New York State Testing Program
P-12 Science Learning Standards
Performance Level Descriptions
Physical Science: Physics
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THE STATE EDUCATION DEPARTMENT / THE UNIVERSITY OF THE STATE OF NEW YORK / ALBANY, NY 12234

Physical Science: Physics Performance Level Descriptions

Performance level descriptions (PLDs) help communicate to students, families, educators, and the public the specific knowledge and skills expected of students in order for them to demonstrate proficiency in each Learning Standard for Science. The PLDs serve several purposes in classroom instruction and assessment. They are the foundation of rich discussion around what students need to do to perform at higher levels, and they explain the progression of learning within a subject area. PLDs are also crucial in explaining student performance on the New York State (NYS) assessments since they make a connection between the scale score, the performance level (e.g., meets the expectation of the learning standards), and specific knowledge and skills typically demonstrated by students achieving at that level.

Policy Definitions of Performance Levels

For each subject area, students perform along a continuum of the knowledge and skills necessary to meet the demands of the Learning Standards for Science. There are students who meet the expectations of the standards with distinction, students who fully meet the expectations, students who minimally meet the expectations, students who partially meet the expectations, and students who do not demonstrate sufficient knowledge or skills required for any performance level. New York State assessments are designed to classify student performance into one of five levels based on the knowledge and skills the student has demonstrated. These performance levels for the Regents level science test are defined as:

NYS Level 5

Students performing at this level meet the expectations of the Science Learning Standards with distinction for Physical Science: Physics.

NYS Level 4

Students performing at this level fully meet the expectations of the Science Learning Standards for Physical Science: Physics. They are likely prepared to succeed in the next level of coursework.

NYS Level 3

Students performing at this level minimally meet the expectations of the Science Learning Standards for Physical Science: Physics. They meet the content area requirements for a Regents diploma but may need additional support to succeed in the next level of coursework.

NYS Level 2

Students performing at this level partially meet the expectations of the Science Learning Standards for Physical Science: Physics. Students with disabilities performing at this level meet the content area requirements for a local diploma but may need additional support to succeed in the next level of coursework.

NYS Level 1

Students performing at this level demonstrate knowledge, skills, and practices embodied by the Science Learning Standards for Physical Science: Physics below that of a Level 2.

How were the PLDs developed?

Following research-based best practice for the development of PLDs, the number of performance levels and their definitions were specified prior to the articulation of the full descriptions. The New York State Education Department (NYSED) convened a group of NYS science educators to develop the initial draft PLDs for Physical Science: Physics. In developing PLDs, participants considered policy definitions of the performance levels and the knowledge and skill expectations for each grade level in the Science Learning Standards. Once they established the appropriate knowledge and skills from a particular standard for NYS Level 4 (fully meet), panelists worked together to parse the knowledge and skills across the other performance levels in such a way that the progression of the knowledge and skills was clearly seen moving from Level 1 to Level 5. This process was repeated for all of the standards within the course. The draft PLDs then went through additional rounds of review and edits from a number of NYS-certified educators, content specialists, and assessment experts under NYSED supervision.

How can the PLDs be used in Instruction?

The PLDs, which differentiate and stratify the overall continuum of knowledge and skills defined by the Learning Standards into five distinct levels of learning, should be used as guidance by educators. NYSED encourages the use of the PLDs for a variety of purposes, including differentiating instruction to maximize individual student outcomes, creating formative classroom assessments and rubrics to help identify target performance levels for individuals or groups of students, and tracking student growth along the proficiency continuum as described by the PLDs. The knowledge and skills shown in the PLDs describe *typical* performance and progression. However, the order in which students will demonstrate the knowledge and skills within and between performance levels may be staggered (i.e., a student who predominantly demonstrates Level 3 knowledge and skills may simultaneously demonstrate certain knowledge and skills indicative of Level 4). Although the ranges of skills expected of students at each performance level are detailed in the PLDs, specific science concepts will be elaborated and expanded as those skills are applied in the science classroom. Because the Learning Standards for science encompass the Science and Engineering Practices (SEP), Disciplinary Core Ideas (DCI), and Crosscutting Concepts (CCC), each of them must be examined in depth. The integration of these three dimensions provides students with a context for the content of science, a sense of how science knowledge is acquired and understood, and a sense of how the sciences are connected through concepts that have universal meaning across the disciplines.

How are the PLDs used in Assessment?

PLDs are essential in setting performance standards (i.e., "cut scores") for New York State assessments. Standard setting panelists use PLDs to determine the expectations for students to demonstrate the knowledge and skills necessary to *just barely* attain a Level 2, Level 3, Level 4, or Level 5 on the assessment. This knowledge and these skills drive discussions that influence the panelists as they recommend the cut scores on the assessment. PLDs are also used in question development. Question writers are assigned to write questions that draw on the specific knowledge and skills from a PLD. This ensures that each test has questions that measure student performance all along the continuum. Questions on the Science Regents Examinations will emphasize skills from the PLDs that can be measured via written assessment. Teachers can use the PLDs in the same manner when developing both formative and summative classroom assessments. Tasks that require students to demonstrate knowledge and skills from the PLDs can be tied back to the performance level with which the PLD is associated, providing the teacher with feedback about the students' progress as well as a wealth of other skills that the students are likely able to demonstrate (or can aspire to in the case of the next-highest PLD).

Topic and PE	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
Structure and Properties of Matter **HS-PS1-8**	Develop and use models to demonstrate the scale of energy released during nuclear processes including fission, fusion, and radioactive decay.	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.	Complete a model that demonstrates the release of energy during fission, and/or fusion, and/or radioactive decay, **or** use model(s), data, and/or information to compare the scale of energy released during a nuclear process to other kinds of energy transformations.	Given a model or data, explain why energy is released during a nuclear process, **or** given a model or data, relate the difference in nuclear mass to the energy released (binding energy) in a nuclear process.	Given a model or data, identify, from the choices provided, evidence to support that energy is released during a nuclear process.

Topic and PE	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
Forces and Interactions **HS-PS2-1**	Plan and conduct an investigation to support a claim that describes the mathematical relationships among the net force on a macroscopic object, its mass, and its acceleration, and make predictions using the results of the investigation by applying Newton's Laws of Motion.	Analyze data to support the claim that Newton's Second Law of Motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.	Analyze and/or interpret data for an object acted upon by unbalanced force(s) by applying the mathematical relationships described in Newton's Laws of Motion to determine the net force acting on the object, the mass, or the acceleration of the object, **or** analyze and/or interpret data for an object acted upon by unbalanced force(s) using mathematical representations (kinematics) to determine quantities describing motion (with or without direction) including the acceleration, velocity, displacement of a macroscopic object, or time that the unbalanced force(s) act(s) on a macroscopic object.	Analyze and/or interpret data for an object acted upon by balanced forces by applying the mathematical relationships described in Newton's Laws of Motion to quantify the force(s) acting on a macroscopic object, or determine the net force acting on the object, the mass, or acceleration of the object, **or** analyze and/or interpret data for an object acted upon by balanced forces using mathematical representations (kinematics) to determine quantities describing motion (with or without direction) including the acceleration, velocity, displacement of a macroscopic object, or time that the balanced forces act on a macroscopic object.	Identify the data or information that supports the claim that Newton's Second Law of Motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and/or its acceleration, **or** identify the data or information that supports a prediction or explanation of a macroscopic object's motion for an object acted upon by balanced or unbalanced force(s).

Topic and PE	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
Forces and Interactions **HS-PS2-2**	Collect and analyze data and use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.	Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.	Given data and/or a model, use a mathematical representation for the conservation of momentum to determine the mass and/or velocity of an object before or after an interaction between two objects when there is no net force on the system.	Given data and/or a model, use a mathematical representation to determine the total momentum, with or without direction, of a system of objects before or after an interaction when there is no net force on the system.	Given data and/or a model, use a mathematical representation for momentum to identify the mass, or the momentum (with or without direction), or the velocity/speed of an object.
Forces and Interactions **HS-PS2-3**	Apply scientific and engineering ideas to design and build a device that minimizes the force on a macroscopic object during a collision and analyze the forces acting on the object during the collision, and use this analysis to refine the device to further minimize the force of impact during the collision.	Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.	Apply scientific and engineering ideas to design a device that reduces the force on a macroscopic object during a collision and explain how this device reduces the force, **<u>or</u>** given the design of a device that minimizes the force on a macroscopic object, apply scientific and engineering ideas to describe how this device can be refined to reduce this force, **<u>or</u>** given data for a mechanism designed to minimize the force on a macroscopic object, evaluate the effectiveness of the mechanism based upon given constraints.	Use an algebraic representation to describe how a given device affects the force, time, change in momentum, and/or change in velocity of a macroscopic object during an interaction.	Identify a device from those provided that reduces the force on a macroscopic object during an interaction, **<u>or</u>** identify an explanation from those provided for how a given device reduces the force on a macroscopic object.

Topic and PE	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
Forces and Interactions **HS-PS2-4**	Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to compare the magnitudes and directions of the gravitational and electrostatic forces, and predict changes in those forces when more than one variable is changed.	Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.	Using mathematical representations of Newton's Law of Gravitation or Coulomb's Law, describe and/or predict the gravitational force(s) or field, or electrostatic force(s) or field associated with an object or a system of two objects, **<u>or</u>** describe and/or predict the magnitude of the factor(s) that result in the given forces or fields.	Given data and/or model(s), describe how factor(s) affect the gravitational or electrostatic force(s) acting on two objects, **<u>or</u>** describe how factor(s) affect the gravitational *or* electrostatic field between two objects.	Given data, information, or a model, draw or identify the direction, with or without the magnitude, of the gravitational force(s) or field, or electrostatic force(s) or field, **<u>or</u>** determine the magnitude of the gravitational force(s) or field, or electrostatic force(s) or field.

Topic and PE	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
Forces and Interactions **HS-PS2-5**	Plan and conduct an investigation to provide evidence that changes in specific physical quantities qualitatively affect the magnetic field produced by an electric current and the electric current produced by a changing magnetic field.	Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.	Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field or that a changing magnetic field can produce an electric current, **<u>or</u>** given a plan, conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current, **<u>or</u>** given a description of an investigation, evaluate if the investigation will provide evidence to support the claim that an electric current can produce a magnetic field or that a changing magnetic field can produce an electric current, **<u>or</u>** revise or complete a plan for an investigation that would provide evidence that an electric current can produce a magnetic field or that a changing magnetic field can produce an electric current.	Given experimental data or information, identify the evidence that supports the claim that an electric current can produce a magnetic field or that a changing magnetic field can produce an electric current.	Identify the cause and effect relationship between an electric current and a magnetic field in a system.

Topic and PE	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
Energy **HS-PS3-1**	Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known, and apply the model to real-world data to evaluate the limitations of the model.	Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.	Given a model or information for a system, calculate the energy change for the system and/or a physical quantity associated with an energy transformation within the system.	Given a model or information (e.g., kinetic energy, change in potential energy, work, or power) for a macroscopic object, calculate a physical quantity (e.g., mass, speed, change in height, spring constant, etc.) associated with that form of energy for the macroscopic object.	Given a model or information for a macroscopic object, calculate the kinetic energy, change in gravitational potential energy, spring potential energy, work, or power associated with a macroscopic object.

Topic and PE	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
Energy **HS-PS3-2**	Develop and use multiple models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects), and revise the models to reflect one or more changes in system parameters.	Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects).	Revise or complete a model(s) to illustrate that energy at the macroscopic scale is a combination of energies associated with the motion of and relative position of particles (objects).	Given a model and/or information, predict energy transfers associated with the motion and relative position of particles (objects).	Given a model and/or information, identify the form(s) of energy associated with motion of and/or relative position of particles (objects).

Topic and PE	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
Energy **HS-PS3-3**	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy, and explain how a similar device could be used to solve a real-world problem using student-generated sources of evidence.	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.	Evaluate and/or refine a given device that converts one form of energy into another form of energy in order to meet given constraints, **or** given a device or a model of a device that converts one form of energy into another form of energy, calculate the device's efficiency.	Given a device or a model of a device that converts one form of energy into another form of energy, evaluate the energy output and the energy input or propose a refinement to improve efficiency, **or** given two or more devices or models of devices that convert one form of energy to another form of energy, evaluate the energy output for the same energy input.	Given a device or model of a device that converts one form of energy into another form of energy, identify the design variables and/or the energy transformations.
Energy **HS-PS3-4**	Plan and conduct an investigation to provide evidence that the transfer of thermal energy, when two components of different temperatures are combined within a closed system, results in a more uniform energy distribution among the components in the system. Analyze and interpret the data to verify the second law of thermodynamics. Evaluate the limitations on the	Plan and conduct an investigation to provide evidence that the transfer of thermal energy, when two components of different temperatures are combined within a closed system, results in a more uniform energy distribution among the components in the system	Given data from an investigation involving the combination of two components of different temperatures within a closed system, explain how the data provides evidence to support that thermal energy is transferred between the objects in the system, which results in a more uniform energy distribution among the components in the system, **or** use mathematical thinking to determine or describe the amount of thermal energy transferred by each component within the system, **or** complete a	Given data from an investigation or information involving two components of different temperatures combined within a closed system, use mathematical representations to determine the mass, specific heat for one component in the system, or the change in temperature of one component in the system.	Given information involving two components of different temperatures combined within a closed system, relate the energy transferred to the temperature change, mass, or specific heat for one of the components in the system, **or** given information involving the change in energy of an object, determine the energy change, temperature change, mass, or specific heat of the object.

Topic and PE	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
Energy **HS-PS3-4** **Continued**	precision of the data and inherent uncertainties in the investigation.	(second law of thermodynamics).	plan for an investigation that would provide evidence that the transfer of thermal energy, when two components of different temperatures are combined within a closed system, results in a more uniform energy distribution among the components in the system, **or** given a plan, conduct an investigation to provide evidence that the transfer of thermal energy, when two components of different temperatures are combined within a closed system, results in a more uniform energy distribution among the components in the system.		

Topic and PE	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
Energy **HS-PS3-5**	Develop and use multiple types of models of two or more objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.	Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.	Complete a model of two objects interacting through electric or magnetic fields to show the changes in energy of the objects due to the interaction, **or** given a model of two objects interacting through an electric field, explain why or show how the energy stored in the electric field changes when the position of the object(s) changes, **or** given a model of an object(s) interacting through a magnetic field, explain why or show how the magnetic force, magnetic field, and/or energy stored in the magnetic field changes when the position of the object(s) changes.	Given a model or information about two objects interacting through an electric field, use a mathematical representation to determine the charge on an object or the potential difference when the position of the object in the electric field changes, **or** given a model or information about two objects interacting through magnetic fields, draw the magnetic force or magnetic field, or identify the relative strength and/or direction of the magnetic force or magnetic field.	Given a model or information about two objects interacting through an electric field, use a cause and effect relationship to qualitatively identify how changes to the charges or position of these charged objects change the energy of the system due to the interaction, **or** given a model or information about two objects interacting through an electric field, use a mathematical representation to describe the change in electric potential energy when the position of the object in the electric field changes, **or** given a model or information about a magnet, draw the magnetic field or identify the relative strength and/or direction of the magnetic field around the magnet.

Topic and PE	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
Energy **HS-PS3-6**	Perform statistical analysis on multiple data sets in order to make and support a claim about Ohm's Law and the mathematical relationship among the potential difference, current, and resistance of an electric circuit.	Analyze data to support the claim that Ohm's Law describes the mathematical relationship among the potential difference, current, and resistance of an electric circuit.	Given a description, information, and/or data for an unspecified series or parallel circuit, draw the corresponding schematic diagram, **or** given a schematic diagram, description of, and/or data for a series or parallel circuit, use mathematical relationship(s) to describe the potential difference, current, resistance, power, and/or energy of the circuit or an individual circuit component, **or** given a schematic diagram, description of, and/or data for a series or parallel circuit, use mathematical relationship(s) to describe what happens to the potential difference, current, resistance, power, and/or energy of the circuit or an individual circuit component when change(s) are made to the circuit.	Given a schematic diagram, description of, and/or data for a circuit (simple, series, or parallel), identify a pattern among the potential difference, current, resistance, power, or energy of the circuit or an individual circuit component, or apply a pattern to determine the potential difference, current, resistance, power, or energy of the circuit or an individual circuit component.	Given a description and/or schematic diagram of a circuit, identify the direction of the conventional current in the circuit, **or** given a description and/or data of a circuit, identify the corresponding schematic diagram for the circuit, **or** given a description of, schematic diagram of, and/or data for a series or parallel circuit, use evidence to support the identification of the circuit, **or** given a schematic diagram, description of information about, and/or data for a simple circuit, determine the potential difference, current, resistance, power, or energy of the circuit.

Topic and PE	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
Waves and Electromagnetic Radiation **HS-PS4-1**	Plan and conduct an investigation and use mathematical representations to evaluate claims regarding the relationships among the period, frequency, wavelength, and speed of waves traveling and transferring energy in various media.	Use mathematical representations to support a claim regarding relationships among the period, frequency, wavelength, and speed of waves traveling and transferring energy (amplitude, frequency) in various media.	Given data, model(s), and/or a mathematical representation, determine the period, frequency, wavelength, or speed of a wave or electromagnetic radiation (photon) traveling and transferring energy in a medium, **or** use mathematical relationships and a ruler and protractor to construct the reflected and/or refracted ray(s) to show the direction of a wave as it hits a boundary, or determine the index of refraction.	Use words, diagrams, and/or graphs to represent the mathematical relationships among the period, frequency, wavelength, and/or speed of waves in a medium, **or** use mathematical relationships to determine the direction of a wave as the wave hits a boundary (reflection and/or refraction), **or** given data, model(s), and/or a mathematical representation, compare the phase of points at positions on the wave or the relative amount of energy transferred due to amplitude or frequency, or determine the amount of energy transferred due to the frequency of electromagnetic radiation (photon).	Draw a model of a wave with given characteristics or identify the characteristics of a given wave traveling and transferring energy in a medium (period, frequency, wavelength, amplitude, speed, and/or type), **or** identify the change in characteristics of a wave as the wave hits a boundary.

Topic and PE	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
Waves and Electromagnetic Radiation **HS-PS4-2**	Evaluate questions about the advantages and disadvantages of using a digital transmission and storage of information using multiple sources of scientific and technical information.	Evaluate questions about the advantages of using a digital transmission and storage of information.	Evaluate a question about an advantage and/or disadvantage of using a digital transmission and/or storage of information.	List the advantages or disadvantages of using a digital transmission and/or storage of information.	Identify given transmission data or storage data as being either analog or digital.
Waves and Electromagnetic Radiation **HS-PS4-3**	Using multiple sources of evidence and scientific reasoning, construct and evaluate a claim that for some situations one model of electromagnetic radiation (wave or particle) is more useful than the other.	Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model (quantum theory), and that for some situations one model is more useful than the other.	Given information, support or refute a claim regarding the use of the wave model or the particle model for electromagnetic radiation to describe a phenomenon.	Given information about a phenomenon, identify the evidence that supports a claim about the model which best describes the phenomenon.	Identify a phenomenon from those given that is best described by the wave and/or particle model of electromagnetic radiation.

Topic and PE	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
Waves and Electromagnetic Radiation **HS-PS4-4**	Gather and evaluate the validity and reliability of various scientific sources. Formulate a valid claim on the effects that different frequencies of electromagnetic radiation have when absorbed by matter, citing evidence from these sources.	Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.	Support or refute a given claim, using scientific and/or technical information, that describes the effect(s) that a frequency or range of frequencies and/or wavelengths of electromagnetic radiation have when absorbed by matter.	Given a claim, identify the evidence to support the claim about an effect electromagnetic radiation of a given frequency or range of frequencies and/or wavelengths has when absorbed by matter.	Identify the claim from those provided that describes an effect that electromagnetic radiation of a given frequency or range of frequencies and/or wavelengths has when absorbed by matter.
Waves and Electromagnetic Radiation **HS-PS4-5**	Communicate technical information to evaluate the effectiveness and reliability of a technological device that uses principles of wave behavior and wave interactions with matter to transmit and capture information and energy.	Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.	Given information about a technological device, explain how the device uses a principle of wave behavior and/or wave interactions with matter to transmit and capture information and energy.	Given information about a technological device, support or refute a claim that explains a principle of wave behavior and/or wave interactions with matter that is used to transmit and/or capture information and/or energy.	Given information about a technological device, identify a principle of wave behavior and/or wave interactions with matter that is used to transmit and/or capture information and/or energy.

Topic and PE	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
Waves and Electromagnetic Radiation **HS-PS4-6**	Use mathematical models, including ray diagrams, to determine relationships among the size and location of images, size and location of objects, and focal lengths for lenses and mirrors.	Use mathematical models to determine relationships among the size and location of images, size and location of objects, and focal lengths of lenses and mirrors.	Use mathematical models and/or ray diagrams to describe the patterns in the change in size and/or location of an image for an object at two or more positions for a lens or mirror with a given focal length.	Use mathematical models or given ray diagrams to identify the patterns in the change in size and/or location of an image for an object at two or more positions for a lens or mirror with a given focal length.	Use mathematical models, patterns, or given ray diagrams to determine the relative size, and/or location of the image and/or focal length for a lens or mirror, **or** given information or ray diagrams, identify the type of lens or mirror and the type of image formed.
Space Systems **HS-ESS1-2**	Construct, evaluate, and revise an explanation to support the connection between electromagnetic radiation and the composition of matter in the universe, **or** construct, evaluate, and revise an explanation to support the connection between spectral data, Doppler shift, and motion relative to Earth (away from or towards) for distant stars and galaxies.	Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and of the composition of matter in the universe.	Evaluate one or more explanations for the composition of matter in the universe based on astronomical evidence of light spectra, **or** using given spectral data from distant stars and/or galaxies, explain how Doppler shift provides evidence for relative motion away from or towards Earth.	Compare spectral data obtained from astronomical evidence to determine the presence of elements that make up distant stars and galaxies, **or** compare spectral data obtained from astronomical evidence to determine the motion relative to Earth (away from or towards) for distant stars and/or galaxies.	Given spectral data (e.g. absorption or emission spectra), identify the data that provides evidence of the presence of an element in a sample of matter, **or** identify an element in a sample of matter by interpreting spectral data, **or** identify spectral data that provides evidence of motion relative to Earth (away from or towards) for a distant star or galaxy.

Topic and PE	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
Engineering Design **HS-ETS1-1**	Evaluate two or more major global challenges to specify qualitative and quantitative criteria and constraints for solutions, which could include new technologies, that account for societal needs and wants.	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.	Analyze a major global challenge to specify qualitative or quantitative criteria and constraints for solutions that account for societal needs and wants.	Given a major global challenge, describe the qualitative or quantitative criteria or constraint for the given solution that best accounts for societal needs or wants.	Given a major global challenge, identify the criteria or constraint for the given solution that best accounts for societal needs or wants.
Engineering Design **HS-ETS1-2**	For a complex real-world problem, design multiple solutions to sub-problems based on student-generated data and/or scientific information from other sources. Describe the rationale, criteria, and constraints of each sub-problem.	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.	Given a complex real-world problem, identify one smaller, more manageable problem and describe a solution to that problem that can be solved through engineering.	Given a complex real-world problem that has been broken down into smaller, more manageable problems, identify a solution to one smaller problem that can be solved through engineering.	Identify the solution from those provided that addresses a smaller, more manageable real-world problem.
Engineering Design **HS-ETS1-3**	Evaluate a solution to a complex real-world problem based on prioritized criteria by generating a prioritized list of criteria and trade-offs that account for a range of multiple constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of multiple constraints, including cost, safety, reliability, and aesthetics, as well as possible	Identify a solution to a complex real-world problem based on prioritized criteria and/or trade-offs (positives and negatives) for a range of constraints, such as cost, safety, reliability, aesthetics, as well as possible social, cultural, or environmental impacts.	Describe a solution to a complex real-world problem based on given criteria and constraints.	Identify the solution from those provided to a complex real-world problem based on given criteria and/or constraints.

Topic and PE	NYS Level 5	NYS Level 4	NYS Level 3	NYS Level 2	NYS Level 1
	environmental impacts. Explain how these solutions affect society and the environment.	social, cultural, and environmental impacts.			
Engineering Design **HS-ETS1-4**	Use a computer simulation to model the impact of proposed solutions to related complex real-world problems with numerous criteria and constraints on interactions within and between systems relevant to the problem.	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.	Given data (from a computer simulation), describe the impact of proposed solutions to a complex real-world problem with limited criteria and constraints on interactions within and/or between systems relevant to the problem.	Given data (from a computer simulation), identify the impact of a proposed solution to a complex real-world problem, or the impact on an interaction within or between two systems relevant to the problem.	Identify the impact of a given solution to a complex real-world problem.