About 8

Amount Per Serving	
Calories 230	Calories from Fat 72
% Daily Value*	
Total Fat 8g	12%
Saturated Fat 1g	5%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 160mg	7%
Total Carbohydrate 37g	12%
Dietary Fiber 4g	16%
Sugars 12g	
Protein 3g	
Vitamin A	10%
Vitamin C	8%
Calcium	20%
Iron	45%

* Percent Daily Values are based on a diet of other people's misdeeds.
Your daily value may be higher or lower depending on your calorie needs.

	Calories: 2,000	2,500
Total Fat	Less than 65g	80g
Salt Fat	Less than 20g	25g
Cholesterol	Less than 300mg	300mg
Sodium	Less than 2,400mg	2,400mg
Total Carbohydrate	300g	375g
Dietary Fiber	25g	30g

New Label

Nutrition Facts

8 servings per container
Serving size **2/3 cup (55g)**

Amount per serving	
Calories 230	
% Daily Value*	
Total Fat 8g	10%
Saturated Fat 1g	5%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 160mg	7%
Total Carbohydrate 37g	13%
Dietary Fiber 4g	14%
Total Sugars 12g	
Includes 10g Added Sugars	20%
Protein 3g	
Vitamin D 2mcg	10%
Calcium 260mg	20%
Iron 8mg	45%
Potassium 235mg	6%

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Allergens in foods

8 major food allergens

Types of allergies and insensitivities -- how do they work?

E.g. nut allergies vs lactose intolerance

Statistics on population allergies

Requirements on labeling

Crystallization and nucleation

Solubility

Crystals -- how do they form? What is special about them?

Forming crystals from supersaturated solutions

Nucleation -- what is it? How does it happen?

Leavening agents

Baking soda: sodium bicarbonate

Baking powder: sodium bicarbonate + tartaric acid

Yeast: it's alive! Fermentation-based leavening

Cold water candy tests

Function of both temperature and solute concentration

STAGES OF CANDY MAKING WITH THE COLD WATER TEST



320° to 350°F
The sugar is fragrant, has an amber color, and is extremely hard and brittle when immersed in water.
dessert decorations or candy coated nuts



300° to 310°F
The sugar immediately forms brittle threads when it is immersed in ice water & easily breaks into hard pieces.
toffee, nut brittles and lollipops



270° to 290°F
The sugar can be stretched between the fingers to form a piece that will bend slightly before breaking apart.
saltwater taffy and butterscotch



250° to 265°F
The sugar forms a ball that cannot be easily flattened.
nougat, marshmallows, gummies and rock candy



245° to 250°F
The sugar forms a solid ball that can still be compressed between the fingers.
caramels



235° to 240°F
The sugar can be formed into a ball, but it starts to soften and flatten after a few seconds.
fudge, pralines and fondant



230° to 235°F
The sugar does not hold its shape, but forms thin threads between the fingers.
syrup for ice cream

Water activity

Measure of amount of available water:

- Free water
 - ◆ Held inside cells
 - ◆ Can be removed by pressure
 - ◆ Maintains properties of free water
- Bound water
 - ◆ Bound to molecules
 - ◆ Loses freedom to move
 - ◆ Does not retain properties of free water

Density

Mass/Volume

Ways to determine (take mass and volume, divide; immerse in different density solutions, etc.)



4.

Coaching and Resources

Challenges

Topics are fairly biochemistry oriented -- many materials assume high background in chemistry, and focus on more medical applications of biochemistry


Breadth vs depth -- what extent to focus



Things to consider

Some aspects may be more or less difficult to self study (giving a student a college level biochemistry textbook right off the bat might be hard)

Hands on activities -- practice for required ones, but also explore other activities as a way for students to understand concepts





Scioly.org

Event pages often have practice tests, good summaries

Forums can be useful for asking questions of other teams/staff elsewhere



Clinic Resource Document

Links to other resources

Where to find materials

Ideas of biochemistry resources to adapt

Ideas for hands on activities





Contact

Maiya Yu

MSO Board

Stanford Structural Biology PhD student

mshyu@umich.edu

msh24@stanford.edu

Please feel free to email me with any questions!

