Unit 04: Reactions and Stoichiometry

Content Area: **Science**
Course(s):
Time Period: **Marking Period 2**
Length: **4-5 Weeks**
Status: **Published**

Brief Summary of Unit

This unit introduces the concepts of atomic mass, molar mass, and isotopic abundances. The relationship of Avogadro's number to the mole will be investigated. Empirical and molecular formula determination, as well as percentage composition calculations, will be utilized as a tool to identify the composition of a compound. There will be an in-depth study of writing chemical equations for reactions. The balancing and classification of reactions will be emphasized and the reactions will then be analyzed stoichiometrically. General stoichiometry problems, limiting and excess reactant problems, and empirical and molecular formula determination problems will be presented.

June2022

Standards

LA.K-12.NJSLSA.R1	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
MA.N-Q.A	Reason quantitatively and use units to solve problems.
LA.K-12.NJSLSA.R8	Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
LA.K-12.NJSLSA.W1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
LA.K-12.NJSLSA.W4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
LA.K-12.NJSLSA.W6	Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
LA.K-12.NJSLSA.W8	Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
SCI.HS.PS3.A	Definitions of Energy
	Energy and Matter
SCI.HS.PS3.D	Energy in Chemical Processes
TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
	Career planning requires purposeful planning based on research, self-knowledge, and informed choices.

Essential Questions

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What is the significance of a chemical equation?

How are mass relationships utilized in identification of compounds and prediction of quantitates?

Enduring Understandings

The Law of Conservation of Matter is used to determine chemical composition in compounds and chemical reactions.

Students Will Know/Students Will be Skilled At

Students will be skilled at predicting products, writing, and balancing a chemical equation.

Students will know how to identify the type of reaction based on reactants.

Students will know how the atomic mass unit was developed and why.

Students will know how a mass spectrometer enables chemist to determine average atomic mass of an element.

Students will be skilled at calculating the average atomic mass of an element.

Students will know Avogadro's number and it's relationship to the mole and molar mass.

Students will be skilled at using dimensional analysis to covert between grams, moles, and atoms/molecules/formula units.

Students will be skilled at utilizing percent composition to determine the formula of a compound.

Students will be skilled at calculating the empirical formula and molecular formula given quantitative data.

Students will know how to solve empirical formula from combustion analysis.

Students will be skilled at solving stoichiometry problems.

Students will know how to determine which, if any, is the limiting reactant and how much excess reactant is left.

Students will know how to identify the actual yield vs. theoretical yield.

Students will know how to represent the efficiency of a reaction with percent yield and percent error.

Learning Plan

Preview the essential questions and connect them to learning throughout the unit.

Discuss the components of a chemical equation and model the method of writing and balancing chemical equations.

Introduce the 5 types of chemical reactions and how to recognize them.

Review how to write formulas for ionic compounds and model how to predict the products of a chemical reaction.

Discuss how the atomic mass unit was derived and why. (Can be done with the Bean Lab)

Watch a video on how a spectrometer works and analyze the data that it provides.

Introduce Avogadro's number and the mole then model how to solve conversions using dimensional analysis.

Model how to calculate percent composition, empirical formula from experimental determination, and molecular formula.

Model how to utilize stoichiometry to predict quantities in a chemical reaction.

Discuss how to determine which reactant is limiting and how much excess reactant remains.

Model how to solve percent yield problems.

Labs/Activities:

Balancing Equations Online Activity (inquiry activity)

Bean Lab

Average Atomic Mass inquiry PhET simulation

Types of Chemical Reactions

Empirical Formula Determination (can be of MgO or a hydrate)

Determining Mass Percent of Carbon in Sodium Bicarbonate

Determining Limiting and Excess Reactant Inquiry Lab

Iron to Copper Lab

Evidence/Performance Tasks

Formative

Results of Balancing game at the end of the online activity

Analysis questions in Bean Lab

Calculated average atomic mass or identification of element from mass spectrometer data

Completed problems in CHEMFILE: MINI GUIDE TO PROBLEM SOLVING HOLT 1999

Assigned homework problems in CHEMISTRY 11 ED. CHANG MCGRAW HILL 2013

Summative

Unit Quizzes and Tests

Benchmark

Midterm Exam

Alternative

Lab Report for Determining Mass Percent of Carbon or Iron to Copper Lab.

Materials

CHEMISTRY 11 ED. CHANG MCGRAW HILL 2013

CHEMFILE: MINI GUIDE TO PROBLEM SOLVING HOLT 1999

Approved Textbook Link

In addition to general lab and safety equipment as noted in lab handouts:

bunsen burner

laptop

magnesium strips

iron

copper (II) sulfate hydrate

Suggestions Strategies for Modifications

FOR SPECIAL EDUCATION STUDENTS , ELL, AT RISK AND STUDENTS GIFTED STUDENTS

https://docs.google.com/spreadsheets/d/1pQwsQoD_QLot65BTdHFEHN5dXIiqS54iQ5iDL8C4q6o/edit?usp=sharing