

The lessons included in the Hubble Exoplanets Classroom website address the following standards from...

[South Carolina Science Standards](#)
[Common Core Mathematics Standards](#)
[ITEA Standards for Technological Literacy](#)

[AAAS Benchmarks](#)
[Framework for K-12 Science Education](#)

South Carolina Science Standards (2005)

Grade 8

Standard 8-4: The student will demonstrate an understanding of the characteristics, structure, and predictable motions of celestial bodies. (Earth Science)

8-4.10 Compare the purposes of the tools and the technology that scientists use to study space (including various types of telescopes, satellites, space probes, and spectroscopes).

Standard 8-6: The student will demonstrate an understanding of the properties and behaviors of waves. (Physical Science)

8-6.3 Summarize factors that influence the basic properties of waves (including frequency, amplitude, wavelength, and speed).

8-6.8 Compare the wavelength and energy of waves in various parts of the electromagnetic spectrum (including visible light, infrared, and ultraviolet radiation).

High School

Standard PS-7: The student will demonstrate an understanding of the nature and properties of mechanical and electromagnetic waves.

PS-7.3 Summarize characteristics of waves (including displacement, frequency, period, amplitude, wavelength, and velocity as well as the relationships among these characteristics).

PS-7.5 Summarize the characteristics of the electromagnetic spectrum (including range of wavelengths, frequency, energy, and propagation without a medium).

Standard P-5: The student will demonstrate an understanding of the properties and behaviors of mechanical and electromagnetic waves.

P-5.1 Analyze the relationships among the properties of waves (including energy, frequency, amplitude, wavelength, period, phase, and speed).

P-5.4 Distinguish the different properties of waves across the range of the electromagnetic spectrum.

Standard ES-2: Students will demonstrate an understanding of the structure and properties of the universe.

ES-2.9 Explain how technology and computer modeling have increased our understanding of the universe.

Common Core Mathematics Standards (2010)

Grade 8

Functions - Use functions to model relationships between quantities.

- 8.F-4 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
- 8.F-5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

High School

Functions – Interpret functions that arise in applications in terms of the context

- F-IF-4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

Geometry – Apply geometric concepts in modeling situations

- G-MG-1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

International Technology and Engineering Educators Association Standards for Technological Literacy (2007)

Grades 6-8

Standard 1 - Students will develop an understanding of the characteristics and scope of technology

- F. New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.
- G. The development of technology is a human activity and is the result of individual and collective needs and the ability to be creative.
- H. Technology is closely linked to creativity, which has resulted in innovation.

AAAS Benchmarks for Science Literacy (1993)

The Nature or Technology – Technology and Science

Grades 6-8

3A/M2 Technology is essential to science for such purposes as access to outer space and other remote locations, sample collection and treatment, measurement, data collection and storage, computation, and communication of information.

Grades 9-12

3A/H1* Technological problems and advances often create a demand for new scientific knowledge, and new technologies make it possible for scientists to extend their research in new ways or to undertake entirely new lines of research. The very availability of new technology itself often sparks scientific advances.

The Physical Setting – The Universe

Grades 9-12

4A/H1a The stars differ from each other in size, temperature, and age, but they appear to be made up of the same elements found on earth and behave according to the same physical principles.

4A/H1b Unlike the sun, most stars are in systems of two or more stars orbiting around one another.

4A/H3 Increasingly sophisticated technology is used to learn about the universe. Visual, radio, and X-ray telescopes collect information from across the entire spectrum of electromagnetic waves; computers handle data and complicated computations to interpret them; space probes send back data and materials from remote parts of the solar system; and accelerators give subatomic particles energies that simulate conditions in the stars and in the early history of the universe before stars formed.

4A/H4 Mathematical models and computer simulations are used in studying evidence from many sources in order to form a scientific account of the universe.

The Physical Setting – Motion

Grades 6-8

4F/M7 Wave behavior can be described in terms of how fast the disturbance spreads, and in terms of the distance between successive peaks of the disturbance (the wavelength).

4F/M8 There are a great variety of electromagnetic waves: radio waves, microwaves, infrared waves, visible light, ultraviolet rays, X-rays, and gamma rays. These wavelengths vary from radio waves, the longest, to gamma rays, the shortest.

A Framework for K-12 Science Education (2012)

By grade 12, students should be able to:

Dimension 1 - Scientific and Engineering Practices

- Use (provided) computer simulations or simulations developed with simple simulation tools as a tool for understanding and investigating aspects of a system, particularly those not readily visible to the naked eye.
- Analyze data systematically, either to look for salient patterns or to test whether data are consistent with an initial hypothesis.
- Recognize when data are in conflict with expectations and consider what revisions in the initial model are needed.
- Use spreadsheets, databases, tables, charts, graphs, statistics, mathematics, and information and computer technology to collate, summarize, and display data and to explore relationships between variables, especially those representing input and output.
- Recognize patterns in data that suggest relationships worth investigating further. Distinguish between causal and correlational relationships.
- Construct their own explanations of phenomena using their knowledge of accepted scientific theory and linking it to models and evidence.
- Use primary or secondary scientific evidence and models to support or refute an explanatory account of a phenomenon.
- Offer causal explanations appropriate to their level of scientific knowledge.
- Read scientific and engineering text, including tables, diagrams, and graphs, commensurate with their scientific knowledge and explain the key ideas being communicated.

Dimension 3 - Disciplinary Core Ideas – Physical Science

PS3.A Definitions of Energy

PS4.B Electromagnetic Radiation

PS4.C Information Technologies and Instrumentation

Dimension 3 - Disciplinary Core Ideas – Earth and Space Sciences

ESS1.A The Universe and Its Stars