Curriculum Guide for 7th Grade SDP Science Teachers

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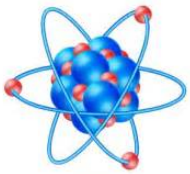
Prepared by :Emily McGady, Science Curriculum Specialist 8/2017

7th Grade (Physical) Science Curriculum Term 1 (9/5-11/13/17)

Topic: Space Science Duration: 9-10 Weeks



Performance Objectives

SWBAT:

- compare the size, composition and surface features of planets **IOT** describe how a planet's features are affected by its distance from the Sun.
- develop and use a model of the Earth-sun-moon system **IOT** describe the patterns of Earth's rotation and revolution in relation to the Sun and Moon.
- develop and use a model of the earth-sun-moon system **IOT** describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.
- compare and contrast characteristics of celestial bodies found in the solar system (e.g., moons, asteroids, comets, meteors, inner and outer planets). **IOT** describe how they differ from earth.
- identify and describe instruments that are used to study the universe **IOT** explain how telescopes, satellites, etc. have advanced our understanding of space.
- develop and use a model **IOT** describe the role of gravity in the motions within galaxies and the solar system.
- analyze and interpret data **IOT** determine scale properties of objects in the solar system.

Key Terms and Definitions

astronomy - the study of the universe

refracting telescope - a telescope that uses a set of lenses to gather and focus light from distant objects

reflecting telescope- a telescope that uses a curved mirror to gather and focus light from distant objects

constellation - a region of the sky that contains a recognizable star pattern and that is used to describe the location of objects in space

zenith- the point in the sky directly above an observer on Earth

horizon - the line where the sky and the Earth appear to meet

light-year - the distance that light travels in one year: about 9.46 trillion kilometers

apparent magnitude - the brightness of a star as seen from the Earth

absolute magnitude - the brightness that a star would have at a distance of 32.6 light years from Earth

parallax - an apparent shift in the position of an object when viewed from different locations

red giant - a large, reddish star late in its life cycle

white dwarf - a small, hot, dim star that is the leftover center of an old star

supernova - a gigantic explosion in which a massive star collapses and throws its outer layers into space

neutron star - a star that has collapsed under gravity to the point that the electrons and protons have smashed together to form neutrons

pulsar - a rapidly spinning neutron star that emits rapid pulses of radio and optical energy

black hole - an object so massive and dense that even light cannot escape its gravity

cosmology - the study of the origin, properties, processes, and evolution of the universe

quasar - a very luminous, star-like, object that generates energy at a high rate; quasars are thought to be the most distant objects in the universe

Big Bang Theory - the theory that states that the universe began with the tremendous explosion about 13.7 billion years ago

sunspot - the dark area of the photosphere of the sun that is cooler than the surrounding areas and that has a strong magnetic field

orbit - the path that a body follows as it travels around another body in space

revolution - the motion of a body that travels around another body in space; one complete trip along an orbit

nova - a variable star that suddenly increases in brightness to several times its normal magnitude and returns to its original appearance in a few weeks to several months or years.

system - a group of related objects that work together to achieve a desired result.

Essential Questions

How does the scientific contributions from historical figures help inform scientific endeavors today?

How can data from instruments, such as telescopes or spacecraft, help us to determine scale properties of objects in the solar system?

How can a model be used to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons?

How can a model be used to describe the role of gravity in motions within galaxies and the solar system?

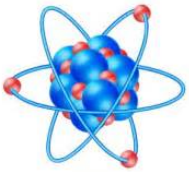
Starting Points

In this unit, students will build upon the foundational knowledge they learned about Space Science in elementary schools. Most recently, students should have completed an astronomy unit in 5th grade which focused on the movement of planets and other objects in space, the phases on the moon, and the seasons. Despite their previous learnings, students may still enter middle school with some strong misconceptions about what causes the moon to appear illuminated, why the sun appears to move across the sky, and what causes the seasons. It will be important to uncover and address these misconceptions at the beginning of and throughout the unit.

Middle school students can examine the Earth's place in relation to the solar system, Milky Way galaxy, and universe. There is a strong emphasis on a systems approach, using models of the solar system to explain astronomical and other observations of the cyclic patterns of eclipses, tides, and seasons. There is also a strong connection to engineering through the instruments and technologies that have allowed us to explore the objects in our solar system and obtain the data that support the theories that explain the formation and evolution of the universe.

7th Grade (Physical) Science Curriculum Term 2 (11/18-1/29/18)

Topic: Matter in Motion



Duration: 3 Weeks

Performance Objectives

SWBAT:

- define speed **IOT** describe how it is a function of distance and time.
- describe how unbalanced forces acting on an object change its velocity **IOT** explain the existence of forces.
- observe how forces act on an object **IOT** explain how inertia is a measure of an object's mass.
- conduct an investigation and evaluate the experimental design **IOT** explain how momentum is related to the forces acting on an object.
- describe the law of universal gravitation **IOT** explain its effect on matter.

- compare balanced and unbalanced forces **IOT** explain how unbalanced forces cause a change in motion of an object.
- use evidence to construct and present arguments **IOT** explain how physics principles underlie everyday phenomena and important technologies.
- use evidence to construct and present arguments **IOT** support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
- conduct an investigation and evaluate the experimental design **IOT** provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact**.**
- evaluate competing design solutions using a systematic process **IOT** determine how well they meet the criteria and constraints of the problem.
- analyze data from tests **IOT** determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- develop a model to generate data for iterative testing and modification of a proposed object, tool, or process **IOT** achieve the optimal design.

Key Terms and Definitions

velocity – the speed of an object in a particular direction

acceleration – the rate at which velocity changes over time; an object accelerates if its speed, direction, or both change

force – a push or pull exerted on an object in order to change the motion of the object; force has size and direction

newton – the SI unit for force (symbol, N)

net force – the combination of all of the forces acting on an object

friction – a force that opposes motion between two surfaces that are in contact

gravity – a force of attraction between objects that is due to their masses

weight – a measure of the gravitational force exerted on an object; its value can change with the location of the object in the universe

mass – a measure of the amount of matter in an object

Essential Questions

What forces exist between objects, even when the objects are not in contact?

What types of problems involve the motion of two colliding objects?

How do force and mass affect the change in an object's motion?

How do we prove that gravitational forces are attractive and depend on the mass of the interacting objects?

What forces exist between objects, even when the objects are not in contact?

Starting Points (repeats throughout Term 2 & 3)

The performance expectations in the topic **Forces and Interactions** focus on helping students understand ideas related to why some objects will keep moving, why objects fall to the ground and why some materials are attracted to each other while others are not. Students answer the question, "How can one describe physical interactions between objects and within systems of objects?" At the middle school level, the PS2 Disciplinary Core Idea from the NRC Framework is broken down into two sub-ideas: Forces and Motion and Types of interactions. By the end of middle school, students will be able to apply Newton's Third Law of Motion to relate forces to explain the motion of objects. Students also apply ideas about gravitational, electrical, and magnetic forces to explain a variety of phenomena including beginning ideas about why some materials attract each other while other repel. In particular, students will develop understanding that gravitational interactions are always attractive but that electrical and magnetic forces can be both attractive and negative. Students also develop ideas that objects can exert forces on each other even though the objects are not in contact, through fields. Students are also able to apply an engineering practice and concept to solve a problem

caused when objects collide. The crosscutting concepts of cause and effect; system and system models; stability and change; and the influence of science, engineering, and technology on society and the natural world serve as organizing concepts for these disciplinary core ideas. In these performance expectations, students are expected to demonstrate proficiency in asking questions, planning and carrying out investigations, and designing solutions, and engaging in argument; and to use these practices to demonstrate understanding of the core ideas.

The performance expectations in the topic **Energy** help students formulate an answer to the question, "How can energy be transferred from one object or system to another?" At the middle school level, the PS3 Disciplinary Core Idea from the NRC Framework is broken down into four sub-core ideas: Definitions of Energy, Conservation of Energy and Energy Transfer, the Relationship between Energy and Forces, and Energy in Chemical Process and Everyday Life. Students develop their understanding of important qualitative ideas about energy including that the interactions of objects can be explained and predicted using the concept of transfer of energy from one object or system of objects to another, and that that the total change of energy in any system is always equal to the total energy transferred into or out of the system. Students understand that objects that are moving have kinetic energy and that objects may also contain stored (potential) energy, depending on their relative positions in a field. Students will also come to know the difference between energy and temperature, and begin to develop an understanding of the relationship between force and energy. Students are also able to apply an understanding of design to the process of energy transfer. The crosscutting concepts of scale, proportion, and quantity; systems and system models; and energy are called out as organizing concepts for these disciplinary core ideas. These performance expectations expect students to demonstrate proficiency in developing and using models, planning investigations, analyzing and interpreting data, and designing solutions, and engaging in argument from evidence; and to use these practices to demonstrate understanding of the core ideas in PS3.

Topic: Forces and Motion Duration: 3.5 Weeks

Performance Objectives

SWBAT:

- describe Newton's Laws IOT explain how changes in motion require a force.
- explain how inertia is a measure of an object's mass IOT provide evidence that it is the natural tendency of objects to resist changes in their state of motion.
- describe how momentum is related to the forces acting on an object IOT determine the velocity of the object.
- describe a closed system IOT explain the law of the conservation of momentum.
- apply Newton's Third Law IOT design a solution to a problem involving the motion of two colliding objects.
- plan an investigation IOT provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.**
- construct and present arguments using evidence IOT support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.**
- conduct an investigation and evaluate the experimental design IOT provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.**

Key Terms and Definitions

terminal velocity – the constant velocity of a falling object when the force of air resistance is equal in magnitude and opposite in direction to the force of gravity

free fall – the motion of a body when only the force of gravity is acting on the body

projectile motion – the curved path that an object follows when thrown, launched, or otherwise projected near the surface of the Earth

inertia – the tendency of an object to resist being moved or, if the object is moving, to resist a change in speed or direction until an outside force acts on the object

momentum – a quantity defined as the product of the mass and velocity of an object

Essential Questions

How do force and mass affect the change in an object's motion?

How do we prove that gravitational forces are attractive and depend on the mass of the interacting objects?

What forces exist between objects, even when the objects are not in contact?

Starting Points (repeats throughout Terms 2 & 3 see page 4)

Topic: Forces in Fluids Duration: 3.5 Weeks

Performance Objectives

SWBAT:

- give examples of how heat moves in predictable ways IOT provide evidence that heat normally flows from warmer objects to cooler ones until they reach the same temperature.
- describe what happens to particles during a phase change IOT explain the effect of heat on particle motion.
- describe velocity IOT describe how unbalanced forces act on an object.
- plan an investigation IOT provide evidence that displacement, velocity, and acceleration prove the existence of forces.
- plan an investigation IOT provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.**
- construct and present arguments using evidence IOT support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.**
- conduct an investigation and evaluate the experimental design IOT provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.**
- define the criteria and constraints of a design problem with sufficient precision IOT ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- evaluate competing design solutions using a systematic process IOT determine how well they meet the criteria and constraints of the problem.
- analyze data from tests IOT determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- develop a model IOT generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
- identify the forces that affect pressure IOT in order to understand buoyancy and fluid pressure.

Key Terms and Definitions

fluid – a non-solid state of matter in which the atoms or molecules are free to move past each other, as in a gas or liquid

pressure – the amount of force exerted per unit area of a surface

pascal – the SI unit of pressure (symbol, Pa)

atmospheric pressure – the pressure caused by the weight of the atmosphere

buoyant force – the upward force that keeps an object immersed in or floating on a liquid

Archimedes' Principle – the principle that states that the buoyant force of an object in a fluid is an upward force equal to the weight of the volume of fluid that the object displaces

Bernoulli's Principle – the principle that states that the pressure in a fluid decreases as the fluid's velocity increases

thrust – the pushing or pulling force exerted by the engine of an aircraft or rocket

drag – a force parallel to the velocity of the flow; it opposes the direction of an aircraft and, in combination with thrust, determines the speed of the aircraft
Pascal's Principle – the principle that states that a fluid in equilibrium contained in a vessel exerts a pressure of equal intensity in all directions

Essential Questions

What are the properties of fluids?

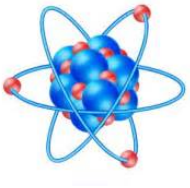
How do the forces caused by fluids, such as buoyant force, lift, and drag, impact objects?

What is the role of pressure in flight?

Starting Points (repeats throughout Terms 2 & 3 see page 4)

7th Grade (Physical) Science Curriculum Term 3 (1/30-4/9/18)

Topic: Work and Machines Duration: 3 Weeks



Performance Objectives

SWBAT:

- plan an investigation IOT provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.**
- describe energy as a property of objects associated with heat, light, electricity, magnetism, mechanical motion, and sound IOT understand the thermal behavior of our bodies and those objects around us.**
- differentiate between potential and kinetic energy IOT describe how energy can be changed from one form to another (transformed) as it moves through a system or transferred from one system to another system.*
- plan an investigation IOT provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.**
- evaluate competing design solutions using a systematic process IOT determine how well they meet the criteria and constraints of the problem.
- analyze data from tests to determine similarities and differences among several design solutions IOT identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- explain the relationship between force, motion, and work IOT model work being done on an object.
- describe the relationship between energy and work IOT determine how machines work.
- construct, use, and present arguments IOT support the claim that when the motion energy of an object changes, energy is transferred to or from the object.**
- differentiate between simple and compound machines IOT explain the progression of technology and its impact on society.
- plan an investigation to combine two or more simple machines into a single complex machine IOT demonstrate the mechanical advantage of more sophisticated and advanced technology.

Key Terms and Definitions

work – the transfer of energy to an object by using a force that causes the object to move in the direction of the force

joule – the unit used to express energy; equivalent to the amount of work done by a force of 1 N acting through a distance of 1 m in the direction of the force (symbol, J)

power – the rate at which work is done or energy is transformed

watt – the unit used to express power; equivalent to joules per second (symbol, W)

machine – a device that helps do work by either overcoming a force or changing the direction of the applied force

work input – the work done on a machine; the product of the input force and the distance through which the force is exerted

work output – the work done by a machine; the product of the output force and the distance through which the force is exerted

mechanical advantage – a number that tells how many times a machine multiplies force

mechanical efficiency – a quantity, usually expressed as a percentage, that measures the ratio of work output to work input; it can be calculated by dividing work output by work input

lever – a simple machine that consists of a bar that pivots at a fixed point called a fulcrum

pulley – a simple machine that consists of a wheel over which a rope, chain, or wire passes

wheel and axle – a simple machine consisting of two circular objects of different sizes; the wheel is the larger of the two circular objects.

inclined plane – a simple machine that is a straight, slanted surface, which facilitates the raising of loads; a ramp

wedge – a simple machine that is made up of two inclined planes and that moves ; often used for cutting

screw – a simple machine that consists of an inclined plane wrapped around a cylinder

compound machine – a machine made of more than one simple machine

Essential Questions

What is the difference between work and power?

How do machines make work easier?

How does distance impact necessary force?

What factors affect the efficiency of machines?

How has technology impacted human work?

Starting Points (repeats throughout Terms 2 & 3 see page 4)

Topic - **Energy and Energy Resources** Duration – 3 weeks

Performance Objectives

SWBAT:

- describe energy as a property of objects associated with heat, light, electricity, magnetism, mechanical motion, and sound **IOT** understand the thermal behavior of our bodies and those objects around us.**
- differentiate between potential and kinetic energy **IOT** describe how energy can be changed from one form to another (transformed) as it moves through a system or transferred from one system to another system.**
- distinguish between different forms of energy **IOT** give examples of how one form of energy can be converted to a different form of energy.
- identify the Sun as a source of energy **IOT** explain how energy from the Sun impacts the environment.
- distinguish between renewable and nonrenewable energy sources **IOT** describe the potential impact of both on the environment.
- construct and interpret graphical displays of data **IOT** describe the relationships of kinetic energy to the mass of an object and to the speed of an object.**
- develop a model **IOT** describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.**

- plan an investigation **IOT** determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.**
- construct, use, and present arguments **IOT** support the claim that when the motion energy of an object changes, energy is transferred to or from the object.**

Key Terms and Definitions

Energy - the capacity to do work

Kinetic energy - the energy of an object that is due to the object's motion

Potential energy - the energy that an object has because of the position, shape, or condition of the object

Mechanical energy - the amount of work an object can do because of the object's kinetic and potential energies

Chemical energy - the energy released when a chemical compound reacts to produce new compounds

Nuclear energy - the energy released by a fission or fusion reaction; the binding energy of the atomic nucleus

Electrical energy - the energy that is associated with charged particles because of their positions

Energy conversion - a change from one form of energy to another

Friction - a force that opposes motion between two surfaces that are in contact

Law of conservation of energy - the law that states that energy cannot be created or destroyed but can be changed from one form to another

Nonrenewable resource - a resource that forms at a rate that is much slower than the rate at which it is consumed

Fossil fuel - a nonrenewable energy resource formed from the remains of organisms that lived long ago

Renewable resource - a natural resource that can be replaced at the same rate at which the resource is consumed

Essential Questions

How is energy converted from one form to another?

What are the sources of energy that you might use on a daily basis?

What is the relationships between potential and kinetic energy?

What role does the Sun play in providing energy to Earth?

What are the advantages and disadvantages of renewable and nonrenewable energy sources?

What is the environment impact of nonrenewable energy use?

Starting Points (work in progress)

Topic: Heat and Heat Technology Duration: 3 Weeks

Performance Objectives

SWBAT:

- describe energy as a property of objects associated with heat, light, electricity, magnetism, mechanical motion, and sound **IOT** understand the thermal behavior of our bodies and those objects around us.**
- describe how electric current produces magnetic forces and how moving magnets produce electric current IOT explain how electrons carry electricity from one place to another.
- conduct an investigation of voltage, current, and resistance in order to describe how current flows through a resistance (Ohm's Law).
- conduct an investigation and evaluate the experimental design IOT provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.**
- construct and interpret graphical displays of data IOT describe the relationships of kinetic energy to the mass of an object and to the speed of an object.**
- develop a model IOT describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.**
- apply scientific principles IOT design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
- plan an investigation IOT determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.**
- construct, use, and present arguments IOT support the claim that when the motion energy of an object changes, energy is transferred to or from the object.**
- apply scientific principles IOT design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
- compare the motion of particles in solids, liquids, and gasses IOT describe the effects of heat on particle motion during a phase change.
- explain how energy is transferred from one place to another through convection, conduction, or radiation IOT give examples of each type of heat transfer.
- describe how heat moves in predictable ways from warmer objects to cooler ones IOT give examples of heat transfer.

Key Terms and Definitions

temperature - a measure of how hot (or cold) something is; specifically, a measure of the average kinetic energy of the particles in an object

thermal expansion - an increase in the size of a substance in response to an increase in the temperature of the substance

absolute zero - the temperature at which molecular energy is at a minimum (0 K on the Kelvin scale or 273.16°C on the Celsius scale)

heat - the energy transferred between objects that are at different temperatures

thermal energy - the kinetic energy of a substance's atoms

thermal conduction - the transfer of energy as heat through a material

thermal conductor - a material through which energy can be transferred as heat

thermal insulator - a material that reduces or prevents the transfer of heat

convection - the transfer of thermal energy by the circulation or movement of a liquid or gas

radiation - the transfer of energy as electromagnetic waves

specific heat - the quantity of heat required to raise a unit mass of homogeneous material 1 K or 1°C in a specified way given constant pressure and volume

states of matter - the physical forms of matter, which include solid, liquid, and gas

change of state - the change of a substance from one physical state to another

insulation - a substance that reduces the transfer of electricity, heat, or sound
heat engine - a machine that transforms heat into mechanical energy, or work

thermal pollution - a temperature increase in a body of water that is caused by human activity and that has a harmful effect on water quality and on the ability of that body of water to support life

Ohm's Law: Voltage is equal to the current times the resistance.

Essential Questions

How does the design of a device either minimize or maximize thermal energy transfer?

How does the type of matter, the mass, and the temperature of a sample affect the energy transferred?

What happens when the kinetic energy of an object changes?

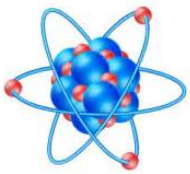
What is the impact of heat on matter?

How has heat technology affected the environment?

Starting Points (repeats throughout Terms 2 & 3 see page 4)

7th Grade (Physical) Science Curriculum Term 4 (4/10-6/15/18)

Topic: Sound and Light Duration: 8 Weeks



Performance Objectives

SWBAT:

- use mathematical representations **IOT** describe a simple model for waves that includes how the amplitude, wavelength, and frequency of a wave is related to the energy in a wave.
- describe energy as a property of an object associated with light and sound **IOT** describe how light and sound energy are transmitted by waves.
- develop and use a model **IOT** describe that waves are reflected, absorbed, or transmitted through various materials.
- integrate qualitative scientific and technical information **IOT** support the claim that digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.
- follow a procedure and develop a model **IOT** demonstrate that visible light is a mixture of many different colors.
- develop and use a model **IOT** explain the construct of the electromagnetic spectrum.

Terms and Definitions

wave - a periodic disturbance in a solid, liquid, or gas as energy is transmitted through a medium

medium - a physical environment in which phenomena occur

transverse wave - a wave in which the particles of the medium move perpendicularly to the direction the wave is traveling

longitudinal wave - a wave in which the particles of the medium vibrate parallel to the direction of wave motion

amplitude - the maximum distance that the particles of a wave's medium vibrate from their rest position

wavelength - the distance from any point on a wave to an identical point on the next wave

frequency - the number of waves produced in a given amount of time

wave speed - the speed at which a wave travels through a medium

reflection - the bouncing back of a ray of light, sound, or heat when the ray hits a surface that it does not go through

refraction - the bending of a wave as the wave passes between two substances in which the speed of the wave differs

diffraction - a change in the direction of a wave when the wave finds an obstacle or an edge, such as an opening

interference - the combination of two or more waves that results in a single wave

standing wave - a pattern of vibration that simulates a wave that is standing still

resonance - a phenomenon that occurs when two objects naturally vibrate at the same frequency; the sound produced by one object causes the other object to vibrate

sound wave - a longitudinal wave that is caused by vibrations and that travels through a material medium

medium - a physical environment in which phenomena occur

pitch - a measure of how high or low a sound is perceived to be, depending on the frequency of the sound wave

doppler effect - an observed change in the frequency of a wave when the source or observer is moving

loudness - the extent to which a sound can be heard

decibel - the most common unit used to measure loudness (symbol, dB)

echo - a reflected sound wave

echolocation - the process of using reflected sound waves to find objects; used by animals such as bats

interference - the combination of two or more waves that results in a single wave

sonic boom - the explosive sound heard when a shock wave from an object traveling faster than the speed of sound reaches a person's ears

standing wave - a pattern of vibration that simulates a wave that is standing still

resonance - a phenomenon that occurs when two objects naturally vibrate at the same frequency; the sound produced by one object causes the other object to vibrate

sound quality - the result of the blending of several pitches through interference

noise - a sound that consists of a random mix of frequencies

electromagnetic wave - a wave that consists of electric and magnetic fields that vibrate at right angles to each other

radiation - transfer of energy as electromagnetic waves

electromagnetic spectrum - all of the frequencies or wavelengths of electromagnetic radiation

plane mirror - a mirror that has a flat surface

concave mirror - a mirror that is curved inward like the inside of a spoon

convex mirror - a mirror that is curved outward like the back of a spoon

lens - a transparent object that refracts light waves such that they converge or diverge to create an image

convex lens - a lens that is thicker in the middle than at the edges

concave lens - a lens that is thinner in the middle than at the edges

nearsightedness - a condition in which the lens of the eye focuses distant objects in front of rather than on the retina

farsightedness - a condition in which the lens of the eye focuses distant objects behind rather than on the retina

laser - a device that produces intense light of only one wavelength and color

hologram - a piece of film that produces a three-dimensional image of an object; made by using laser light

Essential Questions

How can I represent a simple model for waves using mathematics?

Under what circumstances are waves reflected, absorbed, or transmitted?

What makes digitized signals a more reliable way to encode and transmit information than analog signals?

Starting Points

The performance expectations in the topic **Waves and Electromagnetic Radiation** help students formulate an answer to the question, "What are the characteristic properties of waves and how can they be used?" Students are able to describe and predict characteristic properties and behaviors of waves when the waves interact with matter. Students can apply an understanding of waves as a means to send digital information. The crosscutting concepts of patterns and structure and function are used as organizing concepts for these disciplinary core ideas. These performance expectations focus on students demonstrating proficiency in developing and using models, using mathematical thinking, and obtaining, evaluating and communicating information; and to use these practices to demonstrate understanding of the core ideas.