Chemistry Unit 03: The Mathematics of Chemical Reactions

Unit #:	APSDO-00019426	Duration:	4.0 Week(s)	Date(s):	

Team:
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Grades:
12
Subjects:
Science

Unit Focus

In this unit, students will learn that atoms and molecules can be counted through determining the mass of a pure substance and that this ability to count atoms and molecules plays an important role in many aspects of chemistry. Students explore the mole concept and how it applies to quantitative relationships in chemistry and stoichiometry. Summative assessments may include: written quizzes and tests that include application problems where students demonstrate the quantitative relationships of substances in chemical reactions; models of balanced equations; and lab reports that include experimental design, data analysis, and laboratory practice. Instructional materials include a traditional textbook, numerous teacher-generated readings and handouts, guided inquiry learning activities, and online tutorials/simulations/problem sets.

Stage 1: Desired Results - Key Understandings

Established Goals

Next Generation Science Standards (DCI)
Science: 8

- The total number of each type of atom is conserved, and thus the mass does not change. *PS1.6.B2*

Science: 12

- Both physical models and computers can be used in various ways to aid in the engineering design process. Computers

Transfer

T1

Integrate knowledge from a variety of disciplines and apply it to new situations to make sense of information, formulate insightful questions, and/or solve problems

T2

Design an investigation or model using appropriate scientific tools, resources, and methods

T3

Collect, analyze and evaluate the quality of evidence in relation to a question

are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. *ETS1.9.B2*	**T4** Develop a valid scientific conclusion, assess its validity and limitations, and determine future course of actions to inspire further questions **T5** Communicate scientific information clearly, thoroughly, and accurately. **T6** Use mathematics to represent physical variables and their relationships, to make quantitative predictions, and to solve problems.

Meaning	
Understandings	**Essential Questions**
U1 The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. [PS1.B] **U2** (U201) Designs can be conveyed through sketches, drawings, computer simulations, or physical models. These representations are useful in communicating possible solutions to others.	**Q1** (Q404) What happens to substances when they react? **Q2** (Q411) How do we predict and explain why specific substances react, what they will form, and how much product will result? **Q3** (Q200) How do you approach an engineering problem in a systematic way in order to design an effective solution?

Acquisition of Knowledge and Skill	
Knowledge	**Skills**
K1 Balanced equations represent mole ratios which can be used to apply stoichiometric calculations **K2** Amounts of reactants consumed and	**S1** Determine the limiting reactant and theoretical yield of a reaction **S2** Determine the percent yield of a product

	products formed can be determined from the balanced equation **K3** Atoms are counted by measuring a mass of a sample. To relate mass and the number of atoms, the average atomic mass is required. The mass of one mole of an element equals the atomic mass in grams **K4** The molar mass of one mole of a compound is obtained by finding the sum of the average masses of its constituent atoms **K5** Avogadro's number (6.022×10^{23}) represents the number of particles in a mole	**S3** Given the moles or grams of a reaction component, calculate the moles or grams of a different reaction component **S4** Given the mass or moles of a substance, students can apply avogadro's number to determine the number of atoms/molecules in the sample **S5** Given experimental data, determine the empirical formula of a compound **S6** Create and interpret models of chemical reactions