## 🔬 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 |
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| **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)

### 🧩 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

### 🌐 21st Century Skills Emphasized

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