NEW HAMPSHIRE Nationally-Aligned
K – 8 Science MODEL COMPETENCIES

	K-2	3-5	6-8
1. Competency Statements for Nature of Science and Engineering *"I can statements" are examples of what educators may see in performance tasks when students demonstrate their increasing understanding and use of the competencies.*	**Students will work collaboratively to make observations and predictions in order to answer testable questions and use their senses, tools and materials to find possible solutions to simple problems.** • I can make observations (e.g., comparing plants and animals; movement of objects in the sky) and develop drawings, explanations, or demonstrations to represent what I've learned (e.g., predicable patterns in how things move or grow). • I can design and create a model or device to solve a specific problem (e.g., using light or sound to communicate over a distance). • I can support my predictions and conclusions using evidence (facts, observations, or measurements).	**Students will work collaboratively and individually to generate testable questions or to define problems in terms of a given situation; research, plan, and conduct investigations or apply engineering design practices*; analyze and interpret data; and construct and communicate evidence-based explanations or best possible solutions.** • I can develop testable questions, make logical predictions, collect and analyze data, and use specific evidence to interpret, draw conclusions and communicate findings from an investigation. • I can develop a plan to improve or solve authentic problems using evidence. • I can apply science and engineering practices to design and build systems.	**Students will work collaboratively and individually to generate testable questions or define problems in terms of given constraints and criteria; plan and conduct investigations or apply engineering design practices to analyze and interpret data, and construct and communicate evidence-based explanations or possible optimal solutions.** • I can develop testable questions, make logical predictions, collect and analyze data, and use specific evidence to interpret and draw conclusions, communicate findings, and develop scientific explanations. • I can apply the engineering design process to optimally improve or solve problems using evidence. • I can utilize scientific hypotheses, theories and laws to objectively explore and describe the natural and engineered world, investigate changes over time and revise or reinterpret knowledge based on new evidence.
Performance Expectations Coded to National Crosscutting Concepts	K-LS1-1, K-ESS2-1, 1-LS1-2, 1-LS3-1, 1-ESS1-1, 1-ESS1-2, 2-PS1-1, 2-L54-1, 2-ESS2-2, 2-ESS2-3	3-PS2-2, 3-LS1-1, 3-LS3-1, 3-ESS2-1, 3-ESS2-2, 4-PS4-1, 4-PS4-3, 4-ESS1-1, 4-ESS2-2, 5-ESS1-2	MS-PS1-2, MS-PS4-1, MS-LS2-2, MS-LS4-1, MS-LS4-2, MS-LS4-3, MS-ESS1-1, MS-ESS2-3, MS-ESS3-2

*See GLOSSARY

Competencies statements above are aligned with **Nature of Science & Engineering:** The integration of scientific and engineering practices, disciplinary core ideas, and crosscutting concepts sets the stage for learning about the nature of scientific knowledge, understanding the world, and using technology to change or adapt to the environment for different purposes. This concept is from: "4 Dimension 2: Crosscutting Concepts" National Research Council. *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: The National Academies Press, 2012. doi:10.17226/13165.

	K-2	3-5	6-8
2. Competency Statements for Patterns	**Students will observe patterns in the natural world (including human), develop questions to investigate, make connections, and support connections with evidence.** • I can investigate using observations, reading, media, etc. to describe patterns of living things (e.g., how they grow and survive how parents help offspring). • I can investigate using observations, reading, media, etc. to describe or compare patterns in the natural world (e.g., changing seasons, local weather conditions, movement of sun and moon, Earth features). • I can use observations (e.g., observable patterns or properties) to support classifications of or make claims about different materials.	**Students will sort and classify natural and designed phenomena*, identifying similarities and differences, in order to recognize and use patterns.** • I can recognize patterns and use them to describe phenomena. • I can use patterns as evidence (e.g., observations of patterns that can be predicted such as force and interactions, waves, inheritance and variation of traits, weather and climate, Earth's systems, space systems, patterns related to time, including simple rates of change and cycles). • I can develop models to communicate about and describe patterns to make predictions.	• **Students will observe, predict, and analyze patterns in order to support evidence-based claims about relationships (e.g., cause and effect, structure and function, macroscopic and microscopic).** • I can use identified patterns in rates of change and other numerical relationships that provide information about natural and human-designed systems. • I can analyze and interpret data for past patterns to predict future patterns. • I can create models to predict trends and explain patterns in data that support my claims.
Performance Expectations Coded to National Crosscutting Concepts	K-LS1-1, K-ESS2-1, 1-LS1-2, 1-LS3-1, 1-ESS1-1, 1-ESS1-2, 2-PS1-1, 2-ESS2-2, 2-ESS2-3	3-PS2-2, 3-LS1-1, 3-LS3-1, 3-ESS2-1, 3-ESS2-2, 4-PS4-1, 4-PS4-3, 4-ESS1-1, 4-ESS2-2, 5-ESS1-2	MS-PS1-2, MS-PS4-1, MS-LS2-2, MS-LS4-1, MS-LS4-2, MS-LS4-3, MS-ESS1-1, MS-ESS2-3, MS-ESS3-2

*See GLOSSARY

Competencies statements above are aligned with **Patterns:** Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them. This concept is from: "4 Dimension 2: Crosscutting Concepts" National Research Council. *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: The National Academies Press, 2012. doi:10.17226/13165.

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	K-2	3-5	6-8
3. Competency Statements for Cause & Effect	**Students will investigate causal relationships that generate observable patterns and explain their thinking with evidence.** • I can design simple tests to observe causes and to support or refute my own ideas. • I can conduct investigations and use data to support my conclusions about cause-effect relationships (e.g., effects of push-pull forces, heating, cooling, adding nutrients or sunlight). • I can analyze observations and data to determine if a model or design solution works as intended (e.g., to change the speed or direction of an object, which materials have the properties best suited for an intended purpose).	**Students will investigate cause and effect relationships to make predictions and support evidenced-based explanations or claims about change.** • I can verify that events that occur together might or might not share a cause. • I can use observational data to predict or draw conclusions about cause and effect relationships (e.g., forces and interactions, properties of matter, energy, interdependent relationships in ecosystems). • I can locate and use evidence from a variety of sources to develop and support explanations or claims about cause-effect relationships (e.g., inheritance and variation of traits, weather and climate, Earth's systems, space systems).	**Students will investigate, explain, and evaluate potential causal relationships, using evidence to support claims and predictions about the mechanisms that drive those relationships.** • I can classify relationships as causal or correlational using evidence to support my claim. • I can investigate cause and effect relationships in order to explain the mechanisms driving change. • I can predict phenomena in natural or designed systems, by applying cause and effect relationships.. • I can describe cause and effect relationships using probability concepts.
Performance Expectations Coded to National Crosscutting Concepts	K-PS2-1, K-PS2-2, K-PS3-1, K-PS3-2, K-ESS3-2, K-ESS3-3, 1-PS4-1, 1-PS4-2, 1-PS4-3, 2-PS1-1, 2-LS2-1	3-PS2-1, 3-PS2-3, 3PS2-4, 3-LS2-1, 3-LS3-2, 3-LS4-2, 3-LS4-3, 3-ESS3-1, 4-PS4-2, 4-ESS2-1, 4-ESS3-1, 4-ESS3-2, 5-PS1-4, 5-PS2-1	MS-PS1-4, MS-PS2-3, MS-PS2-5, MS-LS1-4, MS-LS1-5, MS-LS2-1, MS-LS3-2, LS4-4, MS-LS4-5, MS-LS4-6, MS-ESS2-5, MS-ESS3-1, MS-ESS3-3, MS-ESS3-4

Competencies statements above are aligned with **Cause-Effect:** Events have causes, sometimes simple, sometimes multi-faceted. A major activity of science is investigation and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.. This concept is from: "4 Dimension 2: Crosscutting Concepts" National Research Council. *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: The National Academies Press, 2012. doi:10.17226/13165.

	K-2	3-5	6-8
4. Competency Statements for Scale, Proportion, and Quantity	**Students will describe and compare objects, situations, or events using relative scale* and standard and nonstandard measurement tools, units, and attributes when making observations or solving problems.** • I can solve problems involving changes in measurement of objects or events (time, money, length, height, weight) using appropriate tools, techniques, and units. • I can describe and compare objects, situations, or events using relative scale and sizes of objects using terms such as: short-long, short-tall, heavy-light, more-less, large-small, thick-thin, etc.	**Students will use relative scale and quantity to describe, compare, or represent data in order to answer questions about observable and non-observable phenomena, create investigations, and solve problems.** • I can represent natural objects from the very small to immensely large (e.g., structure and properties of matter, space systems). • I can analyze and interpret data to provide evidence that observable phenomena exist from very short to very long time periods and very small to vast distances (e.g., interdependent relationships in ecosystems, space systems). • I can describe or compare physical quantities (weight, time, temperature, volume) when answering questions about structure and properties of matter, Earth's systems, etc., using appropriate tools and standard units (e.g., measurement tools, visual displays, graphs, tables).	**Students will apply reasoning and modeling to determine the proportional relationships in observable and non-observable phenomena in terms of relative scale and quantity.** • I can determine an appropriate scale to observe time, space, and energy phenomena using models to study systems that are quite large or small. • I can use a variety of methods, tools and mathematical representations (algebraic expressions and equations) to make measurements, observations, and predictions of phenomena. • I can observe that the function of natural and designed systems may change with scale. • I can find and describe proportional relationships (e.g., speed as the ratio of distance traveled to time taken) among different types of quantities and use the relationship to predict the magnitude of properties and processes.
Performance Expectations Coded to National Crosscutting Concepts		3-LS4-1, 5-PS1-1, 5-PS1-2 5-PS2-2, 5-PS1-3, 5-ESS1-1, 5-ESS2-2	MS-PS1-1, MS-PS3-1, MS-PS3-4, MS-LS1-1, MS-ESS1-3, MS-ESS1-4, MS-ESS2-2

*See GLOSSARY

Competencies statements above are aligned with **Scale, Proportion, and Quantity:** In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, time and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance. This concept is from: "4 Dimension 2: Crosscutting Concepts" National Research Council. *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: The National Academies Press, 2012. doi:10.17226/13165.

	K-2	3-5	6-8
5. Competency Statements for Systems and System Models	**Students will explain how the parts of systems work together (e.g., an environment, including the animals and plants) in order to function effectively.** • I can construct an argument supported by evidence for how living things (plants, animals, humans) use resources in the environment and sometimes change the environment to meet their needs. • I can represent the inter-relationships among the living and non-living things of a given environment, using models.	**Students will investigate and use models of natural or human- designed systems in order to describe a system, how its parts function together, and how internal and external factors affect the system or its parts.** • I can develop a model to describe how a natural system functions in terms of its components and their interactions (e.g., matter and energy within organisms or ecosystems, Earth's systems). • I can design solutions to address internal and external factors that affect a natural or human-designed system (e.g., interdependent relationships in ecosystems, Earth's systems).	**Students will investigate and analyze a natural or human designed system in order to develop and justify a model that accurately represents the system or aspects of the system (e.g., boundaries, inputs, outputs, interactions, and behaviors).** • I can describe the structure and interactions of systems that may exist independently, be composed of sub-systems, or be a part of larger complex systems. • I can model systems and their interactions, including inputs, processes, and outputs. • I can design and utilize a model to explain and justify the possible effects of change within a system (e.g., cycling of matter and the flow of energy). • I can determine the limitations of a model when it represents only certain aspects of the system under study.
Performance Expectations Coded to National Crosscutting Concepts	K-ESS3-1, K-ESS2-2	3-LS4-4, 5-LS2-1 5-ESS2-1, 5-ESS3-1	MS-PS2-1, MS-PS2-4, MS-PS3-2, MS-LS1-3, MS-ESS1-2, MS-ESS2-6

Competencies statements above are aligned with **Systems and System Models**: Defining the system under study- specifying its boundaries and making explicit a model of that system- provides tools for understanding and testing ideas that are applicable throughout science and engineering. This concept is from: "4 Dimension 2: Crosscutting Concepts" National Research Council. *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: The National Academies Press, 2012. doi:10.17226/13165.

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	K-2	3-5	6-8
6. Competency Statements for Energy and Matter in Systems	**Students will investigate, observe and describe solids, liquids, and gases, and what happens when matter and energy is manipulated (e.g., heated, cooled, disassembled, reassembled).** • I can construct an evidence-based account of how heat, light, motion, or sound energy affects other things, using my observations. • I can plan and conduct an investigation to see what happens when I change the amount of energy in a system.	**Students will investigate and use models to make predictions and support evidence-based explanations about the cycling of matter and flow of energy within and between systems.** • I can explain how matter is conserved and transported into, out of, and within systems (e.g. matter & energy in organisms and ecosystems). • I can explain how energy can be transferred in various ways (e.g., sound, light, heat, electrical currents - energy). • I can demonstrate that energy can be transferred between objects (e.g., object speed and collision - energy). • I can demonstrate how energy can be transformed from one form to another (e.g., passive solar heater converting light into heat, electrical currents converting electrical energy into motion energy), using a model I create myself.	**Students will analyze evidence (e.g., investigations, models, theories, scenarios) to predict and track changes in the cycling of matter and flow of energy within and between systems in order to identify their possibilities and limitations.** • I can develop a model and from it draw evidence that matter is conserved in physical and chemical processes. • I can demonstrate how the transfer of energy drives the motion and/or cycling of matter within a natural and a designed system,. • I can interpret and defend my interpretation of the effects of different forms of energy within and between systems (e.g. energy in fields, thermal energy, energy of motion). • I can predict possible changes within the system by tracking the transfer of energy flow through a designed or natural system.
Performance Expectations Coded to National Crosscutting Concepts	2-PS1-3, K-PS2-1, K-PS2-2, 1-PS4-1, 1-PS4-2, 1-PS4-3, 1-PS4-4, 2-PS1-3, 2-PS1-4	4-PS3-1, 4-PS3-2, 4-PS3-3, 4-PS3-4, 5-PS3-1, 5-LS1-1	MS-PS1-5, MS-PS1-6, MS-PS3-3, MS-PS3-5, MS-LS1-6, MS-LS1-k, MS-LS1-7, MS-LS2-3, MS-ESS2-4

Competencies statements above are aligned with **Energy and Matter in Systems**: Tracking fluxes of energy and matter into, out of and within systems helps one understand the system's possibilities and limitations. This concept is from: "4 Dimension 2: Crosscutting Concepts" National Research Council. *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: The National Academies Press, 2012. doi:10.17226/13165.

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	K-2	3-5	6-8
7. Competency Statements for Structure and Function	**Students will observe, demonstrate, and explain how the shape and stability* of structures of natural or designed objects are related to their functions.** • I can develop simple models that mimic various structures and functions of living things (e.g., how structures of a plant or animal disperse seeds, how body structures help animals communicate, move, or meet their needs). • I can analyze how the structures of man-made materials or objects make them useful for specific purposes/functions.	**Students will investigate the structure, substructure, and function of organisms and human-designed objects in order to analyze relationships and support evidence-based explanations about survival or performance.** • I can use observations from investigations or models to support explanations of how structures of plants or animals function to support survival and/or performance. • I can use investigations and engineering processes to redesign structures of human-made products to enhance or change performance.	**Students will analyze the relationship among structure and function of natural or human designed objects, using evidence to redesign or support claims about survival and/or improved performance** • I can model complex and microscopic structures and systems. • I can visualize and model how function depends on the shapes, composition, and relationships among its parts. • I can analyze complex natural and designed structures/systems to determine how they function. • I can use functional and structural evidence to develop or improve natural or human-designed structures by taking into account properties of different materials and how materials can be shaped and used.
Performance Expectations Coded to National Crosscutting Concepts	1-LS1-1, 2-LS2-2, K-2-ETS1-2	4-LS1-1, 4-LS1-2, 4-PS4-2, 3-5-ETS1-2, 3-5-ETS1-2, 3-5-ETS1-3	MS-PS1-5, MS-PS1-6, MS-PS4-a, MS-PS4-2, MS-PS4-3, MS-LS1-6, MS-LS1-7, MS-LS3-1 MS-PS4-2, MS-PS4-3, MS-LS3-1

*See GLOSSARY

Competencies statements above are aligned with **Structure and Function**: The way in which an object or living thing is shaped and its substructure determine many of its properties and functions. This concept is from: "4 Dimension 2: Crosscutting Concepts" National Research Council. *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: The National Academies Press, 2012. doi:10.17226/13165.

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	K-2	3-5	6-8
8. Competency Statements for Stability and Change of Systems	**Students will distinguish between changes in natural systems that happen rapidly and changes that happen over time.** • I can use information from multiple sources, including observations of models, to provide evidence how things change and/or stay the same and that change can occur either slowly or rapidly.	**Students will investigate natural or designed systems in order to make predictions, analyze, and explain how slow or rapid changes may affect the stability of a system over time.** • I can explain simple rates of change for natural phenomena (e.g. space systems). • I can use evidence from observations, data, and maps to make predictions and support evidence-based explanations about how systems change over time (e.g., weather and climate, Earth's systems).	**Students will analyze and evaluate the stability of natural and human designed systems in order to develop evidence-based explanations and predictions of changes over time.** • I can use evidence to analyze and evaluate of stability and change of natural or designed systems. • I can examine changes over time and forces at different scales, including the atomic scale, to explain and predict the stability of a system. • I can use evidence to predict how small changes in one part of a system may influence large changes in another part. • I can use empirical evidence to construct an argument of how stability might be disturbed either by sudden events or gradual changes that accumulate over time. • I can demonstrate, using evidence, that a system in dynamic equilibrium is stable due to a balance of feedback mechanisms.
Performance Expectations Coded to National Crosscutting Concepts	2-ESS1-1, 2-ESS2-1	4-ESS1-1, 4-ESS2-1, 5-ESS1-2	MS-PS2-2, MS-LS2-4, MS-LS2-5, MS-ESS2-1, MS-ESS3-5, MS-ESS1-4, MS-ESS2-2, MS-ESS2-3, MS-ESS2-5, MS-ESS3-5

Competencies statements above are aligned with **Stability and Change of Systems:** For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study. This concept is from: "4 Dimension 2: Crosscutting Concepts" National Research Council. *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: The National Academies Press, 2012. doi:10.17226/13165.

***GLOSSARY:**

Phenomena - observable events. Students can use the three dimensions of practice, cross cutting concepts, or disciplinary core ideas to make sense of or explain phenomena.

Science and Engineering Practices – refers to a process of investigations and inquiry: what students do to make sense of phenomena; skills and knowledge used to investigate the world and to design and build systems.

Relative scale – comparative measures; greater than or less than a referenced amount, measurement, etc.

Stability – in this context, stability denotes a condition of how some aspects of a system are unchanging and how small changes will fade away, in that the system will return to stable functioning