Massachusetts Curriculum Framework | SCIENCE | HS

WHAT TO LOOK FOR

A quick guide for observing classroom content and practice

In **High School Biology**, instructional time should focus on four core ideas:

LS1. From Molecules to Organisms: Structures and Processes

LS2. Ecosystems: Interactions, Energy, and Dynamics

LS3. Heredity: Inheritance and Variation of traits

LS4. Biological Evolution: Unity and Diversity

In a **High School Biology** 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

Molecules to Organisms (LS1)

- Explain the process for building proteins within a cell and the important roles of DNA and RNA communication in regulating cell function.
- Describe the principle structures and functions of the human body systems.
- Show how the human body uses both positive and negative feedback mechanisms to maintain a stable internal environment within cells.
- Explain the life cycle of a cell in multicellular organisms.
- Explain how plants and other photosynthesizing organisms convert light energy into chemical energy.
- Understand that large carbon molecules, necessary for life, are primarily composed of six elements.
- Illustrate the ability of live organisms to convert food into energy.

Ecosystems: Interactions, Energy, and Dynamics (LS2)

- Analyze data to explain how living and nonliving factors affect an area's ability to support life.
- Use math to explain that living and non-living factors affect populations and species within an environment.
- Describe the constant flow of energy throughout an ecosystem and explain how energy affects the individuals living in the environment.
- Illustrate the cycling of the carbon molecule throughout the environment.
- Discuss how an area which includes living and non-living components, will tend to resist change.
- Analyze the effects of human activities on living organisms and ecosystem health

Heredity: Inheritance and Variation of Traits (LS3)

- Show how DNA passes genetic information from parents to offspring.
- Provide evidence that genetic variations in an organism may come from new combinations of genes.
- Simulate the passing of gene combinations from a parent organism to their offspring.
- Illustrate how genetic and environmental factors can affect the traits of individuals.

Biological Evolution: Unity and Diversity (LS4)

- Use scientific evidence to demonstrate biological evolution.
- Construct an explanation of Darwin's Theory of Natural Selection.
- Describe the differences between viruses and bacteria.
- Explain how changes in an environment may result in the modifications of organisms.

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 Biology 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?

- Creating culturally responsive lessons that engage and sustain student attention
- 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?

- Identifying a lesson's standards or objectives and how they connect to unit goals
- Using information from observations to construct an evidence based account for natural phenomena
- Evaluating the reasoning behind currently accepted explanations or solutions

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?

- Providing opportunities for students to communicate ideas, ask questions, and make their thinking visible in writing and speaking
- Highlighting culturally appropriate and effective negotiation skills they observe in students
- 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?

- 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
- Providing exemplars of work (e.g. historical examples, student work)

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