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| **Asking questions (for science) and defining problems (for engineering)** A basic practice of the *scientist* is the ability toformulate empirically answerable questions aboutphenomena to establish what is already know, andto determine what questions have yet to besatisfactorily answered. *Engineering* begins with a problem that needs to besolved, such as “How can we reduce the nation’sdependence on fossil fuels?” or “What can be doneto reduce a particular disease?” or “How can weimprove the fuel efficiency of automobiles?” | **Developing and using models***Science* often involves the construction and use ofmodels and simulations to help developexplanations about natural phenomena.*Engineering* makes use of models and simulationsto analyze systems to identify flaws that might occuror to test possible solutions to a new problem. |
| **Planning and carrying out investigations**A major practice of *scientists* is planning andcarrying out systematic scientific investigations that require identifying variables and clarifying what counts as data.*Engineering* investigations are conducted to gaindata essential for specifying criteria or parametersand to test proposed designs. | **Analyzing and interpreting data**Scientific investigations produce data that must beanalyzed to derive meaning. *Scientists* use a rangeof tools to identify significant features and patterns in the data.*Engineering* investigations include analyses of datacollected in the tests of designs. This allowscomparison of different solutions and determineshow well each meets specific design criteria. |
| **Using mathematics and computational thinking**In *science*, mathematics and computation arefundamental tools for representing physical variables and their relationships.In *engineering*, mathematical and computationalrepresentations of established relationships andprinciples are an integral part of the designprocess. | **Constructing explanations (for science) and designing solutions (for engineering)**The goal of *science* is the construction of theoriesthat provide explanatory accounts of the materialworld.The goal of *engineering* design is a systematicapproach to solving engineering problems that isbased on scientific knowledge and models of thematerial world. |
| **Engaging in argument from evidence**In *science*, reasoning and argument are essential forclarifying strengths and weaknesses of a line ofevidence and for identifying the best explanation for a natural phenomenon.In *engineering*, reasoning and arguments areessential for finding the best solution to a problem.Engineers collaborate with their peers throughoutthe design process. | **Obtaining, evaluating, and communicating information***Science* cannot advance if scientists are unstable tocommunicate their findings clearly and persuasively or learn about the findings of others.*Engineering* cannot produce new or improvedtechnologies if the advantages of their designs arenot communicated clearly and persuasively. |

**Elementary School (Preschool-5)**

Kindergarten

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| **Planning and Carrying Out Investigations** With guidance, plan and conduct an investigation in collaboration with peers. (K-PS2-1)  | **Analyzing and Interpreting Data** Analyze data from tests of an object or tool to determine if it works as intended. (K-PS2-2)  |
| **Planning and Carrying Out Investigations** Make observations (firsthand or from media) to collect data that can be used to make comparisons. (K-PS3-1)  | **Constructing Explanations and Designing Solutions** Use tools and materials provided to design and build a device that solves a specific problem or a solution to a specific problem (K-PS3-2) |
| **Analyzing and Interpreting Data** Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (K-LS1-1) (K-ESS2-1) | **Obtaining, Evaluating, and Communicating Information** Communicate solutions with others in oral and/or written forms using models and/or drawings that provide detail about scientific ideas. (K-ESS3-3) |
| **Engaging in Argument from Evidence** Construct an argument with evidence to support a claim. (K-ESS2-2)  | **Asking Questions and Defining Problems** Ask questions based on observations to find more information about the designed world. (K-ESS3-2)  |

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| **Developing and Using Models** Use a model to represent relationships in the natural world. (K-ESS3-1)  | **Obtaining, Evaluating, and Communicating Information** Read grade-appropriate texts and/or use media to obtain scientific information to describe patterns in the natural world. (K-ESS3-2)  |

1st Grade

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| **Planning and Carrying Out Investigations** Plan and conduct investigations collaboratively to produce data to serve as the basis for evidence to answer a question. (1-PS4-1),(1-PS4-3)  | **Constructing Explanations and Designing Solutions** Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (1-PS4-2)  |
| **Constructing Explanations and Designing Solutions** Use tools and materials provided to design a device that solves a specific problem. (1-PS4-4)  | **Constructing Explanations and Designing Solutions** Use materials to design a device that solves a specific problem or a solution to a specific problem. (1-LS1-1)  |
| **Obtaining, Evaluating, and Communicating Information** Read grade-appropriate texts and use media to obtain scientific information to determine patterns in the natural world. (1-LS1-2)  | **Constructing Explanations and Designing Solutions** Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (1-LS3-1)  |
| **Planning and Carrying Out Investigations** Make observations (firsthand or from media) to collect data that can be used to make comparisons. (1-ESS1-2)  | **Analyzing and Interpreting Data** Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (1-ESS1-1)  |

2nd Grade

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| **Planning and Carrying Out Investigations** Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. (2-PS1-1) (2-LS2-1) | **Analyzing and Interpreting Data** Analyze data from tests of an object or tool to determine if it works as intended. (2-PS1-2)  |
| **Constructing Explanations and Designing Solutions** Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (2-PS1-3)  | **Engaging in Argument from Evidence** Construct an argument with evidence to support a claim. (2-PS1-4)  |
| **Developing and Using Models** Develop a simple model based on evidence to represent a proposed object or tool. (2-LS2-2)  | **Obtaining, Evaluating, and Communicating Information** Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question. (2-ESS2-3)  |
| **Planning and Carrying Out Investigations** Make observations (firsthand or from media) to collect data which can be used to make comparisons. (2-LS4-1)  | **Constructing Explanations and Designing Solutions** Make observations from several sources to construct an evidence-based account for natural phenomena. (2-ESS1-1)  |

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| **Developing and Using Models** Develop a model to represent patterns in the natural world. (2-ESS2-2)  | **Constructing Explanations and Designing Solutions** Compare multiple solutions to a problem. (2-ESS2-1)  |
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3rd Grade

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| **Asking Questions and Defining Problems** Ask questions that can be investigated based on patterns such as cause and effect relationships. (3-PS2-3)  | **Asking Questions and Defining Problems** Define a simple problem that can be solved through the development of a new or improved object or tool. (3-PS2-4)  |
| **Planning and Carrying Out Investigations** Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-PS2-1)  | **Planning and Carrying Out Investigations** Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (3-PS2-2)  |
| **Developing and Using Models** Develop models to describe phenomena. (3-LS1-1)  | **Engaging in Argument from Evidence** Construct an argument with evidence, data, and/or a model. (3-LS2-1)  |
| **Analyzing and Interpreting Data** Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS3-1)  | **Constructing Explanations and Designing Solutions** Use evidence (e.g., observations, patterns) to support an explanation. (3-LS3-2)  |

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| **Analyzing and Interpreting Data** Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS4-1)  | **Constructing Explanations and Designing Solutions** Use evidence (e.g., observations, patterns) to construct an explanation. (3-LS4-2)  |
| **Engaging in Argument from Evidence** Construct an argument with evidence. (3-LS4-3)  | **Engaging in Argument from Evidence** Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-LS4-4)  |
| **Analyzing and Interpreting Data** Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1)  | **Obtaining, Evaluating, and Communicating Information** Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)  |
| **Engaging in Argument from Evidence** Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-ESS3-1)  |  |

4th Grade

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| **Asking Questions and Defining Problems** Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. (4-PS3-3)  | **Planning and Carrying Out Investigations** Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (4-PS3-2)  |
| **Constructing Explanations and Designing Solutions** Use evidence (e.g., measurements, observations, patterns) to construct an explanation. (4-PS3-1)  | **Constructing Explanations and Designing Solutions** Apply scientific ideas to solve design problems. (4-PS3-4)  |
| **Developing and Using Models** Develop a model using an analogy, example, or abstract representation to describe a scientific principle. (4-PS4-1)  | **Developing and Using Models** Develop a model to describe phenomena. (4-PS4-2)  |
| **Constructing Explanations and Designing Solutions** Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4-PS4-3)  | **Developing and Using Models** Use a model to test interactions concerning the functioning of a natural system. (4-LS1-2)  |

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| **Engaging in Argument from Evidence** Construct an argument with evidence, data, and/or a model. (4-LS1-1)  | **Constructing Explanations and Designing Solutions** Identify the evidence that supports particular points in an explanation. (4-ESS1-1)  |
| **Planning and Carrying Out Investigations** Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (4-ESS2-1)  | **Analyzing and Interpreting Data** Analyze and interpret data to make sense of phenomena using logical reasoning. (4-ESS2-2)  |
| **Constructing Explanations and Designing Solutions** Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4-ESS3-2)  | **Obtaining, Evaluating, and Communicating Information** Obtain and combine information from books and other reliable media to explain phenomena. (4-ESS3-1)  |
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5th Grade

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| **Developing and Using Models** Develop a model to describe phenomena. (5-PS1-1)  | **Planning and Carrying Out Investigations** Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (5-PS1-4)  |
| **Planning and Carrying Out Investigations** Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (5-PS1-3)  | **Using Mathematics and Computational Thinking** Measure and graph quantities such as weight to address scientific and engineering questions and problems. (5-PS1-2)  |
| **Engaging in Argument from Evidence** Support an argument with evidence, data, or a model. (5-PS2-1)  | **Developing and Using Models** Use models to describe phenomena. (5-PS3-1)  |
| **Engaging in Argument from Evidence** Support an argument with evidence, data, or a model. (5-LS1-1)  | **Developing and Using Models** Develop a model to describe phenomena. (5-LS2-1)  |

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| **Analyzing and Interpreting Data** Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. (5-ESS1-2)  | **Engaging in Argument from Evidence** Support an argument with evidence, data, or a model. (5-ESS1-1)  |
| **Developing and Using Models** Develop a model using an example to describe a scientific principle. (5-ESS2-1)  | **Using Mathematics and Computational Thinking** Describe and graph quantities such as area and volume to address scientific questions. (5-ESS2-2)  |
| **Obtaining, Evaluating, and Communicating Information** Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. (5-ESS3-1)  |  |
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Grade 3-5 Engineering & Technology SEPs

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| **Asking Questions and Defining Problems** Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)  | **Planning and Carrying Out Investigations** Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-5-ETS1-3)  |
| **Constructing Explanations and Designing Solutions** Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5-ETS1-2)  |  |
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**Middle School Physical Science**

**Science & Engineering Practices**

**MS-PS1**

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| **Developing and Using Models**Develop a model to predict and/or describe phenomena. (MS-PS1-1),(MS-PS1-4)  | **Developing and Using Models**Develop a model to describe unobservable mechanisms. (MS-PS1-5) |
|  **Analyzing and Interpreting Data**Analyze and interpret data to determine similarities and differences in findings. (MS-PS1-2) | **Constructing Explanations and Designing Solutions** Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. (MS-PS1-6) |
| **Obtaining, Evaluating, and Communicating Information** Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-PS1-3)  |  |

**MS-PS2**

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| **Asking Questions and Defining Problems** Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. (MS-PS2-3) | **Planning and Carrying Out Investigations** Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. (MS-PS2-2)  |
| **Planning and Carrying Out Investigations** Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation. (MS-PS2-5)  | **Constructing Explanations and Designing Solutions** Apply scientific ideas or principles to design an object, tool, process or system. (MS-PS2-1)  |
| **Engaging in Argument from Evidence** Construct and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-PS2-4) |  |

**MS-PS3**

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| **Developing and Using Models** Develop a model to describe unobservable mechanisms. (MS-PS3-2) | **Planning and Carrying Out Investigations** Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. (MS-PS3-4) |
| **Analyzing and Interpreting Data** Construct and interpret graphical displays of data to identify linear and nonlinear relationships. (MS-PS3-1) | **Constructing Explanations and Designing Solutions** Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process or system. (MS-PS3-3) |
| **Engaging in Argument from Evidence** Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or explanation or a model for a phenomenon. (MS-PS3-5)  |  |

**MS-PS4**

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| **Developing and Using Models** Develop and use a model to describe phenomena. (MS-PS4-2) | **Using Mathematics and Computational Thinking** Use mathematical representations to describe and/or support scientific conclusions and design solutions. (MS-PS4-1) |
| **Obtaining, Evaluating, and Communicating Information** Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings. (MS-PS4-3) |  |

**Middle School Life Science**

**MS-LS1**

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| **Developing and Using Models** Develop and use a model to describe phenomena. (MS-LS1-2)  | **Developing and Using Models** Develop a model to describe unobservable mechanisms. (MS-LS1-7) |
| **Planning and Carrying Out Investigations**Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. (MS-LS1-1) | **Constructing Explanations and Designing Solutions**Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students’ own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-LS1-5),(MS-LS1-6) |
| **Engaging in Argument from Evidence**Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon. (MS-LS1-3) | **Engaging in Argument from Evidence**Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS1-4) |
| **Obtaining, Evaluating, and Communicating Information** Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-LS1-8) |  |

**MS-LS2**

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| **Developing and Using Models**Develop a model to describe phenomena. (MS-LS2-3) | **Analyzing and Interpreting Data**Analyze and interpret data to provide evidence for phenomena. (MS-LS2-1) |
| **Constructing Explanations and Designing Solutions**Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. (MS-LS2-2) | **Engaging in Argument from Evidence**Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS2-4) |
| **Engaging in Argument from Evidence**Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-LS2-5) |  |

**MS-LS3**

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| **Developing and Using Models**Develop and use a model to describe phenomena. (MS-LS3-1),(MS-LS3-2) |  |

**MS-LS4**

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| **Analyzing and Interpreting Data**Analyze displays of data to identify linear and nonlinear relationships. (MS-LS4-3) | **Analyzing and Interpreting Data**Analyze and interpret data to determine similarities and differences in findings. (MS-LS4-1) |
| **Using Mathematics and Computational Thinking**Use mathematical representations to support scientific conclusions and design solutions. (MS-LS4-6) | **Constructing Explanations and Designing Solutions**Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events. (MS-LS4-2) |
| **Constructing Explanations and Designing Solutions**Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena. (MS-LS4-4) | **Obtaining, Evaluating, and Communicating Information**Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-LS4-5) |

**Middle School Earth & Space Science**

**MS-ESS1**

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| **Developing and Using Models** Develop and use a model to describe phenomena. (MS-ESS1-1),(MS-ESS1-2) | **Analyzing and Interpreting Data**Analyze and interpret data to determine similarities and differences in findings. (MS-ESS1-3) |
| **Constructing Explanations and Designing Solutions**Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students’ own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-ESS1-4) |  |

**MS-ESS2**

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| **Developing and Using Models**Develop and use a model to describe phenomena. (MS-ESS2-1),(MS-ESS2-6) | **Developing and Using Models**Develop a model to describe unobservable mechanisms. (MS-ESS2-4) |
| **Planning and Carrying Out Investigations**Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. (MS-ESS2-5) | **Analyzing and Interpreting Data**Analyze and interpret data to provide evidence for phenomena. (MS-ESS2-3) |
| **Constructing Explanations and Designing Solutions**Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students’ own experiments) and the assumption that theories and laws that describe nature operate today as they did in the past and will continue to do so in the future. (MS-ESS2-2) |  |

**MS-ESS3**

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| **Asking Questions and Defining Problems** Ask questions to identify and clarify evidence of an argument. (MS-ESS3-5) | **Analyzing and Interpreting Data**Analyze and interpret data to determine similarities and differences in findings. (MS-ESS3-2)  |
| **Constructing Explanations and Designing Solutions** Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students’ own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-ESS3-1) | **Constructing Explanations and Designing Solutions** Apply scientific principles to design an object, tool, process or system. (MS-ESS3-3) |
| **Engaging in Argument from Evidence**Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-ESS3-4) |  |

**MS-ETS1**

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| **Asking Questions and Defining Problems** Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1) | **Developing and Using Models** Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MS-ETS1-4) |
| **Analyzing and Interpreting Data** Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3) | **Engaging in Argument from Evidence** Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2) |

**HS-PS1**

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| **Developing and Using Models** Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4),(HS-PS1-8) | **Developing and Using Models** Use a model to predict the relationships between systems or between components of a system. (HS-PS1-1) |
| **Planning and Carrying Out Investigations** Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-PS1-3) | **Using Mathematics and Computational Thinking** Use mathematical representations of phenomena to support claims. (HS-PS1-7)  |
| **Constructing Explanations and Designing Solutions** Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5)  | **Constructing Explanations and Designing Solutions** Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2) |
| **Constructing Explanations and Designing Solutions** Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS1-6)  |  |

HS-PS2

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| **Planning and Carrying Out Investigations** Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-PS2-5) | **Analyzing and Interpreting Data** Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. (HS-PS2-1) |
| **Using Mathematics and Computational Thinking** Use mathematical representations of phenomena to describe explanations. (HS-PS2-2),(HS-PS2-4) | **Constructing Explanations and Designing Solutions** Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects. (HS-PS2-3) |
| **Obtaining, Evaluating, and Communicating Information** Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-PS2-6) |  |

HS-PS3

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| **Developing and Using Models** Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS3-2),(HS-PS3-5)  | **Planning and Carrying Out Investigations** Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-PS3-4)  |
| **Using Mathematics and Computational Thinking** Create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-PS3-1)  | **Constructing Explanations and Designing Solutions** Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS3-3)  |

HS-PS4

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| **Asking Questions and Defining Problems** Evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design. (HS-PS4-2) | **Using Mathematics and Computational Thinking** Use mathematical representations of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-PS4-1) |
| **Engaging in Argument from Evidence** Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments. (HS-PS4-3) | **Obtaining, Evaluating, and Communicating Information** Evaluate the validity and reliability of multiple claims that appear in scientific and technical texts or media reports, verifying the data when possible. (HS-PS4-4) |
| **Obtaining, Evaluating, and Communicating Information** Communicate technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-PS4-5) |  |

**HS-LS1**

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| **Developing and Using Models** Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2) | **Developing and Using Models** Use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-4),(HS-LS1-5),(HS-LS1-7) |
| **Planning and Carrying Out Investigations** Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-LS1-3)  | **Constructing Explanations and Designing Solutions** Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS1-1)  |
| **Constructing Explanations and Designing Solutions**Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS1-6) |  |

HS-LS2

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| **Developing and Using Models** Develop a model based on evidence to illustrate the relationships between systems or components of a system. (HS-LS2-5)  | **Using Mathematics and Computational Thinking** Use mathematical and/or computational representations of phenomena or design solutions to support explanations. (HS-LS2-1) |
| **Using Mathematics and Computational Thinking** Use mathematical representations of phenomena or design solutions to support and revise explanations. (HS-LS2-2) | **Using Mathematics and Computational Thinking** Use mathematical representations of phenomena or design solutions to support claims. (HS-LS2-4) |
| **Constructing Explanations and Designing Solutions** Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS2-3)  | **Constructing Explanations and Designing Solutions** Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-LS2-7)  |
| **Engaging in Argument from Evidence** Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS2-6)  | **Engaging in Argument from Evidence** Evaluate the evidence behind currently accepted explanations to determine the merits of arguments. (HS-LS2-8)  |

HS-LS3

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| **Asking Questions and Defining Problems** Ask questions that arise from examining models or a theory to clarify relationships. (HS-LS3-1)  | **Analyzing and Interpreting Data** Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible. (HS-LS3-3)  |
| **Engaging in Argument from Evidence** Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence. (HS-LS3-2)  |  |

HS-LS4

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| **Analyzing and Interpreting Data** Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible. (HS-LS4-3)  | **Using Mathematics and Computational Thinking** Create or revise a simulation of a phenomenon, designed device, process, or system. (HS-LS4-6)  |
| **Constructing Explanations and Designing Solutions** Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS4-2),(HS-LS4-4) | **Engaging in Argument from Evidence** Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS4-5)  |
| **Obtaining, Evaluating, and Communicating Information** Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-LS4-1)  |  |

High School Earth & Space Science

**HS-ESS1**

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| **Developing and Using Models** Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-ESS1-1) | **Using Mathematical and Computational Thinking** Use mathematical or computational representations of phenomena to describe explanations. (HS-ESS1-4)  |
| **Constructing Explanations and Designing Solutions** Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS1-2) | **Constructing Explanations and Designing Solutions** Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion. (HS-ESS1-6) |
| **Engaging in Argument from Evidence** Evaluate evidence behind currently accepted explanations or solutions to determine the merits of arguments. (HS-ESS1-5)  | **Obtaining, Evaluating, and Communicating Information** Communicate scientific ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-ESS1-3)  |

HS-ESS2

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| **Developing and Using Models** Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-ESS2-1),(HS-ESS2-3),(HS-ESS2-6) | **Developing and Using Models** Use a model to provide mechanistic accounts of phenomena. (HS-ESS2-4) |
| **Planning and Carrying Out Investigations** Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-ESS2-5)  | **Analyzing and Interpreting Data** Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. (HS-ESS2-2)  |
| **Engaging in Argument from Evidence** Construct an oral and written argument or counter-arguments based on data and evidence. (HS-ESS2-7)  |  |

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HS-ESS3

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| **Analyzing and Interpreting Data** Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-5) | **Using Mathematics and Computational Thinking** Create a computational model or simulation of a phenomenon, designed device, process, or system. (HS-ESS3-3) |
| **Using Mathematics and Computational Thinking** Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)  | **Constructing Explanations and Designing Solutions** Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-ESS3-1)  |
| **Constructing Explanations and Designing Solutions** Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4) | **Engaging in Argument from Evidence** Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). (HS-ESS3-2)  |

HS-ETS1

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| **Asking Questions and Defining Problems** Analyze complex real-world problems by specifying criteria and constraints for successful solutions. (HS-ETS1-1)  | **Using Mathematics and Computational Thinking** Use mathematical models and/or computer simulations to predict the effects of a design solution on systems and/or the interactions between systems. (HS-ETS1-4)  |
| **Constructing Explanations and Designing Solutions** Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-2)  | **Constructing Explanations and Designing Solutions** Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-3)  |