Draft Wisconsin High School Science Performance Level Descriptors 10/11/2018

Dimension	Wisconsin Reporting Category	Below Basic (Wisconsin Science Score Range 1–17)	Basic (Wisconsin Science Score Range 18–22)	Proficient (Wisconsin Science Score Range 23–27)	Advanced (Wisconsin Science Score Range 28–36)
Science and Engineering Practices (SEP) and Crosscutting Concepts (CC)	Interpretation of Data	Students performing at the *Below Basic* level may be able to: • Identify and describe the features of scientific tables, graphs, and diagrams (e.g., axis labels, units of measure) of qualitative or quantitative data.*[SCI.SEP2.A.h, SCI.SEP3.A.h, SCI.SEP4.A.h, SCI.CC1.h, SCI.CC3.h, SCI.CC4.h]* • Examine qualitative or quantitative data displayed in a simple scientific table, graph, or diagram to determine what information is present and then locate relevant pieces of the displayed data to support explanations, predict phenomena, analyze systems, and solve problems.*[SCI.SEP2.A.h, SCI.SEP3.A.h, SCI.CC1.h, SCI.CC3.h, SCI.CC4.h]* • Identify and describe the features of scientific tables, graphs, and diagrams (e.g., axis labels, units of measure) of qualitative or quantitative data to support explanations, predict phenomena, analyze systems, and solve problems.*[SCI.SEP2.A.h, SCI.SEP3.A.h, SCI.SEP4.A.h, SCI.CC1.h, SCI.CC3.h, SCI.CC4.h]* • Understand and properly use common scientific terminology, symbols, and units of measure when constructing explanations, arguing from evidence, and communicating information. *[SCI.SEP6.A.h, SCI.SEP7.A.h, SCI.SEP8.A.h, SCI.CC3.h]*	Students performing at the *Basic* level are likely able to: • Examine qualitative or quantitative data displayed in a complex scientific table, graph, or diagram to determine what information is present and then locate relevant pieces of the displayed data to support explanations, predict phenomena, analyze systems, and solve problems.*[SCI.SEP2.A.h, SCI.SEP3.A.h, SCI.SEP4.A.h, SCI.CC1.h, SCI.CC3.h, SCI.CC4.h]* • Interpret patterns in a simple scientific table, graph, or diagram to describe the effect of a change in one variable on another variable. *[SCI.SEP4.A.h, SCI.SEP7.A.h, SCI.CC1.h, SCI.CC3.h]* • Compare and contrast the scale, proportion, or quantity of data in a simple scientific graph, table, or diagram to support explanations, predict phenomena, analyze systems, and solve problems (e.g., order data from a table or graph based on given criteria). *[SCI.SEP4.A.h, SCI.SEP8.A.h, SCI.CC1.h, SCI.CC3.h, SCI.CC4.h]* • Integrate data from a simple scientific graph, table, or diagram in qualitatively or quantitatively meaningful ways to make scientific claims, including claims about specific causes and effects (e.g., summing daily measurements to obtain a weekly total). *[SCI.SEP4.A.h, SCI.SEP8.A.h, SCI.CC2.h, SCI.CC3.h]* • Develop a graphical model or diagram based on raw data or from a table of data to describe and support scientific claims and explanations. *[SCI.SEP2.A.h, SCI.SEP4.A.h, SCI.SEP5.A.h, SCI.SEP8.A.h, SCI.CC1.h, SCI.CC3.h]* • Interpret patterns in a simple scientific table or graph to qualitatively or quantitatively estimate a value or range of values that falls between two known values (i.e. interpolation). *[SCI.SEP4.A.h, SCI.SEP5.A.h, SCI.SEP8.A.h, SCI.CC1.h, SCI.CC3.h]*	Students performing at the *Proficient* level are likely able to: • Compare and contrast the scale, proportion, or quantity of data in two different simple scientific graphs, tables, or diagrams to support explanations, predict phenomena, analyze systems, and solve problems (e.g., compare the scale of data in a table to that in a related graph). *[SCI.SEP4.A.h, SCI.SEP8.A.h, SCI.CC1.h, SCI.CC3.h, SCI.CC4.h]* • Integrate data from two or more simple scientific graphs, tables, or diagrams in quantitatively or qualitatively meaningful ways to make scientific claims, including claims about specific causes and effects (e.g., categorize data from a table using a scale found in another table). *[SCI.SEP4.A.h, SCI.SEP8.A.h, SCI.CC2.h, SCI.CC3.h]* • Compare and contrast the scale, proportion, or quantity of data in a complex scientific graph, table, or diagram to support explanations, predict phenomena, analyze systems, and solve problems (e.g., compare rates of change in different regions of a titration curve). *[SCI.SEP4.A.h, SCI.SEP8.A.h, SCI.CC1.h, SCI.CC3.h, SCI.CC4.h]* • Integrate data from a complex scientific graph, table, or diagram in qualitatively or quantitatively meaningful ways to make scientific claims, including claims about specific causes and effects (e.g., summing data from two different curves in a graph represented by two *y*-axes). *[SCI.SEP4.A.h, SCI.SEP8.A.h, SCI.CC2.h, SCI.CC3.h]* • Analyze and interpret patterns in a simple scientific table or graph to qualitatively or quantitatively estimate a value or range of values that extends beyond the set of known values (i.e. extrapolation). *[SCI.SEP4.A.h, SCI.SEP5.A.h, SCI.SEP8.A.h, SCI.CC1.h, SCI.CC3.h]* • Analyze and interpret patterns in a complex scientific table, graph, or diagram to describe the effect of a change in one variable on another variable. *[SCI.SEP4.A.h, SCI.SEP7.A.h, SCI.CC1.h, SCI.CC3.h]* • Determine and/or apply a simple mathematical relationship that exists between data to describe and support scientific claims and explanations. (e.g., applying ratios, simple unit conversions, averaging data). *[SCI.SEP2.A.h, SCI.SEP5.A.h, SCI.CC1.h, SCI.CC3.h]* • Revise interpretations of simple scientific data based on new evidence. *[SCI.SEP1.A.h, SCI.SEP2.A.h, SCI.SEP4.A.h,SCI.CC1.h, SCI.CC2.h,, SCI.CC3.h]*	Students performing at the *Advanced* level are likely able to: • Compare and contrast the scale, proportion, or quantity of data in two different complex scientific graphs, tables, or diagrams to support explanations, predict phenomena, analyze systems, and solve problems (e.g., compare phases of two substances represented by different phase diagrams). *[SCI.SEP4.A.h, SCI.SEP8.A.h, SCI.CC1.h, SCI.CC3.h, SCI.CC4.h]* • Integrate data from two or more complex scientific graphs, tables, or diagrams in quantitatively or qualitatively meaningful ways to make scientific claims, including claims about specific causes and effects (e.g., use a calibration curve to determine a concentration from a measured absorption value). *[SCI.SEP4.A.h, SCI.SEP8.A.h, SCI.CC2.h, SCI.CC3.h]* • Determine and/or apply a complex mathematical relationship that exists between data to describe and support scientific claims and explanations. (e.g., compound unit conversions, dimensional analysis). *[SCI.SEP2.A.h, SCI.SEP5.A.h, SCI.CC1.h, SCI.CC3.h]* • Analyze and interpret patterns in a complex scientific table or graph to qualitatively or quantitatively estimate a value or range of values that falls between two known values (i.e. interpolation). *[SCI.SEP4.A.h, SCI.SEP5.A.h, SCI.SEP8.A.h, SCI.CC1.h, SCI.CC3.h]* • Analyze and interpret patterns in a complex scientific table or graph to qualitatively or quantitatively estimate a value or range of values that extends beyond the set of known values (i.e. extrapolation). *[SCI.SEP4.A.h, SCI.SEP5.A.h, SCI.SEP8.A.h, SCI.CC1.h, SCI.CC3.h]* • Revise interpretations of complex scientific data based on new evidence. *[SCI.SEP1.A.h, SCI.SEP2.A.h, SCI.SEP4.A.h,SCI.CC1.h, SCI.CC2.h,, SCI.CC3.h]* • Analyze, interpret, and use mathematical, computational, and algorithmic representations of phenomena or design solutions to describe and support scientific claims and explanations. *[SCI.SEP2.A.h, SCI.SEP4.A.h, SCI.SEP5.A.h, SCI.CC1.h, SCI.CC3.h]* • Design solutions to describe and support scientific claims and explanations. *[SCI.SEP2.A.h, SCI.SEP4.A.h, SCI.SEP5.A.h, SCI.CC1.h, SCI.CC3.h]* • Apply concepts of statistics and probability to scientific and engineering questions and problems, using digital tools when feasible. Concepts should include determining the fit of functions, slope, and intercepts to data, along with correlation coefficients when the data is linear. *[SCI.SEP2.A.h, SCI.SEP4.A.h, SCI.SEP5.A.h, SCI.CC1.h, SCI.CC3.h]*

Science and Engineering Practices (SEP) and Crosscutting Concepts (CC)	Scientific Investigation	Students performing at the *Below Basic* level may be able to: • Critically read the procedure for a simple scientific investigation to locate key concepts needed to understand what phenomenon is being studied or what problem the investigators are trying to solve. *[SCI.SEP3.A.h, SCI.SEP8.A.h]* • Select appropriate tools to conduct a simple investigation that can serve as evidence to construct and revise a model, support an explanation for phenomena, or refine a solution to a problem. *[SCI.SEP3.A.h]*	Students performing at the *Basic* level are likely able to: • Critically read the procedure for a complex scientific investigation to locate key concepts needed to understand what phenomenon is being studied or what problem the investigators are trying to solve. *[SCI.SEP3.A.h, SCI.SEP8.A.h]* • Select appropriate tools to conduct a complex investigation that can serve as evidence to construct and revise a model, support an explanation for phenomena, or refine a solution to a problem. *[SCI.SEP3.A.h]* • Understand how a simple investigation was designed to provide accurate and reliable evidence to test conceptual, mathematical, physical, and empirical models (e.g., controlling variables, number of trials, inputs/outputs, constraints). *[SCI.SEP3.A.h, SCI.SEP8.A.h]*	Students performing at the *Proficient* level are likely able to: • Understand how a complex investigation was designed to provide accurate and reliable evidence to test conceptual, mathematical, physical, and empirical models (e.g., controlling variables, number of trials, inputs/outputs, constraints). *[SCI.SEP3.A.h, SCI.SEP8.A.h]* • Evaluate related simple and complex scientific investigations to identify similarities, differences and limitations in their designs, methods, and tools. *[SCI.SEP3.A.h]* • Use and/or develop a model based on patterns of evidence from an investigation in order to predict the outcome of an additional trial or measurement. *[SCI.SEP3.A.h, SCI.SEP2.A.h, SCI.CC1.h, SCI.CC2.h]* • Use and/or develop a model based on patterns of evidence from an investigation in order to predict which experimental conditions would produce an outcome that satisfies specified criteria or solves a problem. *[SCI.SEP3.A.h, SCI.SEP2.A.h, SCI.CC1.h, SCI.CC2.h]*	Students performing at the *Advanced* level are likely able to: • Refine and evaluate empirically testable questions and hypotheses that are the bases for scientific investigations. *[SCI.SEP3.A.h, SCI.SEP8.A.h]* • Evaluate the suitability of the design of an investigation to provide accurate and reliable evidence to test conceptual, mathematical, physical, and empirical models (e.g., identify possible flaws because of precision and accuracy issues, inadequate control of variables, or insufficient number of trials). *[SCI.SEP3.A.h, SCI.SEP8.A.h]* • Refine the design of an experiment or propose a valid alternate method for testing a hypothesis or solving a problem. *[SCI.SEP3.A.h]* • Predict how modifying the design or methods of an investigation may affect the results and its suitability to serve as evidence to build and revise models, support explanations for phenomena, and refine solutions to problems. *[SCI.SEP3.A.h, SCI.SEP8.A.h]* • Plan and design a new investigation that could be carried out to provide additional evidence to build and revise models, support explanations for phenomena, and refine solutions to problems, or to evaluate the results of the original investigation. *[SCI.SEP3.A.h, SCI.SEP8.A.h]*
Science and Engineering Practices (SEP) and Crosscutting Concepts (CC)	Evaluation of Models, Inferences, and Experimental Results	Students performing at the *Below Basic* level may be able to: • Critically read an explanation or the description of a model constructed to explain phenomena or solve a problem to find key facts and cited data. *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]* • Compare and contrast competing arguments and models constructed to determine which models cite certain key facts and data. *[SCI.SEP2.A.h, SCI.SEP6.A.h , SCI.SEP7.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]*	Students performing at the *Basic* level are likely able to: • Compare and contrast competing arguments and models to identify and understand key scientific assumptions and implications. *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP7.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]* • Identify the merits of a set of simple scientific claims, predictions, or conclusions to determine which one is, or is not, consistent with an argument or model. *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP7.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]* • Identify the merits of a set of simple scientific claims, predictions, or conclusions to determine which one is best supported by a source of scientific data (e.g., graph, table, or diagram). *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]* • Compare and contrast competing arguments and models constructed to explain phenomena to determine key similarities and differences in how they explain scientific observations. *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP7.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]*	Students performing at the *Proficient* level are likely able to: • Evaluate the merits of a set of simple scientific claims, predictions, or conclusions to determine which one is, or is not, consistent with two or more competing arguments or models. *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP7.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]* • Compare and contrast competing arguments and models to determine which one best supports or contradicts a simple scientific claim, prediction, or conclusion. *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP7.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]* • Evaluate merits and limitations of competing arguments or models to determine which one best explains phenomena or solves a problem, including how they are impacted by new or additional evidence. *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP7.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]* • Construct a simple scientific claim or prediction and defend it based on evidence about the natural world and defend it based on one or more arguments or models. *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP7.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]* • Evaluate the merits of a set of simple scientific claims, predictions, or conclusions to determine which one is best supported by multiple sources of scientific data (e.g., a table and a graph). *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]* • Examine different sets of experimental results to determine which results best support or contradict a scientific claim, prediction, or conclusion. *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]* • Evaluate a simple scientific claim or conclusion and explain why it is, or is not, supported by the findings of scientific investigations. *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP7.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]* • Construct a simple scientific claim or prediction and defend why it is consistent with the findings of scientific investigations. *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP7.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]*	Students performing at the *Advanced* level are likely able to: • Evaluate the merits of a set of complex scientific claims, predictions, or conclusions to determine which one is, or is not, consistent with two or more competing arguments or models. *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP7.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]* • Compare and contrast competing arguments and models to determine which one best supports or contradicts a complex scientific claim, prediction, or conclusion. *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP7.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]* • Construct and defend an argument based on valid and reliable evidence to explain why scientific data support or weakens a model. *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP7.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]* • Revise an argument or model based on new evidence gathered from investigations to accommodate the new evidence, or construct a new argument or model based on that new evidence. *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP7.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]* • Construct a complex scientific claim or prediction based on evidence about the natural world and defend it based on one or more arguments or models. *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP7.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]* • Evaluate the merits of a set of complex scientific claims, predictions, or conclusions to determine which one is best supported by one or more sources of scientific data (e.g., both a scientific table and a graph of experimental results). *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]* • Evaluate a complex scientific claim or conclusion and explain why it is, or is not, supported by the findings of scientific investigations. *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP7.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]* • Construct a complex scientific claim or prediction and explain why it is consistent with the findings of scientific investigations. *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP7.A.h, SCI.SEP8.A.h, SCI.CC1–4.h]* • Apply scientific ideas, principles, and evidence to design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, and prioritized criteria, and considering

					trade-offs and possible unanticipated effects. *[SCI.SEP2.A.h, SCI.SEP6.A.h, SCI.SEP6.B.h, SCI.SEP8.A.h, SCI.CC1–4.h]*
Dimension	**Content Area**	*Students use Science and Engineering Practices, Crosscutting Concepts, and an understanding of Disciplinary Core Ideas to make sense of phenomena and solve problems. Below are examples of how understandings of Disciplinary Core Ideas may progress across the performance levels:*			
Disciplinary Core Ideas	Life Science	**Below Basic** *Some students performing at the* Below Basic *level may be able to:*	**Basic** *Students performing at the* Basic *level are likely able to:*	**Proficient** *Students performing at the* Proficient *level are likely able to:*	**Advanced** *Students performing at the* Advanced *level are likely able to:*
		Recognize the structures and processes related to topics such as • Organisms contain systems of specialized cells that help perform essential functions of life. *[SCI.LS1.A.h, SCI.CC4.h]* • Cells can divide to form identical new cells. *[SCI.LS1.B.h]* • Plants get their energy from sunlight through photosynthesis. *[SCI.LS1.C.h, SCI.CC5.h]* Recognize the structures and processes related to topics such as • The survival of ecosystems is affected by availability of resources. *[SCI.LS2.A.h, SCI.CC4.h]* • Photosynthesis and cellular respiration provide energy for life processes. *[SCI.LS2.B.h, SCI.CC5.h]* Recognize aspects of heredity related to topics such as • DNA is involved in heredity. *[SCI.LS3.A.h]* • Genetic content is contained in the cells of an organism. *[SCI.LS3.A.h]* • Certain traits common in a population are the result of environmental factors. *[SCI.LS3.B.h]* Recognize aspects of biological evolution related to topics such as • DNA is used to trace lines of descent. *[SCI.LS4.A.h]* • Natural selection results in changes in a population. *[SCI.LS4.B.h, SCI.CC7.h]* • Traits can positively affect survival of a species. *[SCI.LS4.B.h]* • Species evolve over time as a result of changes in their environments and some species become extinct. *[SCI.LS4.C.h, SCI.CC7.h]*	Recognize how an understanding of structures and processes can be used to make sense of phenomena and solve problems by describing that • Each system in an organism is made up of numerous parts. *[SCI.LS1.A.h, SCI.CC4.h]* • Cells increase in number by dividing into new cells, and certain types of cells can change into other types of cells. *[SCI.LS1.B.h]* • Plants use molecules produced through photosynthesis for growth. *[SCI.LS1.C.h]* • Plants produce oxygen and absorb carbon dioxide through cellular respiration. *[SCI.LS1.C.h]* Recognize how an understanding of the interactions, energy, and dynamics within ecosystems can be used to make sense of phenomena and solve problems by describing that • Ecosystems have carrying capacities resulting from biotic and abiotic factors. *[SCI.LS2.A.h, SCI.CC4.h]* • Photosynthesis and cellular respiration provide most of the energy for life processes. *[SCI.LS2.B.h, SCI.CC5.h]* • Photosynthesis and cellular respiration are key components of the global carbon cycle. *[SCI.LS2.B.h]* Recognize how an understanding of aspects of heredity can be used to make sense of phenomena and solve problems by describing that • Traits are passed down via DNA. *[SCI.LS3.A.h]* • Genetic content is the same in all the cells in an organism. *[SCI.LS3.A.h]* • Unique variation and distribution of traits exist in any given population. *[SCI.LS3.B.h]* • Genetic variation can result from mutations in DNA. *[SCI.LS3.B.h]* Recognize how an understanding of biological evolution can be used to make sense of phenomena and solve problems by describing that • Multiple lines of descent share certain DNA sequences. *[SCI.LS4.A.h]* • Natural selection results from competition between organisms in a population. *[SCI.LS4.B.h]* • Traits that positively affect survival are more likely to be passed on over time. *[SCI.LS4.B.h, SCI.CC7.h]* • Species evolve over time as a result of competition for resources. *[SCI.LS4.C.h, SCI.CC7.h]* • Species adapt over time due to changes in their environments or they may become extinct. *[SCI.LS4.C.h, SCI.CC7.h]*	Make sense of phenomena and solve problems related to structures and processes by creating evidence-based explanations of how • Feedback mechanisms maintain an organism's internal conditions within certain limits and mediate its behaviors. *[SCI.LS1.A.h]* • Growth and division of cells in organisms occurs by mitosis and differentiation for specific cell types. *[SCI.LS1.B.h]* • Molecules produced through photosynthesis are used to make amino acids and other molecules that can be assembled into proteins or DNA. *[SCI.LS1.C.h]* • Through cellular respiration, matter and energy flow through different organizational levels of an organism as elements that are recombined to form different products and transfer energy. *[SCI.LS1.C.h, SCI.CC5.h]* Make sense of phenomena and solve problems related to the interactions, energy, and dynamics within ecosystems by creating evidence-based explanations of how • An ecosystem has a carrying capacity that results from biotic and abiotic factors such as food supply, water, ecological conditions, and space. • The fundamental tension between resource availability and organism populations affects the abundance of species in any given ecosystem. *[SCI.LS2.A.h, SCI.CC4.h]* • Only a fraction of matter consumed at the lower level of a food web is transferred up, resulting in fewer organisms at higher levels. *[SCI.LS2.B.h]* • At each link in an ecosystem, elements are combined in different ways, and matter and energy are conserved. *[SCI.LS2.B.h, SCI.CC5.h]* Make sense of phenomena and solve problems related to heredity by creating evidence-based explanations of how • DNA carries instructions for forming species' characteristics. *[SCI.LS3.A.h]* • Each cell in an organism has the same genetic content, but genes expressed by cells can differ. *[SCI.LS3.A.h]* • Genetic and environmental factors affect the variation and distribution of traits in a population. *[SCI.LS3.B.h]* • Genetic variation can result from mutations caused by environmental factors or by errors in DNA replication. *[SCI.LS3.B.h]* Make sense of phenomena and solve problems related to biological evolution by creating evidence-based explanations of how • The ongoing branching that produces multiple lines of descent can be inferred by anatomical and embryological evidence of different organisms. *[SCI.LS4.A.h]* • Natural selection results from variation in the genes and traits between organisms in a population. *[SCI.LS4.B.h]* • Traits that positively affect survival can become more common in a population. *[SCI.LS4.B.h]* • A species evolves as a result of the genetic variation of individuals in the species, competition for resources, and the	Make sense of phenomena and solve problems related to structures and processes by modeling and applying an understanding of how • Feedback mechanisms maintain an organism's internal conditions within certain limits and mediate its behaviors in response to specific stimuli. *[SCI.LS1.A.h]* • Mitosis results in two daughter cells, each having the same number and kind of chromosomes as the parent cell. *[SCI.LS1.B.h]* • Cellular differentiation is the process by which a less specialized cell type becomes a more specialized cell type. *[SCI.LS1.B.h]* • Photosynthesis involves a series of chemical processes by which light energy is converted to chemical potential energy. *[SCI.LS1.C.h]* • There are chemical pathways by which molecules produced through photosynthesis are used to make amino acids and other molecules that can be assembled into proteins or DNA. *[SCI.LS1.C.h]* • Cellular respiration involves chemical processes such as glycolysis and the citric acid cycle by which molecules are broken down to produce ATP which stores and transports chemical energy within cells. *[SCI.LS1.C.h, SCI.CC4.h, SCI.CC5.h]* Make sense of phenomena and solve problems related to the interactions, energy, and dynamics within ecosystems by modeling and applying an understanding of how • The combination of the factors that affect an organism's success can be measured as a multidimensional niche. *[SCI.LS2.A.h, SCI.CC4.h]* • Only a fraction of matter consumed at the lower level of a food web is transferred up, which can be described in terms of the efficiency with which organisms convert assimilated energy. *[SCI.LS2.B.h]* • At each link in an ecosystem, there are chemical processes and pathways by which elements are combined in different ways, and matter and energy are conserved. *[SCI.LS2.B.h, SCI.CC4.h]* • Photosynthesis and cellular respiration by plants and other organisms influence the global carbon cycle. *[SCI.LS2.B.h]* Make sense of phenomena and solve problems related to heredity by modeling and applying an understanding of how • Mechanisms by which DNA carries instructions for forming species' characteristics involve strands of polynucleotides that link in predictable patterns via hydrogen bonding. *[SCI.LS3.A.h]* • Genes are expressed via mechanisms involving RNA and transcription. *[SCI.LS3.A.h]* • Cause and effect relationships between genetic and environmental factors affect the variation and distribution of traits in a population. *[SCI.LS3.B.h]* • Genetic variation can result from mutations caused by environmental factors, by errors in DNA replication, or from genetic recombination during meiosis. *[SCI.LS3.B.h]*

				proliferation of organisms better able to survive and reproduce. *[SCI.LS4.C.h]* • The distribution of traits in a population, as well as species expansion, emergence, or extinction, can change when conditions change because of adaptation. *[SCI.LS4.C.h, SCI.CC7.h]*	Make sense of phenomena and solve problems related to biological evolution by modeling and applying an understanding of how • DNA sequences, amino acid sequences, and anatomical and embryological evidence are used to infer lines of descent in a group of related species. *[SCI.LS4.A.h]* • Natural selection occurs only if there is variation in the genes and traits between organisms in a population and may eventually result in speciation. *[SCI.LS4.B.h]* • Traits that increase biological fitness can become more common in a population. *[SCI.LS4.B.h]* • Species evolution can be described in terms of heritable variation, differential reproduction, competition for resources, and the proliferation of organisms better able to survive and reproduce. *[SCI.LS4.C.h]* • The distribution of traits in a population, as well as species expansion, emergence, or extinction, can change when conditions change because of adaptation, and can be described in terms of evolutionary fitness. *[SCI.LS4.C.h, SCI.CC7.h]*

Students use Science and Engineering Practices, Crosscutting Concepts, and an understanding of Disciplinary Core Ideas to make sense of phenomena and solve problems. Below are example s of how understandings of Disciplinary Core Ideas may progress across the performance levels:

		Below Basic *Some students performing at the* Below Basic *level may be able to:*	Basic *Students performing at the* Basic *level are likely able to:*	Proficient *Students performing at the* Proficient *level are likely able to:*	Advanced *Students performing at the* Advanced *level are likely able to:*
Disciplinary Core Ideas	Physical Science	Recognize matter and its interactions related to topics such as • Different substances are made up of atoms or groups of atoms that can react to form new substances. *[SCI.PS1.A.h]* Recognize forces, interactions, motion and stability related to topics such as • Speed, velocity, and acceleration are ways to describe the motion of objects. *[SCI.PS2.A.h]* • One object may exert a force on another object. *[SCI.PS2.B.h]* Recognize aspects of energy related to topics such as • Energy can be transferred from one object to another object. *[SCI.PS3.B.h, SCI.CC5.h]* • Photosynthesis is how plants use sunlight for energy. *[SCI.PS3.D.h, SCI.CC5.h]* Recognize aspects of waves and their applications in technologies for information transfer related to topics such as • Waves are characterized by wavelength and frequency. *[SCI.PS4.A.h]* • Information and energy are often transmitted as waves. *[SCI.PS4.A.h, SCI.CC5.h]* • Light travels in waves and the color of light is related to the wavelength or frequency of the waves. *[SCI.PS4.B.h*	Recognize how an understanding of aspects of matter and its interactions can be used to make sense of phenomena and solve problems by describing that • Different atoms and groups of atoms have different structures and charges, which guide how or if chemical reactions occur. *[SCI.PS1.A.h, SCI.CC6.h]* Recognize how an understanding of forces, interactions, motion, and stability can be used to make sense of phenomena and solve problems by describing that • The motion of objects can be described in terms of speed, velocity, and acceleration. *[SCI.PS2.A.h]* • Force is related to the mass and acceleration of an object. *[SCI.PS2.A.h]* • One object may exert a force on another object, even if they are not in contact with each other. *[SCI.PS2.B.h]* Recognize how an understanding of aspects of energy can be used to make sense of phenomena and solve problems by describing that • Energy is neither created nor destroyed, just transformed or transferred. *[SCI.PS3.B.h, SCI.CC5.h]* • Photosynthesis is the primary biological means of capturing radiation (energy) from the sun. *[SCI.PS3.D.h, SCI.CC5.h]* Recognize how an understanding of aspects of waves and their applications in technologies can be used to make sense of phenomena and solve problems by describing that • Waves are characterized by wavelength and frequency, and some waves can pass through media that other waves can't pass through. *[SCI.PS4.A.h]* • Information and energy are often transmitted as waves. *[SCI.PS4.A.h, SCI.CC5.h]* • Electromagnetic radiation includes many different useful (and sometimes harmful) types of energy that differ based on frequency and wavelength (light, microwaves, radio waves, ultraviolet radiation, x rays, etc.). *[SCI.PS4.B.h, SCI.CC5.h]*	Make sense of phenomena and solve problems related to aspects of matter and its interactions by creating evidence-based explanations of how • The structure of atoms and interactions between charges can explain the structure and interactions of matter, including basic chemical reactions and nuclear processes. *[SCI.PS1.A.h, SCI.CC6.h]* • The repeating patterns of the periodic table reflect patterns of outer electrons. *[SCI.PS1.A.h]* • Chemical processes can be described in terms of collisions of molecules, rearrangement of atoms, and changes in energy as determined by properties of elements involved. *[SCI.PS1.B.h, SCI.CC5.h, SCI.CC7.h]* • Stoichiometric coefficients can be used to predict, in terms of atoms/molecules, how much product is produced as a given amount of reactant is consumed (or vice-versa). *[SCI.PS1.B.h]* • Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. *[SCI.PS1.C.h, SCI.CC5.h, SCI.CC7.h]* Make sense of phenomena and solve problems related to aspects of forces, interactions, motion, and stability by creating evidence-based explanations of how • The motion of objects can be quantitatively described using the concepts of speed, velocity, and acceleration. *[SCI.PS2.A.h]* • Newton's second law of motion ($F = ma$) and the conservation of momentum can be used to predict changes in the motion of objects. *[SCI.PS2.A.h]* • There are forces between objects (that are apart or in contact) resulting from the attraction and repulsion between electric charges at the atomic scale. *[SCI.PS2.B.h]* Make sense of phenomena and solve problems related to aspects of energy by creating evidence-based explanations of how • Energy within a closed system is conserved and the transfer of energy between systems can be described in terms of	Make sense of phenomena and solve problems related to aspects of matter and its interactions by modeling and applying an understanding of how • The patterns in the periodic table and understandings of atomic structure and charge interactions can be used to predict the properties of substances and the outcomes of chemical reactions and nuclear processes. *[SCI.PS1.A.h, SCI.CC6.h]* • Periodic trends in quantities, such as electronegativity and first ionization, can be used defend a prediction about whether the chemical reaction between two interacting substances will or will not occur. *[SCI.PS1.A.h]* • The absorption or release of energy by a chemical process can be quantified based on properties of substances involved and the conditions under which the process occurs. *[SCI.PS1.B.h, SCI.CC5.h, SCI.CC7.h]* • Temperature affects the speed of a chemical reaction based on rate of collisions of the reactant particles. *[SCI.PS1.B.h]* • Stoichiometric coefficients can be used to predict, in terms of moles and mass, how much product is produced as a given amount of reactant is consumed (or vice-versa). *[SCI.PS1.B.h]* • The amount of energy released or absorbed during nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, can be quantitatively predicted. *[SCI.PS1.C.h, SCI.CC5.h, SCI.CC7.h]* Make sense of phenomena and solve problems related to aspects of forces, interactions, motion, and stability by modeling and applying an understanding of how • The motion of objects can be quantitatively described using the concepts of speed, velocity, acceleration, and momentum. *[SCI.PS2.A.h]* • Based on Newton's second law of motion (F=ma) and the conservation of momentum, the net motion of objects can be predicted using component vectors. *[SCI.PS2.A.h]*

			energy associated with the motion or configuration of particles (objects). *[SCI.PS3.B.h, SCI.CC4.h, SCI.CC5.h]* • Photosynthesis can be described in terms of a balanced chemical equation. *[SCI.PS3.D.h, SCI.CC5.h]* Make sense of phenomena and solve problems related to aspects of waves and their applications in technologies by creating evidence-based explanations of how • The wavelength and frequency of a wave are related to one another by the speed of the wave, which depends on the type of wave and the medium through which it is passing. *[SCI.PS4.A.h]* • Properties of waves make them useful for transmitting information and energy. *[SCI.PS4.A.h, SCI.CC5.h]* • Light and other electromagnetic radiation has both a particle and a wave nature. *[SCI.PS4.B.h, SCI.CC5.h]*	• There are quantifiable forces between objects (that are apart or in contact) resulting from the attraction and repulsion between electric charges at the atomic scale. *[SCI.PS2.B.h]* • The gravitational force of attraction or repulsion between two objects is quantitatively related to the mass of each object and the distance between the objects *[SCI.PS2.B.h]* • The electrostatic force of attraction or repulsion between two objects is quantitatively related to the charge on each object and the distance between the objects *[SCI.PS2.B.h]* Make sense of phenomena and solve problems related to aspects of energy by modeling and applying an understanding of how • Energy within a closed system is conserved and the transfer of energy between systems can be quantitatively predicted based on the energy associated with the motion or configuration of particles (objects). *[SCI.PS3.B.h, SCI.CC4.h, SCI.CC5.h]* • The balanced chemical equation that represents photosynthesis summarizes a series of light-dependent reactions. *[SCI.PS3.D.h]* Make sense of phenomena and solve problems related to aspects of waves and their applications in technologies by modeling and applying an understanding of how • The wavelength and frequency of light are quantitatively related by the speed of light, which depends on the type of wave and the medium through which it is passing. *[SCI.PS4.A.h]* • Properties of waves that make them useful for transmitting information and energy can be explained by their wavelength or frequency, and how they interact with matter. *[SCI.PS4.A.h, SCI.CC5.h]* • Light and other electromagnetic radiation has both a particle and a wave nature, which explain properties of electromagnetic radiation and determine the many useful applications of electromagnetic radiation. *[SCI.PS4.B.h, SCI.CC5.h]*

Disciplinary Core Ideas — Earth & Space Science

Students use Science and Engineering Practices, Crosscutting Concepts, and an understanding of Disciplinary Core Ideas to make sense of phenomena and solve problems. Below are examples of how understandings of Disciplinary Core Ideas may progress across the performance levels:

Below Basic

Some students performing at the Below Basic *level may be able to:*

Recognize aspects of Earth's place in the universe related to topics such as

- There are different types of stars in the universe. *[SCI.ESS1.A.h]*
- Objects in space can move in predictable orbits. *[SCI.ESS1.B.h]*
- Scientists have gathered evidence to explain how solar systems are formed. *[SCI.ESS1.B.h, SCI.CC4.h]*
- Ice ages have occurred throughout Earth's history. *[SCI.ESS1.B.h]*
- Rocks are studied to provide evidence of Earth's early history. *[SCI.ESS1.C.h]*

Recognize aspects of Earth's systems related to topics such as

- Earth's dynamics are greatly influenced by water. *[SCI.ESS2.C.h]*
- Earth's climate is affected by solar radiation. *[SCI.ESS2.D.h, SCI.CC5.h]*

Recognize aspects of Earth and human activity related to topics such as

- Human use of natural resources has benefits and risks. *[SCI.ESS3.A.h]*
- Natural resources must be managed because they are important to human societies. *[SCI.ESS3.C.h]*

Basic

Students performing at the Basic *level are likely able to:*

Recognize how an understanding of aspects of Earth's place in the universe can be used to make sense of phenomena and solve problems by describing that

- Stars have characteristics, processes, and lifecycles. *[SCI.ESS1.A.h]*
- Elements are formed in stars. *[SCI.ESS1.A.h]*
- The Big Bang theory is the currently accepted explanation for how the universe began. *[SCI.ESS1.A.h]*
- Motions of orbiting objects can be predicted mathematically. *[SCI.ESS1.B.h]*
- Scientists study both the light produced by stars and the motion of stars to gather evidence for how solar systems are formed. *[SCI.ESS1.B.h, SCI.CC4.h]*
- Ice ages and other gradual climate changes occur in cycles. *[SCI.ESS1.B.h, SCI.CC7.h]*
- The rock record is used to provide evidence of Earth's early history. *[SCI.ESS1.C.h]*

Recognize how an understanding of aspects of structures and processes can be used to make sense of phenomena and solve problems by describing that

- Earth's dynamics are greatly influenced by water cycling between land, ocean, and the atmosphere. *[SCI.ESS2.C.h]*
- Solar radiation provides energy to Earth that drives the global climate system. *[SCI.ESS2.D.h, SCI.CC4.h, SCI.CC5.h]*
- Scientists use global climate models to predict future changes in climate. *[SCI.ESS2.D.h, SCI.CC7.h]*

Recognize how an understanding of aspects of Earth and human activity can be used to make sense of phenomena and solve problems by describing that

- Humans use natural resources to improve life, there can be negative impacts on Earth. *[SCI.ESS3.A.h]*
- If natural resources are not properly managed, human societies and the biodiversity needed to support them will not be sustainable. *[SCI.ESS3.C.h]*

Proficient

Students performing at the Proficient *level are likely able to:*

Make sense of phenomena and solve problems related to aspects of Earth's place in the universe by creating evidence-based explanations of how

- The characteristics, processes, and lifecycles of a star can be determined by studying light spectra produced by the star. *[SCI.ESS1.A.h]*
- Elements are formed by solar activity via nuclear fusion. *[SCI.ESS1.A.h]*
- Empirical evidence for the Big Bang theory is based on astronomical data gathered by recently developed technologies. *[SCI.ESS1.A.h]*
- Motions of orbiting objects are described by Kepler's laws. *[SCI.ESS1.B.h]*
- Evidence for how solar systems are formed is based on observations from astronomy and space probes. *[SCI.ESS1.B.h, SCI.CC4.h]*
- Cycles of ice ages and other gradual climate changes are caused by the cyclical changes in Earth's tilt and orbit that occur over tens to hundreds of thousands of years. *[SCI.ESS1.B.h]*
- The rock record resulting from tectonic and other geoscience processes can provide evidence of Earth's early history and the relative ages of major geologic formations. *[SCI.ESS1.C.h, SCI.CC7.h]*
- Objects on Earth originating from the solar system can provide evidence of both Earth's early history. *[SCI.ESS1.C.h, SCI.CC4.h]*

Make sense of phenomena and solve problems related to aspects of structures and processes by creating evidence-based explanations of how

- Water has unique chemical and physical properties that greatly influence Earth's dynamics. *[SCI.ESS2.C.h]*
- Radiation from the sun interacts with the atmosphere, ocean, and land to drive the global climate system. *[SCI.ESS2.D.h, SCI.CC4.h, SCI.CC5.h]*
- Global climate models are used to predict future changes in climate, including changes that are influenced by human behavior and natural factors. *[SCI.ESS2.D.h, SCI.CC7.h, SCI.CC7.h, SCI.CC7.h]*

Make sense of phenomena and solve problems related to aspects of Earth and human activity by creating evidence-based explanations of how

- There are costs, risks, and benefits that arise from the development of human society and use of natural resources. *[SCI.ESS3.A.h]*
- Natural resources must be managed properly and new technologies need to be developed in order to sustain human societies and the biodiversity needed to support them. *[SCI.ESS3.C.h]*

Advanced

Students performing at the Advanced *level are likely able to:*

Make sense of phenomena and solve problems related to aspects of Earth's place in the universe by modeling and applying an understanding of how

- Stars can be categorized based on their characteristics, processes, and lifecycles, and based on data about the strength and types of radiation they produce. *[SCI.ESS1.A.h, SCI.CC5.h]*
- Nuclear fusion occurs in the cores of stars, such as the sun, primarily converting hydrogen to helium, but other elements can be formed depending on the properties of the star. *[SCI.ESS1.A.h]*
- The currently accepted cosmological model for the universe is the Big Bang theory which describes how the universe is the result from a singularity that has been expanding over several billions of years. *[SCI.ESS1.A.h]*
- Kepler's laws can be used to quantitatively predict the motions of orbiting objects. *[SCI.ESS1.B.h]*
- Theories about how our solar system formed are continuing to be refined by observing newly forming solar systems in our galaxy. *[SCI.ESS1.B.h, SCI.CC4.h]*
- Chemical evidence in glacial ice along with other evidence from the rock record can be used to determine how cycles of ice ages and other gradual climate changes are caused by the cyclical changes in Earth's tilt and orbit that occur over tens to hundreds of thousands of years. *[SCI.ESS1.B.h, SCI.CC7.h]*
- Analysis of the composition of, textures in, and spatial relationships among rock formations and layers formed by tectonic and other processes provide evidence of Earth's early history and the relative ages of major geologic formations. *[SCI.ESS1.C.h]*
- Chemical analyses of objects originating from the solar system provide evidence of Earth's formation and early history *[SCI.ESS1.C.h, SCI.CC4.h]*

Make sense of phenomena and solve problems related to aspects of structures and processes by modeling and applying an understanding of how

- Water has unique chemical and physical properties that greatly influence Earth's dynamics through processes such as evaporation, condensation, precipitation, surface runoff, infiltration, and subsurface flow. *[SCI.ESS2.C.h]*
- The amount of radiation the Earth receives from the sun regulates the global system which is affected by how that radiation interacts with the atmosphere, ocean, and land. *[SCI.ESS2.D.h, SCI.CC4.h, SCI.CC5.h]*
- Scientists develop global climate models that take into account different amounts of different types of incoming solar radiation, along with human behavior and natural factors, to predict future changes in climate. *[SCI.ESS2.D.h, SCI.CC7.h]*

Make sense of phenomena and solve problems related to aspects of Earth and human activity by modeling and applying an understanding of how

- Human societies expand and branch out based on availability and management of natural resources such as water, land, fossil fuels, and minerals, but can also contract or fall when costs and risks are not properly managed. *[SCI.ESS3.A.h]*

Disciplinary Core Ideas					• New technologies are continually being developed to allow better management of natural resources in order to sustain human societies and the biodiversity needed to support them. *[SCI.ESS3.C.h]*
	Students use Science and Engineering Practices, Crosscutting Concepts, and an understanding of Disciplinary Core Ideas to make sense of phenomena and solve problems. Below are examples of how understandings of Disciplinary Core Ideas may progress across the performance levels:				
	Engineering, Technology, & the Application of Science	**Below Basic** *Some students performing at the* Below Basic *level may be able to:*	**Basic** *Students performing at the* Basic *level are likely able to:*	**Proficient** *Students performing at the* Proficient *level are likely able to:*	**Advanced** *Students performing at the* Advanced *level are likely able to:*
		Recognize the nature of science and engineering by • Identifying scientific claims made in advertisements and by non-scientists (e.g., politicians, actors). *[SCI.ETS3.A.h]* • Understanding some basic scientific methods, tools, and techniques that are used to confirm and study theories that explain phenomena. *[SCI.ETS3.C.h]* • Understanding that science relies on evidence to confirm theories. *[SCI.ETS3.C.h]*	Recognize the nature of science and engineering by • Examining the validity of scientific and non-scientific claims made in advertisements and by non-scientists (e.g., politicians, actors). *[SCI.ETS3.A.h]* • Utilizing some basic scientific methods, tools, and techniques to confirm and study theories that explain phenomena. *[SCI.ETS3.C.h]* • Understanding that scientific theories became accepted based on evidence that was repeatedly confirmed through observation, experimentation (hypothesis-testing), and peer review. *[SCI.ETS3.C.h]*	Explain the nature of science and engineering by • Engaging in scientific thinking by embracing skepticism and analyzing and critiquing scientific and non-scientific claims. *[SCI.ETS3.A.h]* • Utilizing a variety of basic, and some more sophisticated, scientific methods, tools, and techniques to confirm and study theories that explain phenomena. *[SCI.ETS3.C.h]* • Studying examples of how scientific theories became accepted based on evidence that was repeatedly confirmed through observation, experimentation (hypothesis-testing), and peer review. *[SCI.ETS3.C.h]* • Studying examples of how long-held scientific theories were modified over time to accommodate new evidence. *[SCI.ETS3.C.h]*	Apply an understanding of the nature of science and engineering to make sense of phenomena and solve problems by • Carrying out research and devising experiments to challenge questionable scientific claims that influence society and communicate findings to help others develop skepticism about those claims. *[SCI.ETS3.A.h]* • Utilizing a variety of sophisticated scientific methods, tools, and techniques to confirm and study theories that explain phenomena. *[SCI.ETS3.C.h]* • Comparing and evaluating currently competing scientific theories based on the strength of available evidence generated through observation, experimentation (hypothesis-testing), and peer review. *[SCI.ETS3.C.h]* • Defending a currently accepted scientific theory that has been challenged by non-scientific evidence and defend why the theory has been modified over time to accommodate new evidence rather than being rejected. *[SCI.ETS3.C.h]*

What do "simple" and "complex" mean when they describe scientific data presentations and investigations in the Wisconsin High School Science Performance Level Descriptors?

Concepts/Quantities Represented in a Simple Data Graph, Table, or Diagram or Studied in a Simple Investigation

Concepts are likely to be familiar to, or readily understood by, high school students regardless of their exposure to rigorous science instruction: temperature, rainfall—or density and concentration (even if only understood qualitatively); newly introduced but readily understood quantities (e.g., percent of offspring, angle of reflection); numbers of things—or a simple quantity—per another familiar quantity, like rotations per minute or number of lightning strikes per storm event.

Type/Nature of a Simple Scientific Graph, Table, or Diagram

The type and nature of these data presentations are likely to be familiar to high school students regardless of their exposure to rigorous science instruction: tables with one or more columns and single headings, bar graphs with clusters of three or fewer bars, line graphs with three or fewer curves (with a legend, when needed), pie charts, and flow diagrams (e.g., a food web).

Experimental Design and Methods of a Simple Scientific Investigation

These investigations are likely to be familiar to high school students, even those who have not had consistent and well-guided opportunities to engage in science investigations. Examples include field studies involving several test plots and investigations having several steps, some basic and some intricate, in which the number of variables measured and controlled is 4 or fewer. Methods and tools include simple dilutions to vary concentration, using instrumentation (like a pH meter), and sorting soils by particle size.

Concepts/Quantities Represented in a Complex Graph, Table, or Diagram or Studied in a Complex Investigation

Some concepts are likely to be familiar to high school students who have had rigorous science instruction (but may not be to students lacking this instruction), such as momentum, freezing point depression, and reaction rate (even if only understood qualitatively). Others may be newly introduced but readily understood quantities (e.g., genetic frequency, work). In some cases, the concepts may be unfamiliar to high school students, even those who have had rigorous science instruction, such as heat (enthalpy) of reaction ($\Delta H°$) or torque, or concepts specific to complex scenarios that are fully explained in the text but will be challenging to many high school students. For those concepts, students of all levels will likely need to rely heavily on the explanations and definitions provided.

Type/Nature of a Complex Scientific Graph, Table, or Diagram

Many of the data presentations will be familiar to high school students who have had exposure to rigorous science instruction but challenging to other high school students, such as histograms, Venn diagrams, bar graphs with clusters of four or more bars and a legend, line graphs with several curves and a legend, line graphs with two *y*-axes, and flow diagrams with multiple outcomes. Other data presentations may be unfamiliar to high school students regardless of their exposure to rigorous science instruction, such as phase diagrams, combination bar/line graphs with two *y*-axes, or graphs with logarithmic scales.

Experimental Design and Methods of a Complex Scientific Investigation

Some investigations are likely to be familiar to, or readily understood by, high school students who have had consistent and well-guided opportunities to engage in science investigations (but may not be to students lacking this experience). Examples include investigations having several intricate steps with 5 or more variables that are measured and controlled and investigations that employ methods and tools such as burets, paper chromatography, and simple circuits. Some investigations may be challenging for high school students to follow, regardless of their level of experience engaging in science investigations, such as investigations having several intricate steps and 6 or more variables measured and controlled, with more than one variable being measured simultaneously. These investigations may employ unfamiliar, newly introduced methods and tools.