

Unit 4: Transfer of Matter: Mole and Stoichiometry

Content Area: **Science**
Course(s): **Chemistry/Lab Honors**
Time Period: **3rd Marking Period**
Length: **8**
Status: **Published**

Unit Overview

Formulas for compounds are determined by masses of individual atoms. Starting amounts of substances will determine the amounts of each product created.

Transfer

Students will be able to independently use their learning to calculate amounts of atoms.

Meaning

Understandings

- 1) Conversion of Units.
- 2) The mole is a chemists unit for specifying the amount of material
- 3) Mass and Mole Ratios between different compounds in a reaction can answer quantitative questions concerning reactants and products.

Essential Questions

- 1) How can we quantify something that we can not see?
- 2) Why is the mole an important measurement in chemistry?

Application of Knowledge and Skill

Students will know...

- 1) How to solve mole conversions and mole relationship problems.
- 2) How to determine the amount of reactants and products in a chemical reaction using stoichiometry.
- 3) How to prove the Law of Conservation of mass is satisfied.

Students will be skilled at...

- 1) Apply the concept of Dimensional Analysis to perform stoichiometric conversions.

Vocabulary

| Academic Vocabulary | Application Vocabulary |
|----------------------------|-------------------------------|
| empirical formula | analyze |
| excess | prediction |
| limiting | dimensional analysis |
| mole | |
| molecular formula | |
| percent composition | |
| percent yield | |
| theoretical yield | |

Learning Goal 1

Students will demonstrate knowledge of the concepts and calculations involving the mole.

Proficiency Scale

- Students will demonstrate knowledge of the concepts and calculations involving the mole.

SCI.HS-PS1-7

Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

SCI.HS-PS1-2

Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.

Target 1

SWBAT construct a solution to a mathematical conversion by making use of dimensional analysis techniques.

- SWBAT construct a solution to a mathematical conversion by making use of dimensional analysis techniques.

Target 2

SWBAT calculate the formula mass and use it to synthesize a mole conversion problem.

- SWBAT calculate the formula mass and use it to synthesize a mole conversion problem.

Target 3

SWBAT formulate the percentage composition of a given compound from data given or experimentally determined.

- SWBAT formulate the percentage composition of a given compound from data given or experimentally determined.

Target 4

SWBAT apply mathematical concepts to determine a compound's empirical and molecular formula from both percentage and mass composition data.

- SWBAT apply mathematical concepts to determine a compound's empirical and molecular formula from both percentage and mass composition data.

Learning Goal 2

Utilize their learning of elements and compounds to determine the amount of reactants and products in a chemical reaction.

Proficiency Scale

- Utilize their learning of elements and compounds to determine the amount of reactants and products in a chemical reaction.

SCI.HS-PS1-7

Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

SCI.HS-PS1-2

Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.

Target 1

SWBAT evaluate the amount of reactant and products in a chemical reaction using stoichiometry.

- SWBAT evaluate the amount of reactant and products in a chemical reaction using stoichiometry.

Target 2

SWBAT predict the limiting reactant, the excess reactant, and the theoretical yield after performing a stoichiometry calculation.

- SWBAT predict the limiting reactant, the excess reactant, and the theoretical yield after performing a stoichiometry calculation.

Target 3

SWBAT analyze experimental data to determine the percentage yield.

- SWBAT analyze experimental data to determine the percentage yield.

Target 4

SWBAT formulate the amount of excess reactant remaining.

- SWBAT formulate the amount of excess reactant remaining.

Formative Assessment and Performance Opportunities

Lab Reports

Worksheets

PowerPoints with Notes

Homework and Classwork Activities

Group Activities

In Class Discussion

- Lab Reports, Worksheets, PowerPoints with Notes, Homework and Classwork Activities, Group Activities, In Class Discussion

Summative Assessment

Unit Assessment will be created collaboratively and used for every student in the course. In addition, there will be other assessments in the form of lab reports, pen and paper tests, and quizzes. Common Assessment is administered through LinkIt.

- Unit Assessment will be created collaboratively and used for every student in the course. In addition, there will be other assessments in the form of lab reports, pen and paper tests, and quizzes

Accommodations/Modifications

All instruction, labs, activities, and assessments will be modified and enhanced to adhere to individual student's IEPs and 504s. As well differentiated classroom management strategies will be utilized as to adhere to these students individual plans as well. These strategies can be but are not limited to the following: Graphic Organizers and Flow Charts to help visualization of content, Using acronyms and mnemonic devices to assist memorization, Academic Games to practice skills and deepen understanding of topics, Stations and Learning Centers to influence peer tutoring, Utilizing Reviews and Study Guides to reteach complex content before summative and formative assessment, Providing additional resources to students during and outside of school (videos, study guides, teacher notes, web-based resources).

On Assessments, College Prep Chemistry Students will have access to the following resources: Mole Conversion Chart, Avogadro's Number, Molecular Formula Equation, Theoretical Yield Equation.

On Assessments, Honors AND College Prep Chemistry Students will have access to the following resources: Periodic Table, Conversion Factors

- All instruction, labs, activities, and assessments will be modified and enhanced to adhere to individual student's IEPs and 504s. As well differentiated classroom management strategies will be utilized as to adhere to these students individual plans as well. These strategies can be but are not limited to the following: Graphic Organizers and Flow Charts to help visualization of content, Using acronyms and mnemonic devices to assist memorization, Academic Games to practice skills and deepen understanding of topics, Stations and Learning Centers to influence peer tutoring, Utilizing Reviews and Study Guides to reteach complex content before summative and formative assessment, Providing additional resources to students during and outside of school (videos, study guides, teacher notes, web-based resources). On Assessments, College Prep Chemistry Students will have access to the following resources: Mole

Conversion Chart, Avogadro's Number, Molecular Formula Equation, Theoretical Yield Equation. On Assessments, Honors AND College Prep Chemistry Students will have access to the following resources: Periodic Table, Conversion Factors

Unit Resources

Teacher generated PowerPoints, Notes, Labs and Worksheets

Textbooks

Resource Books

Internet Resources

Computer Based Activities

Labs in this lab: Percent Composition Lab, Empirical Formula Lab, Mole Concept Lab, Mole - Mass Lab, Lime Lab and Limiting Lab

- Teacher generated PowerPoints, Notes, Labs and Worksheets, Textbooks, Resource Books, Internet Resources, Computer Based Activities

21st Century Life and Careers

| | |
|-----------------|--|
| CRP.K-12.CRP1.1 | Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good. |
| CRP.K-12.CRP2.1 | Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation. |
| CRP.K-12.CRP4.1 | Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome. |
| CRP.K-12.CRP5.1 | Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization. |
| CRP.K-12.CRP6.1 | Career-ready individuals regularly think of ideas that solve problems in new and different |

ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

CRP.K-12.CRP7.1

Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.

CRP.K-12.CRP8.1

Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

CRP.K-12.CRP9.1

Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.

CRP.K-12.CRP11.1

Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

CRP.K-12.CRP12.1

Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

Interdisciplinary Connections

MA.K-12.1

Make sense of problems and persevere in solving them.

MA.K-12.2

Reason abstractly and quantitatively.

MA.A-SSE.A.1b

Interpret complicated expressions by viewing one or more of their parts as a single entity.

MA.A-SSE.A.2

Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.

MA.K-12.4

Model with mathematics.

MA.K-12.5

Use appropriate tools strategically.

MA.N-Q.A

Reason quantitatively and use units to solve problems.

MA.N-Q.A.1

Use units as a way to understand problems and to guide the solution of multi-step

| | |
|------------------|---|
| | problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. |
| MA.K-12.6 | Attend to precision. |
| MA.N-Q.A.2 | Define appropriate quantities for the purpose of descriptive modeling. |
| MA.N-Q.A.3 | Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. |
| LA.RST.11-12.1 | Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions. |
| LA.RST.9-10.2 | Determine the central ideas, themes, or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. |
| LA.RST.11-12.2 | Determine the central ideas, themes, or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. |
| LA.RST.9-10.3 | Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. |
| LA.RST.9-10.4 | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics. |
| LA.RST.9-10.5 | Analyze the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy). |
| LA.RST.9-10.7 | Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. |
| LA.RST.11-12.7 | Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. |
| LA.RST.9-10.9 | Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. |
| MA.A-CED.A.1 | Create equations and inequalities in one variable and use them to solve problems. |
| MA.A-CED.A.2 | Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. |
| MA.A-CED.A.4 | Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. |
| LA.WHST.9-10.2 | Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. |
| MA.A-REI.A.1 | Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. |
| LA.WHST.9-10.2.D | Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers. |
| MA.A-REI.B.3 | Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. |
| LA.WHST.11-12.5 | Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. |

| | |
|-----------------|---|
| LA.WHST.11-12.7 | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| LA.WHST.11-12.8 | Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. |
| LA.WHST.9-10.7 | Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. |
| LA.WHST.11-12.9 | Draw evidence from informational texts to support analysis, reflection, and research. |
| LA.WHST.9-10.9 | Draw evidence from informational texts to support analysis, reflection, and research. |
| LA.SL.11-12.5 | Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. |