Standard #: SC.912.P.8.9

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Apply the mole concept and the law of conservation of mass to calculate quantities of chemicals participating in reactions.

General Information

Subject Area: Science

Grade: 912

Body of Knowledge: Physical Science

Idea: Level 3: Strategic Thinking & Complex Reasoning

Standard: Matter -
A. A working definition of matter is that it takes up space, has mass, and has measurable properties. Matter is comprised of atomic, subatomic, and elementary particles.

B. Electrons are key to defining chemical and some physical properties, reactivity, and molecular structures. Repeating (periodic) patterns of physical and chemical properties occur among elements that define groups of elements with similar properties. The periodic table displays the repeating patterns, which are related to the atom's outermost electrons. Atoms bond with each other to form compounds.

C. In a chemical reaction, one or more reactants are transformed into one or more new products. Many factors shape the nature of products and the rates of reaction.

D. Carbon-based compounds are building-blocks of known life forms on earth and numerous useful natural and synthetic products.

Date Adopted or Revised: 02/08

Content Complexity Rating: Level 3: Strategic Thinking & Complex Reasoning - More Information

Date of Last Rating: 05/08

Status: State Board Approved

Related Courses

Course Number	Course Title
2003340:	Chemistry 1 (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2003350:	Chemistry 1 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2002420:	Integrated Science 2 (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2002430:	Integrated Science 2 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2003800:	Florida's Preinternational Baccalaureate Chemistry 1 (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
7920011:	Access Chemistry 1 (Specifically in versions: 2014 - 2015, 2015 - 2018, 2018 and beyond (current))
2002425:	Integrated Science 2 for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 - 2020 (course terminated))
2003345:	Chemistry 1 for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)

Related Access Points

Access Points Number	Access Points Title
SC.912.P.8.In.2:	Compare characteristics of physical and chemical changes of matter.
SC.912.P.8.Su.2:	Identify examples of physical and chemical changes.
SC.912.P.8.Pa.2:	Recognize a common chemical change, such as cooking, burning, rusting, or decaying.

Related Resources

Formative Assessment

Name	Description
Balancing Act:	This activity allows students to practice balancing chemical equations. It has three difficulty levels, and the students can practice with 5, 10, or 15 questions.

Lesson Plans

Name	Description

How Big Is a Mole? Do We Really Comprehend Avogadro's Number?:	The unit "mole" is used in chemistry as a counting unit for measuring the amount of something. One mole of something has 6.02×10^{23} units of that thing. The magnitude of the number 6.02×10^{23} is challenging to imagine. The goal of this lesson is for students to understand just how many particles Avogadro's Number truly represents, or, how big is a mole. This lesson is meant for students currently enrolled in a first or second year chemistry course. This lesson is designed to be completed within one approximately 1 hour class; however, completion of optional activities 4 and 5 may require a longer class period or part of a second class period.
Converting from moles to mass (grams) :	Lesson on finding molar mass and converting from moles to mass (grams) for pure substances (elements, compounds and molecules) using the periodic table and the molar road map.
What's In My Water???:	Through an engaging introductory lesson, laboratory, and virtual simulation, students will be prepared to perform a guided inquiry laboratory investigating the amount of sodium sulfate present in an unknown solution. Students will learn the importance of separation techniques such as filtration, determine which reactions form precipitates, and grow in their knowledge of stoichiometry through gravimetric analysis.
Mass Mole Relationships: A Statistical Approach To Accuracy and Precision:	The lesson is a laboratory-based activity involving measurement, accuracy and precision, stoichiometry and a basic statistical analysis of data using a scatter plot, linear equation, and linear regression (line of best fit). The lesson includes teacher-led discussions with student participation and laboratory-based group activities.
Using Acid/Base Neutralization to Study Endothermic vs Exothermic Reactions and Stoichiometry:	In this lesson, students will experimentally determine whether an acid/base neutralization reaction is endothermic or exothermic. They will also use their results to identify the limiting reactant at various times in the process and calculate the concentration of one of the reactants.
Mole Relay:	To be successful in chemistry, students need a solid foundation in solving multi-step (sequential) problems. This activity uses inexpensive materials to strengthening students understanding of stoichiometry problems during an engaging group competition. A student-centered approach develops the reasoning skills needed for scientific thinking. Each student assumes a different role as they complete work in a complex stoichiometry problem. Students may receive immediate feedback from their teammates so that success is felt by all learners.
Making Menus:	Students can organize information about a chemical substance into a menu that will help them establish their thoughts when converting using the concept of the mole. Ordering off their menu narrows the information to only what is relevant and allows them to easily set up factor label conversions.
Determining the Empirical Formula of Hydrates:	Students will apply the mole concept and the law of conservation of mass to determine the empirical formula of a hydrate. Students will also use data from their experiment to understand the concept of mole ratios, formulas and predicting products from reactions. Students will interpret formula representation of compounds and understand their percent composition.

Lesson Study Resource Kit

Name	Description
Atomically Correct:	A Lesson Study Resource Kit that addresses interpreting chemical reactions at three areas of cognition: the macroscopic world of observable properties (sensory); the microscopic world of atoms, molecules, ions, and subatomic particles (diagrams); and the symbolic world of chemical formulas, equations, and symbols.

Video/Audio/Animation

Name	Description
Concentration:	• Explain the concept of concentration • Explain the effect of concentration changes on colors of solutions • Demonstrate the effect of changing the amount of solute, or solvent, or both on the concentration of the solution • Identify a saturated solution

Virtual Manipulatives

Name	Description
Titrations:	This virtual manipulative will help you understand the process of titration, which is a neutralization reaction that is performed in order to determine an unknown concentration of acid and base. With this simulation, you will be able to calculate the moles of the acid with the understanding that the moles of acid will be equal to the moles of base at the equivalence point.
Limiting Reactants:	This virtual manipulative will help the learners to recognize the limiting reactant effect in a reaction. Limiting reactants can be explained from the extent to which reactions that involve more than one reactant can produce products depends on the quantities of those reactants combined. In most cases, one reactant will be totally consumed while the other reactants remain in excess.
Compounds, Molecules and the Mole:	The relationship of numbers of particles on the atomic scale to measurements made on the bulk scale uses the concept of the mole. Using this simulation, the learner will be able to explore the relationship between mass, moles, molecules and atoms.
	This activity will allow you to make colorful concentrated and dilute solutions and explore how much light they absorb and transmit using a virtual spectrophotometer. You can explore concepts in many ways including: • Describe the relationships between volume and amount of solute to solution concentration. • Explain qualitatively the relationship between solution color and concentration. • Predict and explain how solution concentration will change for adding or removing: water, solute, and/or solution.

Beer's Law Lab:	• Calculate the concentration of solutions in units of molarity (mol/L). • Design a procedure for creating a solution of a given concentration. • Identify when a solution is saturated and predict how concentration will change for adding or removing: water, solute, and/or solution. • Describe the relationship between the solution concentration and the intensity of light that is absorbed/transmitted. • Describe the relationship between absorbance, molar absorptivity, path length, and concentration in Beer's Law. • Predict how the intensity of light absorbed/transmitted will change with changes in solution type, solution concentration, container width, or light source and explain why?

Student Resources

Video/Audio/Animation

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Parent Resources

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