

A Chemist's Classified Cookie Recipe

Grades: 3-5

Materials: *Mole and Tell*, calculator, recipe sheet, cookie recipe worksheet, chocolate chip cookies (premade dough, from scratch, or prepackaged), answer key.

Subject: Chemistry, Food Science

NGSS: 5-PS1-2 Matter and Its Interactions

Skills: Problem solving, critical thinking, working with equations

Background: *Mole and Tell* discusses how chemists measure the mass of the elements and other substances. Chemists and other scientists all use moles as their measurement for mass, so this chemist's chocolate chip cookie recipe is a little hard to decipher! With your students, you will need to learn how to convert a recipe that uses moles as the measurement to figure out how to make chocolate chip cookies with measurements that are more familiar!

Activity:

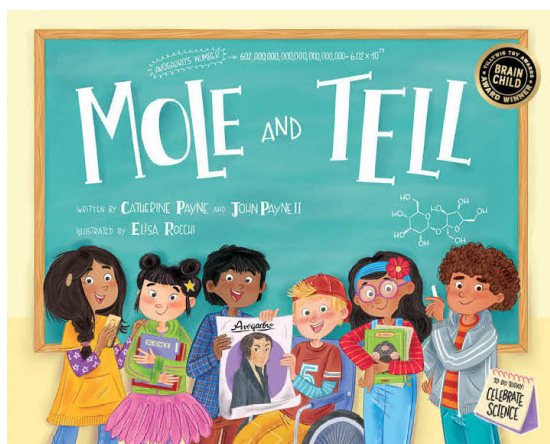
1. You have a few options on how to incorporate cookies into this lesson:
 - Bake chocolate chip cookies before class, and give them to your students after the assignment is completed.
 - Buy premade chocolate chip cookies to hand to your students after class.
 - Bake the cookies as a class, as you are solving for the measurements.
2. Read *Mole and Tell* out loud to the class. Once you are finished, hand out the Chemist's Classified Cookie Recipe worksheet and the Cookie Recipe sheet. Discuss the equation used to find the grams of a substance that is measured in moles with your students.
3. You have three steps to convert mole values to grams.
 - Find how many moles there are of the substance.
 - Find the molar mass (atomic weight) of the substance.
 - Multiply both the values together.
$$\text{Grams} = \# \text{ of Moles} \times \text{Molar Mass}$$
4. Use an ingredient from the recipe as an example to teach the student's on how to do the equation.
5. Set the students in groups, pairs, or independently, so they can solve each part of the recipe in a timely manner.

6. After the students finish the conversion of each ingredient, you can bake the cookies as a class or start handing out the cookies to the students.
7. While the students (and you) are finishing the cookies, have a discussion about what they learned about Avogadro's number.

Discussion: What did you learn about the measurement of moles compared to grams? Do you think that using moles as a unit of measurement for cooking is a good thing or a bad thing?

A Chemist's Classified Worksheet Answers

113 g butter (1/2 cup)	4.2 g vanilla extract (1 tsp)
165 g brown sugar (3/4 cup)	28.3495 g chocolate chips (12 oz)
150 g sugar (3/4 cup)	50 g eggs (2 large eggs)
281 g flour (2 1/4 cup)	
2.55 g baking soda (3/4 tsp)	
5.92 g salt (1 tsp)	



This activity was excerpted from the Teacher's Guide to
Mole and Tell

English:

Hardback: 978-1-958629-11-6

Paperback: 978-1-958629-10-9

eBook: 978-1-958629-12-3

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A Chemist's Classified Cookie Recipe Worksheet

Convert the recipe ingredients from moles to grams using the molar masses listed below. Multiply the molar mass of a substance by the corresponding number of moles listed on the recipe handout.

Molar Mass of _____

butter: 503.847 g/mol

brown sugar: 342.2965 g/mol

sugar: 342.3 g/mol

all-purpose flour: 108.068403 g/mol

baking soda: 84.007 g/mol

salt: 58.44 g/mol

vanilla extract: 152.149 g/mol

chocolate chips: 120.1039 g/mol

eggs: 160.1711 g/mol

Unsalted butter

Fine salt

Brown sugar

Vanilla extract

Sugar

Chocolate chips

All-purpose flour

Large eggs

Baking soda

Cookie Recipe

Ingredients

0.2243 mol unsalted butter
0.4820 mol brown sugar
0.4382 mol sugar
2.6002 mol all-purpose flour
0.0304 baking soda
0.1013 mol fine salt
0.0276 mol vanilla extract
0.2360 mol chocolate chips
0.3122 mol large eggs

Instructions

1) Preheat the oven to 375 F. Line two baking sheets with parchment paper or silicone baking sheets.

2) Melt the butter, either by microwaving on medium in a covered heat-safe bowl, or in a saucepan on the stove. Whisk butter, eggs, sugar, brown sugar, and vanilla in a large bowl until smooth.

3) Whisk the flour, salt, and baking powder together in a separate bowl. Then stir the dry ingredients into the wet ingredients, making sure to not over-mix. Stir in the chocolate chips.

4) Scoop large tablespoons of dough onto the baking sheets. Wet your hands and roll the dough into balls, and place them about two inches apart from each other.

5) Bake until golden brown, about 12 to 16 minutes. Adjust time depending on how chewy or crispy you like your cookies. Transfer cookies to a cooling rack with a spatula and let cool.

6) Serve. Cookies can also be stored in a tightly sealed container for up to five days.