Massachusetts Curriculum Framework | SCIENCE | HS

WHAT TO LOOK FOR

A quick guide for observing classroom content and practice

High School Earth and Space Science, instructional time should focus on three core ideas:

ESS1. Earth's Place in the Universe

ESS2. Earth's Systems

ESS3. Earth and Human Activity

In a **High School Earth and Space Science** 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

Earth's Place in the Universe (ESS1)

•Explaining that nuclear fusion in a star's core affects its lifespan, produces elements from helium to iron, and releases energy in the form of radiation.

•Describing evidence for the Big Bang theory including: the motion of galaxies; background microwave radiation; and matter in the universe.

•Explaining the motion of planets with Kepler's laws of planetary motion and describing how interactions and collisions between planets can affect orbits.

•Evaluating evidence of the movement of the crust, the theory of plate tectonics, and density of rocks to explain why continental rocks are older than rocks on the ocean floor.

Earth's Systems (ESS2)

•Analyzing data to support that one change to Earth's surface water can cause changes to other Earth systems.

•Using a model based on evidence to explain the motion of matter inside the Earth through convection currents and the effects of gravity on denser materials.

•Using a model to describe how energy variations in Earth's systems over time result in changes in climate.

Earth's Systems (ESS2) continued

•Analyzing and interpreting data that changes in Earth's tilt and orbit result in climate change.

•Describing how the properties of water affect Earth materials and surface processes.

•Using a model to explain the carbon cycle through Earth's systems and how human activity causes increases in carbon dioxide resulting in atmospheric and climate changes.

Earth and Human Activity (ESS3)

•Constructing an explanation for how the availability of natural resources and changes in climate have influenced human activity.

•Evaluating design solutions for minimizing the impacts of developing/using resources, and conserving/recycling those resources, including the cost-benefits.

•Explaining the relationships between natural resources, human populations, and biodiversity.

•Analyzing global climate models to describe how forecasts are made of climate change.

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 Earth and Space Science 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 how to evaluate reasoning behind currently accepted explanations or solutions

What are the students doing?

- Identifying a lesson's standards or objectives and how they connect to unit goals
- Applying scientific knowledge when explaining natural phenomena or real world problems
- 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?

- Providing opportunities for students to communicate ideas, ask questions, and make their thinking visible in writing and speaking
- 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)
- Actively incorporating others into discussions about scientific ideas
- 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)
- Conducting frequent checks for student understanding and adjusting instruction accordingly
- 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