

WELCOME TO...
MARYLAND SCIENCE
OLYMPIAD:
Food Science



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(UCLA 2011, B.S.
Post-bac: NIH)

OUTLINE OF PRESENTATION

1. Goal of Food Science Event
2. PART I: Laboratory Exercise Descriptions
3. PART II: Questions/Written Portion
4. PART III: Safety & Materials to Bring





Food Science Event Goals

- Understand the physical and chemical properties of common food ingredients, baking/cooking techniques
- Have fun!



PART I

Lab Exercise Explanations



Event Guidelines: Labs

- **Lab 1:** Determine the relative viscosity (in centipoise, cP) of individual ingredients
 - Compare ingredients to known, pre-measured standard curve
 - Home-made Viscosity-Meter Guidelines
 - Directions on pamphlet
 - Considerations for Reproducibility and Consistency of Measurement
 - Hole in which liquid flows out must be equal in size, in (relative) same position on cup... if making multiple viscosity-meters
 - Timing measurement consistency depends on manual error, measuring at same starting volumes of liquids, and standardization of equipments (cup size, shape [pressure differences between flat and tall volume columns], texture)



Event Guidelines: Labs

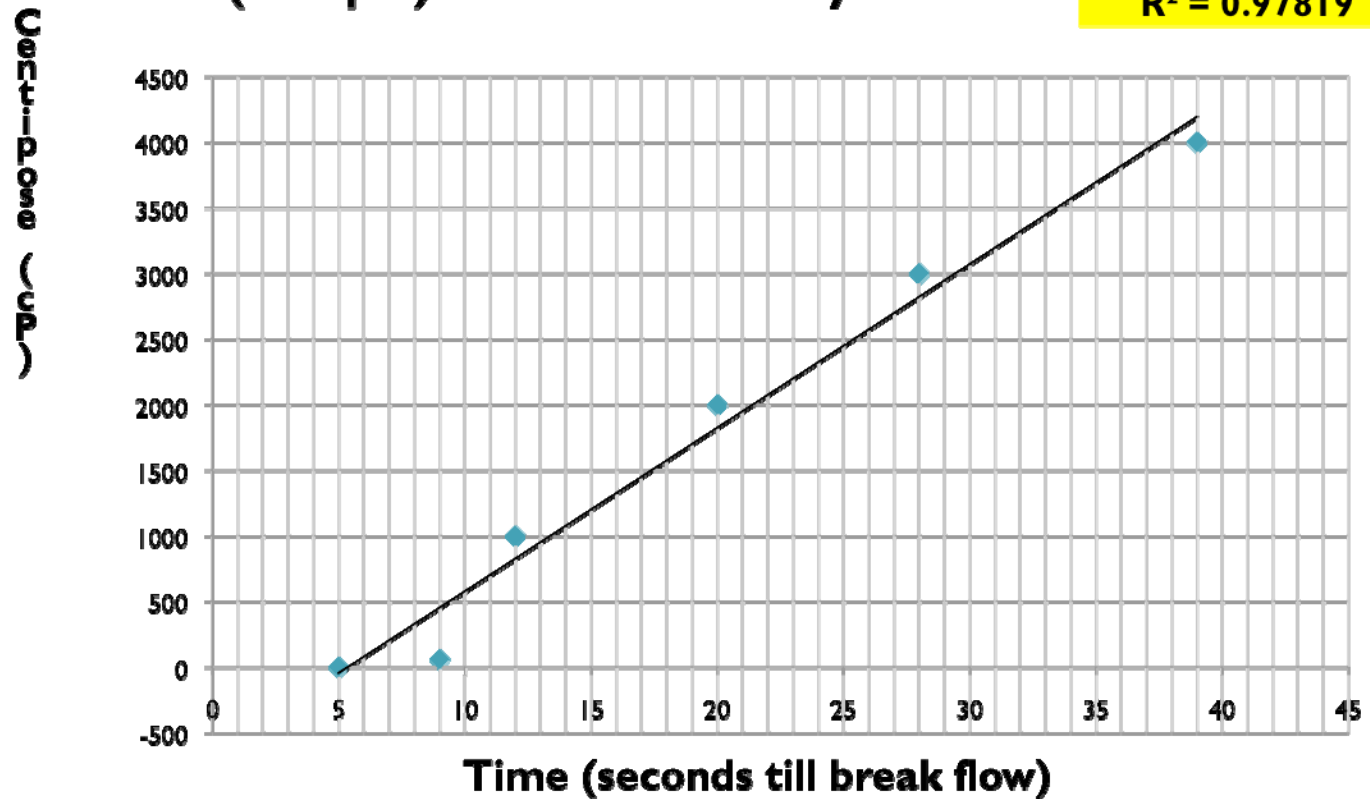
- Viscosity Test
- Standard Curve Graph... so you have something to compare the viscosities of your samples

i. Water	1 cP
ii. Mazola Canola Oil	60 cP
iii. Hershey Chocolate Syrup	1000 cP
iv. Karo Corn Syrup	2000 cP
v. Molasses	3000 cP
vi. Pure Honey	7000 cP

Event Guidelines: Labs

(Sample) Standard Viscosity Curve

$$y = 124.65x - 670.7$$
$$R^2 = 0.97819$$



Individual Teams' absolute measurements may be different, but relative ratios and relationships between values of the standard curve should remain constant



Event Guidelines: Labs

- **Lab II: Measuring density with water displacement**
 - Weigh the same amount of two or more items of solid food (twinkie vs. carrot)
 - Place in a brim-full beaker of DI-H₂O
 - Measure volume displaced
 - Calculate density using the above measured values



Event Guidelines: Labs

- **Labs III, IV: Ingredient Functions and Differences**
 - Determine effect of different amounts of ingredients, the order of addition of ingredients, or how absence/presence of certain ingredients affect the final product
 - *Grading Guidelines:*
 - How closely density adheres to pre-determined density values (within 5% error = 5 [perfect]. Every 5% deviation from set value is 1 point deduction)
 - Succinctness and level of detail of descriptions of Taste, Texture and Qualitative Qualities

Example Experimental Setup

Purpose: Test effect on density, taste & texture of baking powder vs. baking soda, as well as presence of vanilla in pastries.

Batch #	Flour	Leavening agent	Sweetener	Liquid	Egg	lipid	Salt	Vanilla
1	2 ¼ cups	3 tsps. Baking powder	1 1/3 Cup	1 cup milk or substitute sub.	2 large or none	none	½ tsp.	1 tsp.
2	2 ¼ cups	3 tsps. Baking powder	1 1/3 Cup	1 cup milk or substitute sub.	2 large or 3 Tbsp	oil	½ tsp.	none
3	2 ¼ cups	None	1 1/3 Cup	1 cup milk or substitute sub.	2 large or 3 Tbsp	oil	½ tsp.	1 tsp.
4	2 ¼ cups	3 tsps. Baking soda	1 1/3 Cup	1 cup milk or substitute sub.	2 large or 3 Tbsp	oil	½ tsp.	1 tsp.
5	2 ¼ cups	3 tsps. Baking powder	1 1/3 Cup	2 cup milk or substitute sub.	2 large or 3 Tbsp	oil	½ tsp.	1 tsp.
6	2 ¼ cups	3 tsps. Baking powder	2 1/3 Cup	1 cup milk or substitute sub.	2 large or 3 Tbsp	oil	½ tsp.	1 tsp.

Event Guidelines: Lab

- *Qualitative Tests:*

- Benedicts: measure presence of polysaccharides
- Biuret: measure presence of protein
 - Quantitative protein measurements can be obtained given a spectrophotometric reading compared against a known standard
- Iodine: measure presence of starch
- Brown bag rub: presence of lipids, oils, fats





Event Guidelines: Labs

Approved Ingredients for all Labs:

Liquids: water, milk, eggs

Lipids: veggie oil, shortening, butter,
margarines

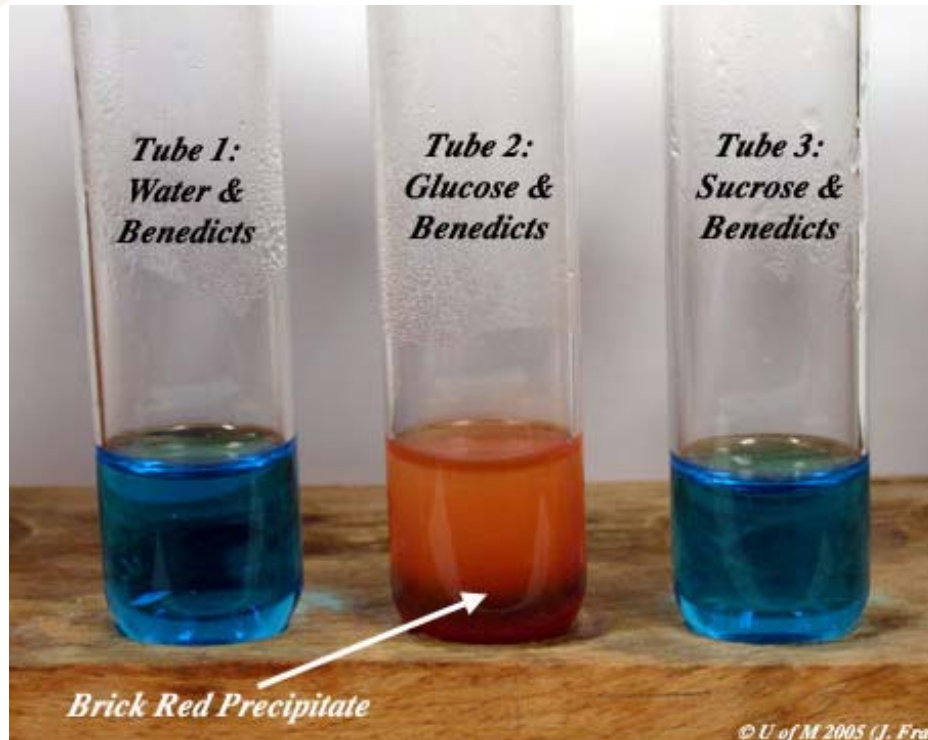
Leavening: baking powder/soda, yeast, cream of
tartar

Flavoring: salt, vanilla

Flours: all purpose white cake, whole wheat,
almond, coconut (shredded?), corn, rice

Sweeteners: sugar (white, brown) honey, molasses,
sucralose, aspartame, fructose (corn syrup, or other
forms)

Event Guidelines: Labs



Benedict's Solution: expected readout when mixed with ingredients of differing polysaccharide contents.

Benedict's Test:
measuring the presence of
glucose

Do this for different types of
foods containing different
ingredients:

High sugar

Low Sugar

No Sugar

Substitute Sugars

Do these ingredients hold up
to their advertisement's
promises?



PART II

Question Topics and Examples

Question Topics and Examples

- Chemical properties of each of the following reagents:
 - Benedict's solution
 - Biuret
 - Iodine
- Explain general (bio)chemical reactions
- Differences in function and chemistry of leavening agents
- Calculate nutritional value of a given food item
- *Possible* Exercise: Taste and texture of certain pre-baked goods, troubleshooting issues using chemical knowledge.



Question Topics and Examples

- What is the chemistry behind adding a certain ingredient?
 - Not only general reason, but chemical reasoning and/or reaction
 - **Example:** what is the purpose of yeast (answer is NOT making bread dough rise)?

More Complete Answer: upon contact with warm water, latent yeast feeds on the polysaccharides present in the bread, producing CO₂, which gets trapped in tiny pockets in the dough. Yeast also gives bread their distinctive flavors...



Question Topics and Examples

- Given only the recipe, find the ingredient by order of greatest \rightarrow least molar mass, or greatest \rightarrow least density
- Calculate nutritional value of a given food item
- *Possible Exercise:* Taste and texture of certain pre-baked goods, troubleshooting issues using chemical knowledge.





SAFE SCIENCE IS GOOD SCIENCE **!**

- Close-toed shoes
- ANSI Z87 indirect vent chemical splash goggles
- Pants that cover all the way to ankles
 - Highly DISCOURAGED: long skirts (it's cold anyways!)
 - Capris!
- Long-sleeved lab coat (sleeves reach wrists and knees)
- Recommended: Gloves (nitrile, latex ok)



What Materials to Bring

- **Notebook**
 - To get a head start and maintain organization, teams can pre-label their notebook with section headings, and mentally brainstorm what observations, data and numbers they will record.
- **3-ring binder**
 - information from previous experiments & outside sources (textbooks, credible online webpages)
- Teams are not expected to bake items on site, but are encouraged to bake items, test differences in density, texture, taste (...etc), and record them in their notebook for use to answer questions.
- **TIMER/stopwatch** (as reminded by a teacher ☺) **Although wristwatches and iphones may work, they are not as convenient, nor professional.**

Any Questions, Comments?



Thank you!

