Percent Composition of an Oreo

General Lesson Information:

Subject	Chemistry
Unit of Study	Unit: Chemical quantities Lesson: Understanding Percent Composition
Grade/Level	11^{th} and 12^{th} grade
Summary of Lesson Plan	Introduce students to concept of percent composition – the relative amount of each element in a compound
Measurable Lesson Objective	Students calculate the percent composition of the crème filling in a regular and double stuff Oreo.
Rationale	The students are familiar with chemical formulas and how to determine the molar mass of a compound therefore they should be able to combine their prior knowledge of the two concepts in order to determine the percent composition of a given compound.

Detailed Lesson Outline: Mini-Inquiry + Instructional Input

Lesson Title	Percent Composition of a Compound
Measurable Lesson Objective	Students calculate the percent composition of the crème filling in a regular and double stuff Oreo.
Standards (California State Standards)	S3. Compounds have a fixed percent elemental composition. For a compound, the empirical formula can be calculated from the percent composition of the mass of each element. To determine the molecular formula from the empirical formula, the molar mass of the substance must also be known.
Materials	Teacher Supplied Materials ▪ Promethean Board ▪ Flipchart (PPT instruction) ▪ Whiteboard Markers ▪ Student In-class Worksheet ▪ Oreo cookies (original and double stuff 1 of each/group) ▪ Paper towels ▪ Plastic knives (1/group) ▪ Electronic balances Student Supplied Materials ▪ School Laptop ▪ Paper ▪ Writing Instrument ▪ Scientific Calculator
Duration	60-minute class period
Anticipatory Set (Mini-Inquiry)	Engage: What percent composition is the crème filling of an Oreo? ▪ Begin discussing with the students the idea of percent composition – the relative amount of each component (or element) in a compound ▪ Pose the question to the students: How can we determine percent composition? What do you need to know? Mass of each component and total mass of the compound ▪ Percent mass of element X = $\frac{\text{grams of element X}}{\text{grams of the compound}} \times 100\%$ Explore: ▪ Teacher Action: Instruct the students to determine the percent composition of the crème filling in a regular Oreo. ▪ Student Action: In their lab group students determine the percent composition of

	the crème filling in an Oreo. Explain: ▪ Student Action: Students compare their results with another group and discuss any differences that may have resulted due to error. Elaborate: ▪ Have the students complete the same procedure except they determine the percent composition for a double stuff Oreo. Evaluate: ▪ Students will calculate and compare the percent composition of crème filling for a regular and double stuff Oreo. ▪ Students will answer the corresponding questions on the inquiry handout. ▪ ***Time: 30 minutes***
Teaching Instruction	▪ Show the students how to use the same procedure they used in the Oreo-Inquiry to determine the percent composition of elements in a compound ▪ Determine the percent composition of $CuSO_4$ ▪ Determine the percent composition of $CuSO_4 \cdot 5H_2O$ ▪ ***Time: 15 minutes*** Checking for Understanding: ▪ Have the students complete two additional problems on their own ▪ Review both problems as a class and cold call on students to fill-in the various steps used to reach the answer ▪ ***Time: 10 minutes***
Closure	▪ Review the concepts the students have learned thus far by reminding them they can find the composition of any compound as long as the mass values are known. ▪ Prepare the students for empirical formula ▪ ***Time: 5 minutes***

Differentiation:

Gate/High Achieving Students	Extra problems will be provided for students to complete, in addition to the problems on the worksheet.
ELL Students	ELL students will be provided a modeled student worksheet in order to follow along during the input section of the lesson.

Assessment:

Formative Assessment	The Oreo-inquiry worksheet will serve as the formative assessment
Rubric	See attached rubric below

Performance Criteria	Evidence	Zero Points	Half Points	Full Points
Students demonstrate knowledge of percent composition	Students are able to calculate the percent composition of the crème filling in a regular Oreo.	No attempt is made to answer the question	An attempt is made to answer the question with some minor calculation errors	Were able to correctly determine the answer without any calculation errors
	Students are able to determine the percent composition of the crème filling in a double stuff Oreo	No attempt is made to answer the question	An attempt is made to answer the question with some minor calculation errors	Were able to correctly determine the answer without any calculation errors

Name: _____
Date: _____
Period: _____

INQUIRY ACTIVITY: THE COMPOSITION OF AN OREO COOKIE

Procedure:

1. Obtain your materials from your designated bucket
2. Weigh the mass of the cookie using the electronic balances
3. Determine the mass of the wafer cookie and the crème filling
4. Record all mass values with **TWO** decimal places

	Regular Oreo	**Double Stuff Oreo**
Mass of the Cookie (grams)		
Mass of the Wafer (grams)		
Mass of Crème Filling (grams)		

Calculations: Must show all work

Percent Composition of the crème filling (Original Oreo)	Percent Composition of the crème filling (Double Stuff Oreo)

Group Comparisons:

Your Group:	**Another Group:**
What possible errors could have occurred to explain the difference in values?	

Question Time:

1. How do the percent composition of the cookies compare?

2. Is the double stuff, double the percent composition? Use evidence to support your statements.

3. If each Oreo had a molar mass of 120 g/mol, how many moles would be present in one Oreo cookie?

4. If each Oreo had a molar mass of 120 g/mol, how many particles would be present in one Oreo cookie?

5. What is the general formula for determining percent composition?