New York Science

# Physical Science: Physics

**HS. Structure & Properties of Matter**

1 **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.** HS-PS1-8

NYS Level 5. Develop and use models to demonstrate the scale of energy released during nuclear processes including fission, fusion, and radioactive decay. NYS LEVEL 5

NYS Level 4. 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. NYS LEVEL 4

NYS Level 3. 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. NYS LEVEL 3

NYS Level 2. 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. NYS LEVEL 2

NYS Level 1. Given a model or data, identify, from the choices provided, evidence to support that energy is released during a nuclear process. NYS LEVEL 1

**HS. Forces & Interactions**

1 **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.** HS-PS2-1

NYS Level 5. 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. NYS LEVEL 5

NYS Level 4. 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. NYS LEVEL 4

NYS Level 3. 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. NYS LEVEL 3

NYS Level 2. 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. NYS LEVEL 2

NYS Level 1. 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). NYS LEVEL 1

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2 **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.** HS-PS2-2

NYS Level 5. 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. NYS LEVEL 5

NYS Level 4. 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 NYS LEVEL 4

NYS Level 3. 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. NYS LEVEL 3

NYS Level 2. 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. NYS LEVEL 2

NYS Level 1. 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. NYS LEVEL 1

**3 Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.*** HS-PS2-3

NYS Level 5. 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. NYS LEVEL 5

NYS Level 4. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. NYS LEVEL 4

NYS Level 3. 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, or 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, or given data for a mechanism designed to minimize the force on a macroscopic object, evaluate the effectiveness of the mechanism based upon given constraints. NYS LEVEL 3

NYS Level 2. 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. NYS LEVEL 2

NYS Level 1. Identify a device from those provided that reduces the force on a macroscopic object during an interaction, or identify an explanation from those provided for how a given device reduces the force on a macroscopic object NYS LEVEL 1

**4 Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.** HS-PS2-4

NYS Level 5. 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. NYS LEVEL 5

NYS Level 4. Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects. NYS LEVEL 4

NYS Level 3. 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, or describe and/or predict the magnitude of the factor(s) that result in the given forces or fields. NYS LEVEL 3

NYS Level 2. Given data and/or model(s), describe how factor(s) affect the gravitational or electrostatic force(s) acting on two objects, or describe how factor(s) affect the gravitational or electrostatic field between two objects. NYS LEVEL 2

NYS Level 1. 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, or determine the magnitude of the gravitational force(s) or field, or electrostatic force(s) or field. NYS LEVEL 1

5 **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.** HS-PS2-5

NYS Level 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. NYS LEVEL 5

NYS Level 4. 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. NYS LEVEL 4

NYS Level 3. 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, or 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, or 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, or 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. NYS LEVEL 3

NYS Level 2. 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. NYS LEVEL 2

NYS Level 1. Identify the cause and effect relationship between an electric current and a magnetic field in a system. NYS LEVEL 1

## HS. Energy

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.** HS-PS3-1

NYS Level 5. 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. NYS LEVEL 5

NYS Level 4. 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. NYS LEVEL 4

NYS Level 3. 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. NYS LEVEL 3

NYS Level 2. 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. NYS LEVEL 2

NYS Level 1. 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. NYS LEVEL 1

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2 **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).** HS-PS3-2

NYS Level 5. 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. NYS LEVEL 5

NYS Level 4. 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). NYS LEVEL 4

NYS Level 3. 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). NYS LEVEL 3

NYS Level 2. Given a model and/or information, predict energy transfers associated with the motion and relative position of particles (objects). NYS LEVEL 2

NYS Level 1. Given a model and/or information, identify the form(s) of energy associated with motion of and/or relative position of particles (objects). NYS LEVEL 1

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3 **Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.*** HS-PS3-3

NYS Level 5. 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. NYS LEVEL 5

NYS Level 4. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy. NYS LEVEL 4

NYS Level 3. 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. NYS LEVEL 3

NYS Level 2. 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. NYS LEVEL 2

NYS Level 1. 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. NYS LEVEL 1

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4 **Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).** HS-PS3-4

NYS Level 5. 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 precision of the data and inherent uncertainties in the investigation. NYS LEVEL 5

NYS Level 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 NYS LEVEL 4

NYS Level 3. 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 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. NYS LEVEL 3

NYS Level 2. 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. NYS LEVEL 2

NYS Level 1. 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. NYS LEVEL 1

5 **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.** HS-PS3-5

NYS Level 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. NYS LEVEL 5

NYS Level 4. 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. NYS LEVEL 4

NYS Level 3. 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. NYS LEVEL 3

NYS Level 2. 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. NYS LEVEL 2

NYS Level 1. 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. NYS LEVEL 1

6 **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.** HS-PS3-6

NYS Level 5. 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. NYS LEVEL 5

NYS Level 4. 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. NYS LEVEL 4

NYS Level 3. 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. NYS LEVEL 3

NYS Level 2. 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. NYS LEVEL 2

NYS Level 1. 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. NYS LEVEL 1

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**HS. Waves & Electromagnetic Radiation**

1 **se 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.** HS-PS4-1

NYS Level 5. 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. NYS LEVEL 5

NYS Level 4. 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. NYS LEVEL 4

NYS Level 3. 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. NYS LEVEL 3

NYS Level 2. 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). NYS LEVEL 2

NYS Level 1. 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. NYS LEVEL 1

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2 **Evaluate questions about the advantages of using a digital transmission and storage of information.** HS-PS4-2

NYS Level 5. Evaluate questions about the advantages and disadvantages of using a digital transmission and storage of information using multiple sources of scientific and technical information. NYS LEVEL 5

NYS Level 4. Evaluate questions about the advantages of using a digital transmission and storage of information. NYS LEVEL 4

NYS Level 3. Evaluate a question about an advantage and/or disadvantage of using a digital transmission and/or storage of information. NYS LEVEL 3

NYS Level 2. List the advantages or disadvantages of using a digital transmission and/or storage of information. NYS LEVEL 2

NYS Level 1. Identify given transmission data or storage data as being either analog or digital. NYS LEVEL 1

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3 **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.** HS-PS4-3

NYS Level 5. 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. NYS LEVEL 5

NYS Level 4. 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. NYS LEVEL 4

NYS Level 3. 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. NYS LEVEL 3

NYS Level 2. Given information about a phenomenon, identify the evidence that supports a claim about the model which best describes the phenomenon. NYS LEVEL 2

NYS Level 1. Identify a phenomenon from those given that is best described by the wave and/or particle model of electromagnetic radiation. NYS LEVEL 1

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**4 Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.** HS-PS4-4

NYS Level 5. 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. NYS LEVEL 5

NYS Level 4. Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. NYS LEVEL 4

NYS Level 3. 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. NYS LEVEL 3

NYS Level 2. 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. NYS LEVEL 2

NYS Level 1. 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. NYS LEVEL 1

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**5 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.*** HS-PS4-5

NYS Level 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. NYS LEVEL 5

NYS Level 4. 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. NYS LEVEL 4

NYS Level 3. 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 NYS LEVEL 3

NYS Level 2. 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. NYS LEVEL 2

NYS Level 1. 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. NYS LEVEL 1

6 **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.** HS-PS4-6

NYS Level 5. 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 NYS LEVEL 5

NYS Level 4. 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. NYS LEVEL 4

NYS Level 3. 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. NYS LEVEL 3

NYS Level 2. 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. NYS LEVEL 2

NYS Level 1. 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 HS-PS4-6 and focal lengths for lenses and mirrors. objects, and focal lengths of lenses and mirrors. length. information or ray diagrams, identify the type of lens or mirror and the type of image formed. NYS LEVEL 1

**Earth & Space Science: Space Systems**

1 **Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, or motion of distant galaxies, and/or the composition of matter in the universe (Cosmic Microwave Background Radiation (CMBR)).** HS-ESS1-2

NYS Level 5. 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. NYS LEVEL 5

NYS Level 4. 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. NYS LEVEL 4

NYS Level 3. 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. NYS LEVEL 3

NYS Level 2. 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. NYS LEVEL 2

NYS Level 1. 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. NYS LEVEL 1

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**Engineering Design**

1 **Analyze a major global challenge to specify qualitative or quantitative criteria and constraints for solutions that account for societal needs and wants.** HS-ETS1-1

NYS Level 5. 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. NYS LEVEL 5

NYS Level 4. 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. NYS LEVEL 4

NYS Level 3. Analyze a major global challenge to specify qualitative or quantitative criteria and constraints for solutions that account for societal needs and wants. NYS LEVEL 3

NYS Level 2. 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. NYS LEVEL 2

NYS Level 1. Given a major global challenge, identify the criteria or constraint for the given solution that best accounts for societal needs or wants. NYS LEVEL 1

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2 **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.** HS-ETS1-2

NYS Level 5. 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 subproblem. NYS LEVEL 5

NYS Level 4. 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 subproblem. NYS LEVEL 4

NYS Level 3. 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. NYS LEVEL 3

NYS Level 2. 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. NYS LEVEL 2

NYS Level 1. Identify the solution, from those provided, that addresses a smaller, more manageable real-world problem. NYS LEVEL 1

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3 **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, and aesthetics, as well as possible social, cultural or environmental impacts.** HS-ETS1-3

NYS Level 5. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. Explain how these solutions affect society and the environment. NYS LEVEL 5

NYS Level 4. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. Explain how these solutions affect society and the environment. NYS LEVEL 4

NYS Level 3. 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, and aesthetics, as well as possible social, cultural or environmental impacts. NYS LEVEL 3

NYS Level 2. Describe a solution to a complex real world problem based on given criteria and constraints. NYS LEVEL 2

NYS Level 1. Identify a solution, from those provided, to a complex real world problem based on given criteria and/or constraints. NYS LEVEL 1

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4 **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.** HS-ETS1-4

NYS Level 5. 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. NYS LEVEL 5

NYS Level 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. NYS LEVEL 4

NYS Level 3. 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. NYS LEVEL 3

NYS Level 2. 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. NYS LEVEL 2

NYS Level 1. Identify the impact of a given solution to a complex real-world problem. NYS LEVEL 1