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Grandma Button's Molasses Cookies

A Mole Day Activity

Introduction

The following recipe for "Mole"asses cookies provides a fun and interesting activity to celebrate Mole Day, October 23! The activity offers a useful review of metric and unit conversions and mole calculations.

Materials

Partially-hydrogenated soybean and cottonseed oils, mono and diglycerides, 135 g

Unrefined, dark crystalline sugar, 266 g

Pure, unsulphured, whole sugar cane juice, 82.5 g

Matured ovum with yolk overlaid with albumen proteins from *Gallus domesticus* female, 50 g

Hard and soft flours, 317.25 g

Sodium chloride, 0.0567 moles

Sodium hydrogen carbonate, 7.167×10^{22} formula units

Dried and powdered rhizome of *Zingiber officinale,* 5 mL

Dried and powdered inner bark of *Cinnamomum cassia,* 5 g

Dried and powdered flower-buds of *Eugenia caryophyllata,* 1.25 cm^3

Sucrose, 100 g (excess)

Procedure

All reactants should be at room temperature. Do not double the recipe—trust Grandma Button.

1. Preheat oven to 450 Kelvin.
2. To a 2-liter bowl, add 135 g partially-hydrogenated soybean and cottonseed oils, mono and diglycerides, and 266 g unrefined, dark crystalline sugar. Mix until a homogeneous mixture is obtained.
3. Add 82.5 g highest grade, pure, unsulphured, whole sugar cane juice to the mixture of oils and sugar. Stir until well blended.
4. Add 50 g matured ovum with yolk overlaid with albumen proteins from *Gallus domesticus* female to the mixture of oils and sugars. Stir until well blended.
5. Combine the following dry reagents in a 1-liter bowl: 317.25 g of a blend of hard and soft flours, 0.0567 moles of sodium chloride, 7.167×10^{22} particles of sodium hydrogen carbonate, 5 mL dried and powdered rhizome of *Zingiber officinale,* 5 g dried and powdered inner bark of *Cinnamomum cassia,* 1.25 cm^3 of dried and powdered flower-buds of *Eugenia caryophyllata*. Mix gently to obtain a homogeneous mixture.
6. Add the dry reactants from the 1-liter bowl to the wet reactants in the 2-liter bowl. Slowly stir until well blended.
7. Form 24.00-g balls of mixture. Roll in a bowl containing 100 g sucrose until each ball is well coated with sucrose.
8. Place 12 balls on a $304.8 \text{ mm} \times 4.572 \times 10^{-4}$ km cookie sheet lined with aluminum foil (shiny side up). Procedure should make about 36 balls total.
9. Place the cookie sheet into the oven set at 450 K.
10. Bake for 0.007 days.
11. Carefully remove from oven using a hot mitt. Place on a heat-protected surface and allow to come to room temperature (25 °C).
12. Ingest, digest, and egest, but most of all, ***enjoy***!

Teacher's Notes

Grandma Button's Molasses Cookie

Introduction

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Safety Precautions

This activity should not be performed in a laboratory setting where the food items will come in contact with laboratory chemicals or laboratory supplies. Any food items brought into a laboratory automatically become laboratory chemicals and are no longer suitable for human consumption.

Conversion Factors

Partially hydrogenated soybean and cottonseed oils, mono and diglycerides = Crisco® shortening
1 cup of Crisco = 180 g

Unrefined dark crystalline sugar = Dark brown sugar
1 tablespoon = 16.625 g of dark brown sugar
16 tablespoons = 1 cup

Pure, unsulphured, whole sugar cane juice = Molasses
1 teaspoon = 6.875 g molasses
3 teaspoons = 1 tablespoon

Matured ovum with yolk overlaid with albumen proteins from *Gallus domesticus* female = Chicken egg
1 large chicken egg with shell removed = 50 g

Hard and soft flours = All-purpose flour
1 cup of all-purpose flour = 141 g

Sodium chloride = Table salt
1 teaspoon table salt = 6.63 g

Sodium hydrogen carbonate = sodium bicarbonate = Baking soda
1 mole = 6.02×10^{23} particles
1 teaspoon baking soda = 5 g

Dried and powdered rhizome of *Zingiber officinale* = Ginger
1 metric teaspoon = 5 mL

Dried and powdered inner bark of *Cinnamomum cassia* = Cinnamon
1 metric teaspoon cinnamon = 2.5 g

Dried and powdered flower-buds of *Eugenia caryophyllata* = Ground clove
1 cm^3 = 1 mL

Sucrose = Table sugar
1 cup = 200 g sucrose
°C + 273 = Kelvin

5/9 (°F – 32) = °C

1 inch = 2.54 cm

1000 m = 1 km

10 mm = 1 cm

Discussion

Remind students to think about the number of significant figures that are allowed in the final answers.

$$135 \text{ g of Crisco} \times \frac{1 \text{ cup}}{180 \text{ g}} = 0.750 \text{ cups} = 3/4 \text{ cup Crisco}$$

$$266 \text{ g dark brown sugar} \times \frac{1 \text{ tablespoon}}{16.625 \text{ g}} \times \frac{1 \text{ cup}}{16 \text{ tablespoons}} = 1 \text{ cup brown sugar}$$

$$82.5 \text{ g molasses} \times \frac{1 \text{ teaspoon}}{6.875 \text{ g}} \times \frac{1 \text{ tablespoon}}{3 \text{ teaspoons}} \times \frac{1 \text{ cup}}{16 \text{ tablespoons}} = 0.250 \text{ cups} = 1/4 \text{ cup molasses}$$

$$50 \text{ g egg} \times \frac{1 \text{ large egg}}{50 \text{ g}} = 1 \text{ large egg}$$

$$317.25 \text{ g flour} \times \frac{1 \text{ cup}}{141 \text{ g}} = 2.25 \text{ cups} = 2¼ \text{ cups flour}$$

$$0.0567 \text{ moles NaCl} \times \frac{58.5 \text{ g}}{\text{mole}} \times \frac{1 \text{ teaspoon}}{6.63 \text{ g}} = 0.500 \text{ teaspoons} = 1/2 \text{ teaspoon salt}$$

$$7.167 \times 10^{22} \text{ formula units } NaHCO_3 \times \frac{1 \text{ mole}}{6.02 \times 10^{23} \text{ formula units}} \times \frac{84 \text{ g}}{1 \text{ mole}} \times \frac{1 \text{ teaspoon}}{5 \text{ g}} = 2 \text{ teaspoons baking soda}$$

$$5 \text{ mL ginger} \times \frac{1 \text{ teaspoon}}{5 \text{ mL}} = 1 \text{ teaspoon ginger}$$

$$5 \text{ g cinnamon} \times \frac{1 \text{ teaspoon}}{2.5 \text{ g}} = 2 \text{ teaspoons cinnamon}$$

$$1.25 \text{ cm}^3 \text{ ground clove} \times \frac{1 \text{ mL}}{\text{cm}^3} \times \frac{1 \text{ teaspoon}}{5 \text{ mL}} = 0.250 \text{ teaspoon} = 1/4 \text{ teaspoon ground clove}$$

$$100 \text{ g sucrose} \times \frac{1 \text{ cup}}{200 \text{ g}} = 0.5 \text{ cup sucrose} = 1/2 \text{ cup sugar}$$

Oven Temperature

°C + 273 = Kelvin
5/9 (°F – 32) = °C
450 K = 177 °C = 350 °F (2 significant figures)

Baking Pan

$$304.8 \text{ mm} \times \frac{1 \text{ cm}}{10 \text{ mm}} \times \frac{1 \text{ inch}}{2.54 \text{ cm}} = 12.00 \text{ inches}$$

$$4.572 \times 10^{-4} \text{ km} \times \frac{1000 \text{ m}}{\text{km}} \times \frac{100 \text{ cm}}{1 \text{ m}} \times \frac{1 \text{ inch}}{2.54 \text{ cm}} = 18.00 \text{ inches}$$

Baking Time

$$0.007 \text{ days} \times \frac{24 \text{ hours}}{\text{day}} \times \frac{60 \text{ minutes}}{1 \text{ hour}} = 10 \text{ minutes}$$

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12

Systems, order, and organization

Constancy, change, and measurement

Content Standards: Grades 5–8

Content Standard A: Science as Inquiry

Content Standard B: Physical Science, properties and changes of properties in matter

Content Standards: Grades 9–12

Content Standard A: Science as Inquiry

Content Standard B: Physical Science, structure and properties of matter

Acknowledgments

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