Massachusetts Curriculum Framework | SCIENCE | HS

WHAT TO LOOK FOR

A quick guide for observing classroom content and practice

In **High School Chemistry**, instructional time should focus on three core ideas:

PS1. Matter and its Interactions

PS2. Motion and stability: Forces and Interactions

PS3. Energy

In a **High School Chemistry** class you should observe students engaged with at least one science concept and practice:

Science and Engineering Practices

- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations and designing solutions
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

Science Concepts

Matter and Its Interactions (PS1)

•Predicting the properties of ionization energy, atomic size, configuration of outer shell electrons and reactivity using the periodic table.

•Using a model to predict the products of a chemical reaction, when basic ionic and molecular compounds are produced. Explain the relative strength of ionic and covalent bonds

•Using evidence to relate observable properties of substances to their structure in terms of how molecules are arranged, the motion of molecules and the attractive forces between them.

•Explaining how energy is transferred during endothermic and exothermic chemical reactions by bonds being broken and formed into new substances.

•Investigating the variables that impact how fast a chemical reaction occurs and explain how the motion and collisions of particles impacts that rate.

•Investigating conditions that impact the products of an equilibrium reaction, and explain how the motion and collisions of particles impacts the forward and reverse rates of a reaction until equilibrium is reached.

•Supporting a claim that atoms and mass are conserved during a reaction. Use balanced chemical equations and stoichiometry to calculate a specific amount of product for a reaction.

•Explaining oxidation-reduction (redox) theory by showing how electrons are transferred within a reaction and predict the products of redox reactions. Assigning oxidation numbers to show how the electrons move through devices that produce electricity or prevent corrosion.

Matter and Its Interactions (PS1) Continued

•Comparing relative strengths of acids or bases based on the pH of a solution.

•Utilizing chemical and physical properties of substances to separate and identify the components of a mixture.

Motion and Stability: Forces and Interactions (PS2)

•Explaining how the structure of polymers, ionic compounds, acids and bases, and metals impact the functional uses of different materials.

•Explaining how ionic substances dissolve in polar substances. Use solubility and conductivity data to determine how much an ionic substance dissolves.

•Comparing the strength and relative amount of attractive forces in solids, liquids and gases based on the motion and collisions of these particles. Use the combined gas law to determine how changes in pressure, volume and temperature impact gases.

Energy (PS3)

•Communicating and analyzing data to illustrate that the overall energy in a chemical reaction is conserved despite transfer of enthalpy and entropy that occurs.

NOTES

Comments on the Science and Engineering Practices: For a list of specific skills, see the *Science and Engineering Practices Progression Matrix* (www.doe.mass.edu/stem/review.html); Practices are skills **students** are expected to learn and do; standards focus on some but not all skills associated with a practice.

STE What to Look For The example below features three Indicators from the Standards of Effective Practice. These Indicators are just a sampling from the full set of Standards and were chosen because they create a sequence: the educator plans a lesson that sets clear and high **expectations**, the educator then delivers high quality **instruction**, and finally the educator uses a variety of **assessments** to see if students understand the material or if re-teaching is necessary. This example highlights teacher and student behaviors aligned to the three Indicators that you can expect to see in a rigorous High School Chemistry classroom.

Expectations (Standard II, Indicator D)	Plans and implements lessons that set clear and high expectations and also make knowledge accessible for all students.

What is the teacher doing?

- Communicating a lesson's objectives and their connections to unit essential questions and goals.
- Asking students to apply scientific knowledge and ideas when engaging with real-world problems
- Modeling the development of complex, testable models

What are the students doing?

- Persisting when engaging with meaningful scientific tasks
- Evaluating the reasoning behind currently accepted explanations or solutions
- Developing a complex model of multiple variables that can be tested

Instruction (Standard II, Indicator A)	Uses instructional practices that reflect high expectations regarding content and quality of effort and work; engage all students; and are personalized to accommodate diverse learning styles, needs, interests, and levels of readiness.

What is the teacher doing?

- Highlighting culturally appropriate and effective negotiation skills they observe in students
- Providing opportunities for students to work with large data sets
- Creating activities that require sophisticated analysis (such as finding an equation) to find patterns

What are the students doing?

- Evaluating questions and arguments (e.g., to determine whether they are testable and relevant)
- Using both linear and nonlinear functions to find patterns in data
- Using detailed statistical analysis or models that can evaluate data sets for consistency

Assessment (Standard I, Indicator B)	Uses a variety of informal and formal methods of assessments to measure student learning, growth, and understanding to develop differentiated and enhanced learning experiences and improve future instruction.

What is the teacher doing?

- Providing students with feedback aligned to long-term goals
- Using multiple formative approaches to assess student learning (e.g., mid-unit quiz, completion of investigation)
- Providing opportunities for students to conduct investigations that test models

What are the students doing?

- Reflecting on how they are progressing toward goals
- Engaging in challenging learning tasks regardless of learning needs (e.g., linguistic background, disability, academic gifts)
- Using exemplars to inform their work