

Content Area Competency	Performance Indicators
<p>1. Questioning: Students can develop and use relevant scientific questions to investigate a phenomena, test a hypothesis, conduct an experiment or solve a problem.</p>	<ul style="list-style-type: none"> a. Develop questions from observations, phenomena, prior knowledge and data. b. Construct questions to determine cause/effect relationships between variables. c. Ask questions to clarify an explanation, challenge a scientific argument or refine a model or design. d. Evaluate questions based on relevance, usefulness, and specificity.
<p>2. Investigation: Students can design and conduct appropriate scientific investigations.</p>	<ul style="list-style-type: none"> a. Formulate a testable hypothesis for an investigation that demonstrates relationships between variables and connections to scientific concepts. b. Select and use appropriate tools, laboratory equipment and techniques to gather data and make observations. c. Conduct investigations safely and ethically, using appropriate protocols. d. Evaluate and refine experiments and design solutions as needed to improve reliability and relevance.
<p>3. Modeling: Students can construct and use models to represent and analyze phenomena and systems.</p>	<ul style="list-style-type: none"> a. Design and construct scientific models to represent, explain and predict scientific phenomena. b. Design, construct and justify scientific models to represent and predict interactions between natural and designed systems or between components of a system. c. Construct and use multiple types of models to represent similar phenomena or systems. d. Evaluate and refine scientific models.
<p>4. Data Analysis: Students can analyze and interpret scientific data and solve problems using a range of tools, technology and mathematical techniques.</p>	<ul style="list-style-type: none"> a. Demonstrate patterns and relationships in data sets by constructing appropriate representations through technology and graphical displays. b. Compare and contrast various types of data sets to examine consistency of measurement and observations. c. Analyze data in order to make valid and reliable scientific claims and predictions. d. Analyze and interpret data sets by applying concepts of statistics and probability. e. Apply a range of mathematical techniques and computations, including limitations, to make sense and interpret data in real world applications.
<p>5. Explanation & Argumentation: Students can develop, evaluate and critique scientific claims/explanations, arguments and solutions based on evidence from the natural and designed world.</p>	<ul style="list-style-type: none"> a. Construct a scientific claim/explanation that describes phenomena or relationships between variables. b. Assess claims/explanations for issues of credibility, bias, and validity in scientific ideas, data, or results. c. Construct, use and present oral and written arguments supported by a variety of evidence and scientific reasoning to defend or refute scientific claims/explanations. d. Critique and evaluate arguments and rebuttals for a scientific topic based on appropriate criteria. e. Evaluate solutions to complex, real-world problems based on evidence and design criteria.



Content Area: Science

Competency 1: Questioning
 Students can develop and use relevant scientific questions to investigate phenomena, test a hypothesis, conduct an experiment or solve a problem.

Indicator	Exemplary	Competent	Emerging	Novice
<p>1a. Develop questions from observations, phenomena, prior knowledge and data.</p>	<p>I can...</p> <ul style="list-style-type: none"> construct multiple, relevant questions from observing demonstrations, experiments, presentations, and events; construct multiple questions that draw on prior knowledge or complex implications from observable data. 	<p>I can...</p> <ul style="list-style-type: none"> construct relevant questions from observing demonstrations, experiments, presentations, and events; construct accurate questions drawing on prior knowledge or implications from observable data. 	<p>I can...</p> <ul style="list-style-type: none"> formulate questions from observing demonstrations, experiments, presentations, and events; draw on prior knowledge or observable data to formulate questions. 	<p>I can...</p> <ul style="list-style-type: none"> make observations about demonstrations, experiments, presentations, and events; identify prior knowledge or observable data that applies to observations or demonstrations.
<p>1b. Construct questions to determine cause/effect relationships between variables.</p>	<p>I can...</p> <ul style="list-style-type: none"> create and justify a relevant question that accurately determines the the independent and dependent variable, and identify other factors that could be potential independent variables. 	<p>I can...</p> <ul style="list-style-type: none"> construct a relevant question that accurately determines the independent and dependent variable. 	<p>I can...</p> <ul style="list-style-type: none"> construct a question that identifies an independent and dependent variable. 	<p>I can...</p> <ul style="list-style-type: none"> make observations that show relationships between variables.

Competency 1: Questioning (continued) Students can develop and use relevant scientific questions to investigate phenomena, test a hypothesis, conduct an experiment or solve a problem.

Indicator	Exemplary	Competent	Emerging	Novice
1c. Ask questions to clarify an explanation, challenge a scientific argument or refine a model or design.	I can... <ul style="list-style-type: none"> construct multiple and relevant questions that will help clarify explanations, challenge a scientific argument or refine a model or design. 	I can... <ul style="list-style-type: none"> construct relevant questions to clarify an explanation, challenge a scientific argument or refine a model or design. 	I can... <ul style="list-style-type: none"> construct questions that will address discrepancies with evidence in explanations, arguments, or models. 	I can... <ul style="list-style-type: none"> identify discrepancies in explanations, arguments, or models.
1d. Evaluate questions based on relevance, usefulness, and specificity.	I can... <ul style="list-style-type: none"> justify why a question is relevant, useful, and specific enough for investigating a phenomenon, and appropriately revise a question when necessary. 	I can... <ul style="list-style-type: none"> explain why a question is relevant, useful, and specific enough for investigating a phenomenon. 	I can... <ul style="list-style-type: none"> offer suggestions for improving the appropriateness of a question based on its relevance, usefulness, or specificity. 	I can... <ul style="list-style-type: none"> recognize an appropriate question for explaining a phenomenon.



Content Area: Science

Competency 2: Investigation Students can design and conduct appropriate scientific investigations.

Indicator	Exemplary	Competent	Emerging	Novice
<p>2a. Formulate a testable hypothesis for an investigation that demonstrates relationships between variables and connections to scientific concepts.</p>	<p>I can...</p> <ul style="list-style-type: none"> critique and evaluate testable hypotheses that identify independent and dependent variables; incorporate background knowledge to predict the cause and effect relationship between the variables; comprehensively explain how hypotheses relate to or address the scientific concept under investigation. 	<p>I can...</p> <ul style="list-style-type: none"> develop a testable hypothesis that identifies an independent and dependent variable that shows the cause and effect relationship between the variables; explain how the hypothesis relates to or addresses the scientific concept under investigation. 	<p>I can...</p> <ul style="list-style-type: none"> construct a hypothesis with a cause and effect relationship that identifies the independent and dependent variables. 	<p>I can:</p> <ul style="list-style-type: none"> identify a hypothesis, cause, and/or effect.
<p>2b. Select and use appropriate tools, laboratory equipment and techniques to gather data and make observations.</p>	<p>I can...</p> <ul style="list-style-type: none"> make precise selections, and effectively & efficiently use a variety of appropriate tools, sophisticated laboratory equipment & efficient techniques to gather accurate and precise data & make relevant and thorough observations. 	<p>I can...</p> <ul style="list-style-type: none"> make precise selections, and effectively use a variety of appropriate tools, laboratory equipment & techniques to gather accurate data & make relevant observations. 	<p>I can...</p> <ul style="list-style-type: none"> select and use appropriate tools, laboratory equipment & techniques to gather data & make observations. 	<p>I can...</p> <ul style="list-style-type: none"> use appropriate tools, laboratory equipment & basic techniques to gather data & make observations.



Competency 2: Investigation (continued) Students can design and conduct appropriate scientific investigations.				
Indicator	Exemplary	Competent	Emerging	Novice
2c. Conduct investigations safely and ethically, using appropriate protocols.	<p>I can...</p> <ul style="list-style-type: none"> conduct investigations in a safe & ethical manner by; complying with the necessary precautions in using lab equipment and suggesting improvements to lab protocols; applying laboratory rules and explaining why the necessary precautions in using lab equipment are required; gaining necessary permissions to proceed with an experiment and explaining ethical justifications for permissions; minimize environmental, social, and personal impacts of an investigation. 	<p>I can:</p> <ul style="list-style-type: none"> conduct investigations in a safe & ethical manner by; complying with the necessary precautions in using lab equipment; effectively applying laboratory rules; gaining necessary permissions to proceed with an experiment and identifying ethical implications of permissions; minimize harmful environmental, social, and personal impacts of an investigation. 	<p>I can...</p> <ul style="list-style-type: none"> identify the necessary precautions in using lab equipment; apply laboratory rules; gain necessary permissions to proceed with an experiment; identify potential environmental, social, and personal impacts of an investigation. 	<p>I can...</p> <ul style="list-style-type: none"> identify the basic protocols that are needed for safe and ethical investigations; identify some potential environmental, social, and personal impacts of an investigation.
2d. Evaluate and refine experiments and design solutions as needed to improve reliability and relevance.	<p>I can...</p> <ul style="list-style-type: none"> evaluate whether the experiment addressed and/or answered the problem and identify improvements to the design; evaluate the effective precision and/or accuracy of the equipment and investigation for the data collected and suggest improvements for equipment use; design methods or solutions that will significantly improve the reliability, repeatability, or relevance of the experiment. 	<p>I can...</p> <ul style="list-style-type: none"> evaluate whether the experiment addressed and/or answered the problem; evaluate the effective precision and/or accuracy of the equipment and investigation for the data collected; design methods or solutions to improve the reliability, repeatability, or relevance of the experiment. 	<p>I can...</p> <ul style="list-style-type: none"> discuss the relationship between the experiment and the problem; explain how the equipment is used to collect data; suggest possible solutions to improve the reliability or relevance of the experiment. 	<p>I can:</p> <ul style="list-style-type: none"> identify the relationship between the experiment and the problem; identify equipment and explain how the equipment is used; identify problems in the reliability or relevance of the experiment.



Content Area: Science
Competency 3: Modeling Students can construct and use models to represent and analyze phenomena and systems.

Indicator	Exemplary	Competent	Emerging	Novice
<p>3a. Design and construct scientific models to represent, explain and predict scientific phenomena.</p>	<p>I can...</p> <ul style="list-style-type: none"> design and construct comprehensive models that precisely represent scientific phenomena; clearly explain in detail how scientific phenomena work using models; predict outcomes using models and scientific knowledge; justify the reasons for the designed model. 	<p>I can...</p> <ul style="list-style-type: none"> design and construct models that accurately represent scientific phenomena; explain scientific phenomena using a model; predict outcomes using models; justify the reasons for the designed model. 	<p>I can...</p> <ul style="list-style-type: none"> design models that represent aspects of scientific phenomena accurately; explain some aspects of scientific phenomena using a model; answer questions using models. 	<p>I can...</p> <ul style="list-style-type: none"> design a model that represents some components of scientific phenomena; identify components of a scientific phenomena using a model; answer some questions using models.
<p>3b. Design, construct, and justify scientific models to represent, explain and predict interactions between natural and designed systems or between components of a system.</p>	<p>I can...</p> <ul style="list-style-type: none"> design and construct comprehensive models that precisely represent how a system or parts of a system work; clearly explain in detail how a system or components of a system work using a model; predict outcomes using models and scientific knowledge; justify the reasons for the designed model. 	<p>I can...</p> <ul style="list-style-type: none"> design and construct models that accurately represent how a system or parts of a system work; explain how a system or components of a system work using a model; predict outcomes using models; justify the reasons for the designed model. 	<p>I can...</p> <ul style="list-style-type: none"> design models that represent components of a system or part of a system accurately; explain the components of a system using a model; answer questions using models. 	<p>I can...</p> <ul style="list-style-type: none"> design a model of some components of a system; identify components of a system using a model; answer some questions using models.



Competency 3: Modeling (continued) Students can construct and use models to represent and analyze phenomena and systems.				
Indicator	Exemplary	Competent	Emerging	Novice
3c. Construct and use multiple types of models to represent similar phenomena or systems.	<p>I can...</p> <ul style="list-style-type: none"> design and create and utilize multiple mental, visual, mathematical, physical, and computational models that accurately represent similar phenomena, systems and predict outcomes; determine and justify how each can be used to represent concepts from a system or phenomenon based on the model's merits and limitations. 	<p>I can...</p> <ul style="list-style-type: none"> construct and utilize visual, mathematical and physical models that accurately represent similar phenomena, systems and predict outcomes; explain when to use each different model to represent concepts from a system or phenomenon based on the model's merits and limitations. 	<p>I can...</p> <ul style="list-style-type: none"> utilize mental, visual and physical models that accurately represent similar phenomena, systems and predict outcomes; explain how multiple models can be used to represent concepts from a system or phenomenon. 	<p>I can...</p> <ul style="list-style-type: none"> utilize visual and physical models that accurately represent similar phenomena, systems; recognize that multiple models can be used to represent concepts from a system or phenomenon.
3d. Evaluate and refine scientific models.	<p>I can...</p> <ul style="list-style-type: none"> select the most appropriate model from varied options of a system or phenomena; test, determine, and explain the reliability of varied models; critique original model and change model to more accurately represent the system or phenomenon based on evidence or scientific knowledge. 	<p>I can...</p> <ul style="list-style-type: none"> compare and contrast varied models that represent systems or phenomena based on merits and limitations; test and determine reliability of varied models; change model to more accurately represent the system or phenomenon based on evidence or scientific knowledge. 	<p>I can...</p> <ul style="list-style-type: none"> describe merits and limitations of various models that represent systems or phenomena; ask relevant questions to determine reliability of varied models; respond to feedback to adjust model to make it more accurate. 	<p>I can...</p> <ul style="list-style-type: none"> identify merits and limitations of specific models that represent systems or phenomena; ask questions about the quality of models.

Content Area: Science

Competency 4: Data Analysis

Students can analyze and interpret scientific data and solve problems using a range of tools, technology and mathematical techniques.

Indicator	Exemplary	Competent	Emerging	Novice
4a. Demonstrate patterns and relationships in data sets by constructing appropriate representations through technology and graphical displays	<p>I can...</p> <ul style="list-style-type: none"> display data in a variety of appropriate graphical methods or visual representations using titles, labels, units, and an appropriate scale in order to demonstrate the pattern of the data; justify why the graph type chosen is most appropriate. 	<p>I can...</p> <ul style="list-style-type: none"> display data in an appropriate graphical method or visual representation using titles, labels, units, and an appropriate scale in order to demonstrate the pattern of the data. 	<p>I can...</p> <ul style="list-style-type: none"> choose and create the appropriate type of graph or other visual representations to construct based on a data set. 	<p>I can...</p> <ul style="list-style-type: none"> display my data in a graph and other visual representations.
4b. Compare and contrast various types of data sets to examine consistency of measurement and observations.	<p>I can...</p> <ul style="list-style-type: none"> critique various types of data sets to examine consistency of measurement and observations to determine validity. 	<p>I can...</p> <ul style="list-style-type: none"> compare and contrast data sets to examine consistency of measurement and observations. 	<p>I can...</p> <ul style="list-style-type: none"> identify what data is missing from a dataset in order to adequately draw conclusions from it. 	<p>I can...</p> <ul style="list-style-type: none"> identify if a data set doesn't match the expected outcome of the experiment or is inadequate to draw conclusions.
4c. Analyze data in order to make valid and reliable scientific claims and predictions.	<p>I can...</p> <ul style="list-style-type: none"> analyze data in order to independently make valid and reliable scientific claims and predictions supported by the collected evidence; evaluate data to determine relevance, usefulness, and specificity to refine hypothesis and/or synthesize related questions. 	<p>I can...</p> <ul style="list-style-type: none"> analyze data in order to independently make valid and reliable scientific claims and predictions supported by the collected evidence. 	<p>I can...</p> <ul style="list-style-type: none"> match data to the correct conclusion from provided options and use it to make predictions. 	<p>I can...</p> <ul style="list-style-type: none"> match data to the correct conclusion from provided options.

Competency 4: Data Analysis (continued)

Students can analyze and interpret scientific data and solve problems using a range of tools, technology and mathematical techniques.

Indicator	Exemplary	Competent	Emerging	Novice
4d. Analyze and interpret data sets by applying concepts of statistics and probability.	I can... <ul style="list-style-type: none"> determine which statistical approach is most appropriate for data analysis and perform the necessary calculations for statistics and probability, including function fits and reliability measures; analyze and interpret the results; recognize limitations of analysis; recommend how to improve the data set or suggest other analyses that should be done. 	I can... <ul style="list-style-type: none"> determine which statistical approach is most appropriate for data analysis and perform the necessary calculations for statistics and probability, including determining function fits to data; analyze and interpret the results. 	I can... <ul style="list-style-type: none"> determine which statistical approach is most appropriate for data analysis and perform the necessary calculations for statistics and probability including measures of variability. 	I can... <ul style="list-style-type: none"> perform the necessary calculations for statistics and probability including mean, median, and mode.
4e. Apply a range of mathematical techniques and computations, including limitations, to make sense and interpret data in real-world applications.	I can... <ul style="list-style-type: none"> apply a wide range of mathematical techniques, algorithms, and algebraic computations, thinking, and analysis including limitations, to predict potential results and determine which techniques are the most likely to produce valid and reliable results. 	I can... <ul style="list-style-type: none"> apply a range of mathematical techniques, algorithms and algebraic computations, including limitations, to make sense and interpret data in real-world applications. 	I can... <ul style="list-style-type: none"> recognize and correctly use simple mathematical techniques, algorithms and computations to make sense and interpret data in real-world applications. 	I can... <ul style="list-style-type: none"> recognize which mathematical techniques are relevant to making sense of, and interpreting, data sets.

Content Area: Science

Competency 5: Explanation & Argumentation Students can develop, evaluate and critique scientific claims/explanations, arguments and solutions based on evidence from the natural and designed world.

Indicator	Exemplary	Competent	Emerging	Novice
5a. Construct a scientific claim/explanation that describes phenomena or relationships between variables.	I can... <ul style="list-style-type: none"> construct a relevant conclusion about a scientific concept or principle, based on credible data or information, that predicts results for similar phenomena and accounts for exceptions or nuance; apply scientific concepts to explain, in detail, something that happens, accounting for exceptions or nuance; explain the relationship between variables using credible data and relevant scientific information. 	I can... <ul style="list-style-type: none"> construct a relevant conclusion about a scientific concept or principle based on credible data; apply scientific concepts to explain something that happens; state the relationship between variables based on credible data. 	I can... <ul style="list-style-type: none"> make a relevant statement about a scientific concept or principle based on data; match the relevant scientific concepts to something that happens; identify which variable affects another. 	I can... <ul style="list-style-type: none"> make a statement about a scientific concept or principle; list scientific concepts that may apply; identify the variables involved.
5b. Assess claims/explanations for issues of credibility, bias, and validity in scientific ideas, data, or results.	I can... <ul style="list-style-type: none"> choose valid claims/explanations and data and combine them to create a complete explanation of phenomena and results; explain which components of claims/explanations or data are biased and assess how the bias could be removed or mitigated. 	I can... <ul style="list-style-type: none"> determine which components of scientific claims/explanations and data are credible and valid and explain why; explain which components of claims/explanations or data are biased and why. 	I can: <ul style="list-style-type: none"> identify components of claims/explanations and data that are credible and valid; identify biased claims/explanations or data. 	I can: <ul style="list-style-type: none"> make claims about the credibility and validity of claims/explanations and data; list claims/explanations that could be biased.

Competency 5: Explanation & Argumentation (continued)

Students can develop, evaluate and critique scientific claims/explanations, arguments and solutions based on evidence from the natural and designed world.

Indicator	Exemplary	Competent	Emerging	Novice
5c. Construct, use and present oral and written arguments supported by a variety of evidence and scientific reasoning to defend or refute scientific claims/explanations.	<p>I can...</p> <ul style="list-style-type: none"> synthesize relevant evidence from multiple reliable sources to construct an accurate, thorough, and persuasive scientific argument or refutation of a scientific claim that allows for making predictions or recommendations; communicate and defend (orally, in writing, and through discussion) a central idea and how relevant evidence supports the argument; includes multiple presentations methods, such as tables, diagrams, graphs, models, and equations; determine and justify the validity of a scientific claim based on evidence from several relevant sources. 	<p>I can...</p> <ul style="list-style-type: none"> evaluate and combine relevant evidence from multiple reliable sources to construct an accurate scientific argument or refute a scientific claim; communicate, orally and in writing, a central idea and how relevant evidence supports the argument; determine the validity of a scientific claim based on evidence from several relevant sources. 	<p>I can...</p> <ul style="list-style-type: none"> select details or evidence from multiple sources that connect to a central idea; communicate a central idea and how supporting evidence is related to the scientific argument; determine the validity of a scientific claim based on evidence. 	<p>I can...</p> <ul style="list-style-type: none"> develop a central idea to argue; Include examples to support the argument; state ideas and claims related to the argument; identify whether a claim is scientifically valid or not.
5d. Critique and evaluate arguments and rebuttals for a scientific topic based on appropriate criteria.	<p>I can...</p> <ul style="list-style-type: none"> synthesize arguments and counterarguments using validity, data, information, reasoning, and/or other evidence in order to articulate a new perspective. 	<p>I can...</p> <ul style="list-style-type: none"> critique an argument or counterargument using validity, data, information, reasoning, and/or other evidence. 	<p>I can...</p> <ul style="list-style-type: none"> determine validity of a scientific argument or counterargument based on data, information, and/or reasoning. 	<p>I can...</p> <ul style="list-style-type: none"> agree or disagree with a scientific argument or counterargument and provide a reason.



Competency 5: Explanation & Argumentation (continued)

Students can develop, evaluate and critique scientific claims/explanations, arguments and solutions based on evidence from the natural and designed world.

Indicator	Exemplary	Competent	Emerging	Novice
<p>5e. Evaluate solutions to complex, real-world problems based on evidence and design criteria.</p>	<p>I can...</p> <ul style="list-style-type: none"> • use evidence to explain how specific parts of a solution solve specific aspects of the problem and meet the design criteria; • use evidence to make, and justify, multiple adjustments to a solution to address specific design criteria and optimize the solution. 	<p>I can...</p> <ul style="list-style-type: none"> • use evidence to explain how a solution solves the problem and meets the design criteria; • use evidence to refine a solution several times to meet more design criteria, or adjust the solution for a better fix to the problem . 	<p>I can...</p> <ul style="list-style-type: none"> • explain how a solution solves the problem and meets the design criteria; • use direct feedback to adjust my solution to meet more criteria and better solve the problem. 	<p>I can...</p> <ul style="list-style-type: none"> • identify strengths and problems with my solution; • adjust my solution.