



Module 2: Chemistry Fundamentals - Molecules, Reactions, and Chemical Systems

(Science – Chemistry Core Concepts)



Core Focus

From atoms to molecules, chemistry is the study of transformations within and between systems.

Students explore the fundamentals of chemistry through the lens of structure, interaction, and change, continuing the systems-of-systems thinking established in Module 1.

Key Concepts & Learning Goals

Theme	Topics
1. What is Chemistry?	- Definition of chemistry as the study of matter and its changes - Historical roots and modern applications - Importance of chemistry in everyday life and across scientific disciplines
2. Atomic Structure Review	- Revisit atoms, subatomic particles, atomic number and mass - Isotopes and ions - Electron configuration and its role in bonding
3. Molecules & Compounds	- Chemical bonding (ionic, covalent) - Forming molecules from atoms - Intermolecular forces and molecular structure
4. Chemical Reactions	- Types of reactions (synthesis, decomposition, combustion, etc.) - Signs of a chemical reaction - Conservation of mass and balancing equations
5. States of Matter & Changes	- Solid, liquid, gas, plasma - Physical vs. chemical changes - Phase transitions and energy involvement
6. Measurements & Observations in Chemistry	- Precision and accuracy in measurements - Units (moles, liters, grams) - Using lab tools and interpreting results
7. Disciplines of Chemistry	- Organic, Inorganic, Physical, Analytical, Biochemistry - Applications in pharmaceuticals, materials science, and environmental chemistry Emphasis on green chemistry principles and sustainable innovation
8. Chemistry in Systems	- Chemistry in biological systems, industry, and nature - Chemical cycles (carbon, nitrogen) Designing safe, eco-friendly, and sustainable chemical processes



Hands-On Activities

- **Build a Molecule Kit** (using physical or digital tools)
 - **Chemical Reaction Lab** (observe exothermic and endothermic changes)
 - **pH Testing and Indicators**
 - **Molecular Model Challenge** (create isomers or molecular structures)
 - **Green Chemistry Design Lab** (create or test eco-safe reaction setups)
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STEAM Integration

- **Science:** Core chemistry concepts and reaction mechanisms
 - **Technology:** Digital simulations, chemical modeling
 - **Engineering:** Material design and safe chemical handling
 - **Arts:** Molecular geometry drawing, reaction infographics
 - **Math:** Stoichiometry, ratios, unit conversions
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21st Century Skills Emphasized

- Systems Analysis
- Precision & Safety
- Data Interpretation
- Real-World Application Awareness
- **Sustainability & Environmental Responsibility**