



Chemistry - Unit 6 - Stoichiometry of Chemical Reactions

Unit Focus

In Unit 6, the previous learnings of Units 4 and 5 are brought together as students begin to quantify substances that react and are produced in a full chemical reaction. Students begin by learning how to apply molar ratios from a balanced equation to use as a conversion factor to compare one substance in a chemical reaction to another. They expand on this by comparing reactants and products in terms of mass, moles, and particles. Students will continue to learn what a limiting reactant and what an excess reactant is, as well as using these data to accurately predict a theoretical yield from a chemical reaction and determine the amount of excess reactant remaining at the conclusion of a chemical reaction where an excess reactant occurs. The end of the unit concludes by determining percent yields of chemical reactions both theoretically and experimentally.

Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
NGSS/NSTA Science & Engineering Practices NGSS Science & Engineering Practices: 9-12 - Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. (SE.9-12.4.1) - Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m³, acre-feet, etc.). (SE.9-12.5.6) - Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion. (SE.9-12.6.4) - Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (SE. 9-12.6.5) Next Generation Science Standards Performance Expectations: High School Physical Sciences - Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. (HS-PS1-7) Madison Public Schools Profile of a Graduate - Analyzing: Examining information/data/ evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2)	<i>Students will be able to independently use their learning to...</i> T1 Analyze qualitative and quantitative data to interpret patterns, draw conclusions, and/or make predictions. T2 model relationships among quantities. T3 make sense of a problem, initiate a plan, execute it, and evaluate the reasonableness of the solution. T4 apply familiar mathematical concepts to a new problem or apply a new concept to rework a familiar problem.	
	Meaning	
	Understanding(s)	Essential Question(s)
	<i>Students will understand that...</i> U1 The mole provides a direct relation between the observable macroscopic properties and the submicroscopic atoms that are not visible. U2 The fact that atoms are conserved can be used to describe and predict chemical reactions. U3 Effective problem solvers work to make sense of the problem before trying to solve it.	<i>Students will keep considering...</i> Q1 How can we measure what we can't see?
	Acquisition of Knowledge and Skill	
	Knowledge	Skill(s)
	<i>Students will know...</i> K1 A limiting reactant dictates the outcome of a chemical reaction. K2 Excess reactant will always exist in a leftover amount when the reaction is completed.	<i>Students will be skilled at...</i> S1 Make conversions among particles, mass, and moles of any substance. S2 Write a complete and balanced equation, given only the reactants, by name.

Stage 1: Desired Results - Key Understandings

- Collective Intelligence: Working respectfully and responsibly with others, exchanging and evaluating ideas to achieve a common objective. (POG.3.1)

K3 The law of Conservation of Matter states that the mass of reactants must match the mass of products in a chemical reaction.

S3 Use dimensional analysis to calculate amounts of reactants and products including limiting and excess reagents.