Next Generation Science Standards
Appendix H: Understanding the Scientific Enterprise: The Nature of Science in NGSS

Grades 9, 10, 11, 12

Adopted 2013

Understandings about the Nature of Science

1. **Scientific Investigations Use a Variety of Methods** AH.1
    1. Science investigations use diverse methods and do not always use the same set of procedures to obtain data. 9-12.AH.1.1
    2. New technologies advance scientific knowledge. 9-12.AH.1.2
    3. Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings. 9-12.AH.1.3
    4. The discourse practices of science are organized around disciplinary domains that share exemplars for making decisions regarding the values, instruments, methods, models, and evidence to adopt and use. 9-12.AH.1.4
    5. Scientific investigations use a variety of methods, tools, and techniques to revise and produce new knowledge. 9-12.AH.1.5

2. **Scientific Knowledge is Based on Empirical Evidence** AH.2
    1. Science knowledge is based on empirical evidence. 9-12.AH.2.1
    2. Science disciplines share common rules of evidence used to evaluate explanations about natural systems. 9-12.AH.2.2
    3. Science includes the process of coordinating patterns of evidence with current theory. 9-12.AH.2.3
    4. Science arguments are strengthened by multiple lines of evidence supporting a single explanation. 9-12.AH.2.4

3. **Scientific Knowledge is Open to Revision in Light of New Evidence** AH.3
    1. Scientific explanations can be probabilistic. 9-12.AH.3.1
    2. Most scientific knowledge is quite durable but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence. 9-12.AH.3.2
    3. Scientific argumentation is a mode of logical discourse used to clarify the strength of relationships between ideas and evidence that may result in revision of an explanation. 9-12.AH.3.3

4. **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** AH.4

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1. Theories and laws provide explanations in science, but theories do not with time become laws or facts. 9-12.AH.4.1
2. A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that has been repeatedly confirmed through observation and experiment, and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence. 9-12.AH.4.2
3. Models, mechanisms, and explanations collectively serve as tools in the development of a scientific theory. 9-12.AH.4.3
4. Laws are statements or descriptions of the relationships among observable phenomena. 9-12.AH.4.4
5. Scientists often use hypotheses to develop and test theories and explanations. 9-12.AH.4.5

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5. Science is a Way of Knowing AH.5

1. Science is both a body of knowledge that represents a current understanding of natural systems and the processes used to refine, elaborate, revise, and extend this knowledge. 9-12.AH.5.1
2. Science is a unique way of knowing and there are other ways of knowing. 9-12.AH.5.2
3. Science distinguishes itself from other ways of knowing through use of empirical standards, logical arguments, and skeptical review. 9-12.AH.5.3
4. Science knowledge has a history that includes the refinement of, and changes to, theories, ideas, and beliefs over time. 9-12.AH.5.4

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6. Scientific Knowledge Assumes an Order and Consistency in Natural Systems AH.6

1. Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. 9-12.AH.6.1
2. Science assumes the universe is a vast single system in which basic laws are consistent. 9-12.AH.6.2

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7. Science is a Human Endeavor AH.7

1. Scientific knowledge is a result of human endeavor, imagination, and creativity. 9-12.AH.7.1
2. Individuals and teams from many nations and cultures have contributed to science and to advances in engineering. 9-12.AH.7.2
3. Scientists' backgrounds, theoretical commitments, and fields of endeavor influence the nature of their findings. 9-12.AH.7.3
4. Technological advances have influenced the progress of science and science has influenced advances in technology. 9-12.AH.7.4

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5. Science and engineering are influenced by society and society is influenced by science and engineering. 9-12.AH.7.5

8. **Science Addresses Questions About the Natural and Material World.** AH.8
    1. Not all questions can be answered by science. 9-12.AH.8.1
    2. Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions. 9-12.AH.8.2
    3. 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. 9-12.AH.8.3
    4. Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues. 9-12.AH.8.4