

FOOD SCIENCE

1. **DESCRIPTION:** Using their understanding of the chemistry and physical properties of baking ingredients, teams will answer questions at a series of stations.

A TEAM OF UP TO: 2

EYE PROTECTION: #4

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:**

- a. Prior to the event, teams must make and bring a viscosity-testing device (only one is needed but back-ups are permitted) and prepare standard curve graph(s) using their homemade viscosity-testing device. **Teams may bring their entire device including a timer and a stand to use with their viscosity-testing device.**
- b. Teams must bring something to write with and may bring: calculators and one 3-ring binder, any size, containing information in any form from any source including results and analysis of their prior experimentation (i.e., teams are encouraged to bake goods, observe and record the differences caused by adjusting the ingredients from the Approved List of Ingredients).
- c. Event Supervisors must provide: Ingredients to be tested from the Approved List of Ingredients, reagents, and lab equipment for all labs and activities.
- d. Safety Requirements: Students must wear the following or they will not be allowed to participate: closed-toed shoes, ANSI Z87 indirect vent chemical splash goggles (see <http://soinc.org>), pants or skirts that cover the legs to the ankles, and additionally a long sleeved lab coat that reaches the wrists and the knees or a long sleeved shirt that reaches the wrists with a chemical apron that reaches the knees. Chemical gloves are optional. Students who unsafely remove their safety clothing/goggles or are observed handling any of the material or equipment in a hazardous/unsafe manner (e.g., tasting or touching chemicals or flushing solids down a drain and not rinsing them into a designated waste container provided by the supervisor) will be disqualified from the event.

3. **THE COMPETITION:**

- a. All ingredients in the activities or lab stations are limited to the following Approved List of Ingredients:
 - i. Liquids: water, milk (whole/reduced, cow, goat, almond, buttermilk, soy, coconut), eggs, and egg substitute
 - ii. Lipids: vegetable oil, shortening, butter, margarine, chocolate
 - iii. Leavening Agents: baking powder, baking soda, yeast, cream of tartar
 - iv. Flavoring: Salt and vanilla (essential oils and extracts - Nationals only)
 - v. Flours: all-purpose white, cake, whole wheat, almond, coconut, corn, rice
 - vi. Sweeteners: sugar, brown sugar, honey, molasses, sucralose, aspartame, fructose



- b. There must be one activity/lab station and related questions where teams will determine the viscosity, in centipoises (cP), of any one individual ingredient (Regional & State) or one combination of ingredients (Nationals) from the Approved List of Ingredients using their homemade viscosity-testing device and standard curve graph.
- c. There must be at least seven other activities/lab stations with questions related to the Approved List of Ingredients or baked goods made from those ingredients. The activities or stations must be related to this list of topics or tasks:
 - i. Lipids
 - ii. Proteins
 - iii. Carbohydrates
 - iv. Starches
 - v. Liquids
 - vi. Leavening agents
 - vii. Sweeteners
 - viii. Density
 - ix. Nutritional value of a sample label
 - x. Other measurable properties of baked goods

4. SCORING:

- The team with the highest score wins.
- Time will not be used for scoring.
- Ties are broken by the accuracy of the viscosity testing device activity/station. If teams do not bring a viscosity-testing device, ties are broken by an essay question designated by the event supervisor. **Teams will turn in a copy of their standard curve with the results of their viscosity experiment clearly marked.**
- Penalties: A penalty of up to 10% if the team's area is not cleaned up as instructed by the event supervisor. Teams without a homemade viscosity-testing device receive zero points for the viscosity testing activity/station.

5. Sample Activities, Lab Stations, and Relevant Questions:

- Teams may answer questions concerning chemical properties of approved ingredients and their use in baking (e.g., understanding of chemical test reactions using Benedict's, Biuret, Iodine, brown bags, etc.).
- Teams may answer questions about how different ingredients and different amounts of ingredients used during the baking process affect the final product. For example, what is the difference in using corn oil or butter and how does this affect the final product?
- Teams may answer questions about how baking powder differs from baking soda or yeast as leavening agents (e.g., explain the affect altitude has on baking and what adjustments are necessary in baking procedures due to altitude.).
- When given data, teams may calculate the nutritional value of a sample and answer questions concerning computation of nutrition and energy stored in foods.
- Teams may be required to measure the density of a baked good.
- When given only a recipe from the Approved List of Ingredients, teams may be required to produce a list of ingredients (found on a sample nutritional label) in order by the greatest mass.
- Given only a recipe, students may be required to identify which ingredients are the sources of starch, protein, etc.
- Given information about taste and texture of a baked good, teams may identify possible mistakes or substitutions made in a recipe. For instance if told a baked good is dry and crumbly but has no over cooked starch, students could identify the problem as the ingredients were not mixed properly or insufficient liquid was put into the batter, but not a result of baking too long. Students will use the results of their testing to answer these questions.

Homemade Viscosity Testing Device: Viscotesters **can be made** by drilling a 7/64" hole from the inside out of a 30 ml scoop or cup for liquids less than 200 cP viscosity, and a 5/32" hole for liquids with viscosities greater than 200 cP. Volumes of liquids provided at the event will be between 30-50 ml/team. When using the viscotester, materials should be filled above a start line, the flow started, and timed from the time the surface reaches the start line and a stop line which should be between 1-2 cm. Record your data to create your standard curve graph(s).

Standard Curve Graph: Create a graph of time to break flow vs. viscosity in *centipoise* (cP) using the homemade viscosity-testing device and **some of** the following liquids **at 20°C:**

| | | | |
|--------------------------|--------|---|---------|
| i. Water | 1 cP | vii. Carnation Evaporated Sweetened Milk | 1200 cP |
| ii. Milk | 5 cP | viii. Hershey's Chocolate Syrup | 1500 cP |
| iii. Crisco® Canola Oil | 40 cP | ix. Brer Rabbit Light Molasses | 3000 cP |
| iv. Virgin Olive Oil | 50 cP | x. Meadow Gold or Eagle Brand Evaporated Sweetened Milk | 5000 cP |
| v. Great Egg Spectations | 200 cP | xi. Pure Honey | 7000 cP |
| vi. Castor Oil | 900 cP | | |

Recommended Resources: All reference and training resources including the **Chem/Phy Sci CD** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>