A quick guide for observing classroom content and practice

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) 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 [here](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.
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 E)**

**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)**

**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)**

**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