

Academic Standards

The following standards are addressed in this module.

Standard	Description
Next Generation Science Standards - High Schoolⁱ	
Disciplinary Core Ideas	
HS-LS2.A	Interdependent Relationships in Ecosystems: Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem.
HS-LS2.B	Cycles of Matter and Energy Transfer in Ecosystems: Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. Plants or algae form the lowest level of the food web.
HS-LS2.C	A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. Anthropogenic changes (induced by human activity) in the environment – including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change – can disrupt an ecosystem and threaten the survival of some species.
HS-LS4.C	Adaptation: Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline – and sometimes the extinction – of some species. Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost.
HS-LS4.D	Biodiversity and Humans: Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus, sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.
HS-ESS2.A	Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes.

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HS-ESS2.E	The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it.
HS-ESS3.A	All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors.
HS-ESS3.C	Human Impacts on Earth Systems: The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.
	Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.
HS-EST1.A	Defining and Delimiting Engineering Problems: Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them.
	Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities.
HS-EST1.B	Developing Possible Solutions: When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.
Science and Engineering Practices	
Constructing Explanations and Designing Solutions	Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
Engaging in Argument from Evidence	Construct an oral and written argument or counter-argument based on data and evidence. Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments.
Developing and Using Models	Use a model based on evidence to illustrate the relationships between systems or between components of a system.
Obtaining, Evaluating, and Communicating Information	Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).

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Crosscutting Concepts	
Systems and System Models	Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions – including energy, matter, and information flows – within and between systems at different scales.
	When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models.
	Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models.
Cause and Effect	Cause and effect relationships can be suggested and predicted for complex natural- and human-designed systems by examining what is known about smaller scale mechanisms within the system.
Stability and Change	Feedback (negative or positive) can stabilize or destabilize a system.
Energy and Matter	Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.
Patterns	Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.
Connections to Engineering, Technology, and Applications of Science	
Influence of Science, Engineering, and Technology on Society and the Natural World	New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology.
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Connections of Science to Nature	
Science Addresses Questions about the Natural and Material Worlds	Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions.
	Science knowledge indicates what can happen in natural systems – not what should happen. The latter involves ethics, values, and human decisions about the use of knowledge.
	Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues.
National Council for the Social Studies Thematic Strandsⁱⁱ	
Culture	Human beings create, learn, share and adapt to culture.
	Cultures are dynamic and change over time.
Time, Continuity, and Change	Knowledge and understanding of the past enable us to analyze the causes and consequences of events and developments, and to place these in the context of institutions, values and beliefs of the periods in which they took place.

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People, Places, and Environments	The study of people, places, and environments allows us to understand the relationship between human populations and the physical world.
	Apply knowledge, skills and understandings to today's social, cultural, economic and civic issues: How do people interact with the environment, and what are the consequences of those interactions?
Individual Development and Identity	Personal identity is shaped by an individual's culture, by groups, by institutional influences, and by lived experiences shared with people inside and outside the individual's own culture.
	Questions related to identity and development are central to understanding who we are. How do individuals grow and change physically, emotionally and intellectually? Why do individuals behave as they do? What influences how people learn, perceive, and grow? How do people meet their basic needs in a variety of contexts? How do social, political, and cultural interactions support the development of identity?
Power, Authority, and Governance	Students study dynamic relationships between individual rights and responsibilities, the needs of social groups, and concepts of a just society. Students become more effective problem-solvers and decision-makers.
Production, Distribution, and Consumption	People have wants that often exceed limited resources. Unequal distribution of resources leads to systems of exchange. Economic decisions are increasingly global. Students need to study interdependent world economy and the role of technology in economic growth.
Science, Technology, and Society	Science, and its practical application, technology, influence social and cultural change and ways people interact with the world. Modern life, as we know it, would be impossible without technology and the science that supports it.
	Students think analytically about the consequences of change and how we can manage science and technology to increase benefits to all.
Global Connections	Analyses of the costs and benefits of increased global connections, and evaluations of the tensions between national interests and global priorities contribute to the development of possible solutions to persistent and emerging global issues. By interpreting the patterns and relationships of increased global interdependence, and its implications for different societies, cultures and institutions, students learn to examine policy alternatives that have both national and global implications.
Civic Ideals and Practices	High school students increasingly recognize the rights and responsibilities of citizens in identifying societal needs, setting directions for public policies, and working to support both individual dignity and the common good. They become familiar with methods of analyzing important public issues and evaluating different recommendations for dealing with these issues.
Common Core Language Artsⁱⁱⁱ	
CCSS.ELA-LITERACY.RH.9-10.4	Determine the meaning of words and phrases as they are used in a text, including vocabulary describing political, social, or economic aspects of history/social science.
CCSS.ELA-LITERACY.RST.9-10.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.

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CCSS.ELA-LITERACY. W.9-10.1.D	Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
CCSS.ELA-LITERACY. W.9-10.2	Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
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CCSS.ELA-LITERACY. W.9-10.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
CCSS.ELA-LITERACY. W.9-10.9	Draw evidence from literary or informational texts to support analysis, reflection, and research.
CCSS.ELA-LITERACY. W.9-10.10	Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
CCSS.ELA-LITERACY. SL.9-10.1	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9-10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
CCSS.ELA-LITERACY. SL.9-10.1.A	Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.
CCSS.ELA-LITERACY. SL.9-10.1.B	Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.
CCSS.ELA-LITERACY. SL.9-10.1.C	Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.
CCSS.ELA-LITERACY. SL.9-10.1.D	Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.
CCSS.ELA-LITERACY. SL.9-10.4	Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
CCSS.ELA-LITERACY. SL.9-10.6	Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.