Young Scholars of Western Pennsylvania Charter School

7th Grade Science Curriculum Framework

- Grade

  7

  Big Idea

  The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.

  Essential Questions

  How do we describe and interpret Earth's features, their origins and the processes that shape them?

  Concepts

  All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. The energy is derived from the sun and the earth's interior. These flows and cycles produce chemical and physical changes in Earth's materials and living organisms.

  Competencies

  Construct and analyze models to describe systems interactions among the geosphere, hydrosphere, atmosphere, and biosphere.

  Plan and carry out investigations that model the chemical and physical processes that cycle earth materials and form rocks.

  Vocabulary

  Model

  Geosphere

  Hydrosphere

  Atmosphere

Biosphere

Chemical Change

Physical Change

Energy Flow

Standard(s)

3.3.4.A4, 3.3.4.A5

Eligible Content

S8.A.1.1

S8.1.2

S8.A.1.3

S8.A.2.1

S8.A.2.2

S8.A.3.1

S8.A.3.2

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Big Idea

The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.

Essential Questions

How do we describe and interpret Earth's features, their origins and the processes that shape them?

Concepts

Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation as well as downhill flows on land.

Competencies

Investigate movement of water in the Earth's systems and research and develop models for the cycling of water.

Investigate water systems to identify seasonal and annual variations in precipitation and stream flow and the causes of those variations.

Vocabulary

Water Cycle

Water System

Precipitation

Transpiration

Atmosphere

Standard(s)

3.3.5.A4, 3.3.6.A4, 3.3.8.A4

Eligible Content

S8.A.1.1

S8.1.2

S8.A.1.3

S8.A.2.1

S8.A.2.2

S8.A.3.1

S8.A.3.2

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The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.

Essential Questions

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Concepts

Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things.

These interactions vary with latitude, altitude and local and regional geography.

Competencies

Collect data and generate evidence to show how changes in weather conditions result from the motions and interactions of air masses.

Construct and use models to support the explanation of how the unequal heating of earth's surface and earth's rotation result in patterns of atmospheric and oceanic circulation that vary with latitude, altitude and local and geographical land distribution.

Vocabulary

Oceanic Circulation

Altitude

Latitude

Geography

Weather

Climate

Standard(s)

3.3.7.A6, 3.3.6.A6, 3.3.6.A5, 3.3.8.A4

Eligible Content

S8.A.1.1

S8.1.2

S8.A.1.3

S8.A.2.1

S8.A.2.2

S8.A.3.1

S8.A.3.2

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Essential Questions

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Concepts

The ocean and other large bodies of water exert a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents

Competencies

Construct explanations from models of oceanic and atmospheric circulation and for the development of local and regional climates.

Vocabulary

Oceanic Circulation

Atmospheric Circulation

Standard(s)

Eligible Content

S8.A.1.1

S8.1.2

S8.A.1.3

S8.A.2.1

S8.A.2.2

S8.A.3.1

S8.A.3.2

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Big Idea

The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.

Essential Questions

How do we describe and interpret Earth’s features, their origins and the processes that shape them?

Concepts

Major events in Earth's history leave evidence in the geologic record that allows the construction of a geologic time scale based on relative ages.

Competencies

Use patterns in geologic evidence to determine the relative ages and sequence of geologic events in Pennsylvania and on the rest of the Earth.

Apply scientific reasoning using geological evidence to determine the relative ages of a sequence of events that have occurred in Earth’s past.

Vocabulary

Geologic Evidence

Geologic Time Scale

Standard(s)

3.3.7.A3

Eligible Content

S8.A.1.1

S8.1.2

S8.A.1.3

S8.A.2.1

S8.A.2.2

S8.A.3.1

S8.A.3.2

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Essential Questions

How do we describe and interpret Earth’s features, their origins and the processes that shape them?

Concepts

Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth’s surface and provides a framework for understanding its geological history. Tectonic processes continually generate new ocean seafloor at ridges and destroy old seafloor at trenches.

Competencies

Develop and use models of past plate motions to support explanations of existing patterns in the fossil record, rock record, continental shapes and sea floor structures..

Incorporate a variety of data including geological evidence from maps and representations of current plate motions to predict future plate motions.

Use models to explain how the flow of energy drives the cycling of matter between Earth's surface and deep interior.

Vocabulary

Model

Fossil Record

Continent

Rock Record

Plate Motion

Tectonic Processes

Seafloor

Standard(s)

3.3.6.A1, 3.3.7.A6, 3.3.8.A6

Eligible Content

S8.A.1.1

S8.1.2

S8.A.1.3

S8.A.2.1

S8.A.2.2

S8.A.3.1

S8.A.3.2

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Big Idea

The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.

Essential Questions

How do we describe and interpret Earth's features, their origins and the processes that shape them?

Concepts

Some natural hazards such as volcanic eruptions and severe weather may be preceded by phenomena that allow for reliable prediction. Others such as earthquakes occur suddenly with no notice and are not yet predictable.

Competencies

Investigate or develop a map of the history of natural hazards in a region to demonstrate an understanding of forecasting the likelihood of future events.

Vocabulary

Natural Hazard

Earthquake

Standard(s)

Eligible Content

S8.A.1.1

S8.1.2

S8.A.1.3

S8.A.2.1

S8.A.2.2

S8.A.3.1

S8.A.3.2

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Essential Questions

How do we describe and interpret Earth’s features, their origins and the processes that shape them?

Concepts

Greenhouse gases in the atmosphere absorb and retain the energy radiated from land and ocean surfaces, thereby regulating earth’s average surface temperatures and keeping it habitable.

Competencies

Use models of earth's atmosphere and surface to support the explanation of the greenhouse effect.

Vocabulary

Atmosphere

Greenhouse Effect

Habitable

Standard(s)

Eligible Content

S8.A.1.1

S8.1.2

S8.A.1.3

S8.A.2.1

S8.A.2.2

S8.A.3.1

S8.A.3.2

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Big Idea

The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.

Essential Questions

How do we describe and interpret Earth's features, their origins and the processes that shape them?

Concepts

Evolution is shaped by Earth's varying geological conditions. Sudden changes in conditions (e.g., meteor impacts, major volcanic eruptions) have caused mass extinctions, but these changes, as well as more gradual ones, have ultimately allowed other life forms to flourish.

Competencies

Use arguments supported by evidence from the rock and fossil records to explain how past changes in earth's conditions have caused major extinctions of some life forms and allowed others to flourish.

Vocabulary

Fossil Record

Mass Extinction

Meteor Impact

Volcanic Eruption

Standard(s)

3.3.7.A3

Eligible Content

S8.A.1.1

S8.1.2

S8.A.1.3

S8.A.2.1

S8.A.2.2

S8.A.3.1

S8.A.3.2

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The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales.

Essential Questions

How do we describe and interpret Earth's features, their origins and the processes that shape them?

Concepts

As new life forms evolve, the life processes of those organisms may alter the physical and chemical characteristics of the ocean, atmosphere, and earth materials.

Competencies

Use evidence from the rock and fossil records to investigate how evolution of new life forms has changed earth's systems.

Vocabulary

Fossil Record

Physical Characteristic

Chemical Characteristic

Standard(s)

3.3.7.A3

Eligible Content

S8.A.1.1

S8.1.2

S8.A.1.3

S8.A.2.1

S8.A.2.2

S8.A.3.1

S8.A.3.2

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7

Big Idea

Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.

Essential Questions

How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms? How does biodiversity affect humans?

Concepts

Biodiversity is the wide range of existing life forms that have adapted to the variety of conditions on Earth from terrestrial to marine ecosystems.

Competencies

Use models to explain biodiversity in ecosystems.

Vocabulary

Biodiversity

Adapt

Terrestrial

Marine

Standard(s)

3.1.8.C

3.4.8.E

Eligible Content

S8.B.2.1.1

S8.B.2.1.2

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7

Big Idea

Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.

Essential Questions

How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms? How does biodiversity affect humans?

Concepts

Anatomical similarities and differences between various organisms living today, and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent.

Competencies

Construct explanations for the anatomical similarities and differences between fossils of once living organisms and organisms living today.

Vocabulary

Anatomical

Fossil Record

Evolutionary History

Evolutionary Descent

Standard(s)

3.1.8.C

3.4.8.E

Eligible Content

S8.B.2.1.2

S8.B.2.1.5

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Big Idea

Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.

Essential Questions

How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms? How does biodiversity affect humans?

Concepts

Fossils are mineral replacements, preserved remains, or traces of organisms that lived in the past.

Competencies

Develop explanations for why most individual organisms, as well as some entire species of organisms, that lived in the past were never fossilized.

Vocabulary

Mineral Replacement

Standard(s)

3.1.8.C

3.4.8.E

Eligible Content

S8.B.2.1.2

S8.B.2.1.5

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Big Idea

Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.

Essential Questions

How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms? How does biodiversity affect humans?

Concepts

The collection of fossils and their placement in chronological order is known as the fossil record.

Competencies

Analyze and interpret patterns of change in fossils to provide evidence of the history of life on Earth.

Vocabulary

Chronological

Standard(s)

3.1.8.C

3.4.8.E

Eligible Content

S8.B.2.1.5

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Big Idea

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Essential Questions

How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms? How does biodiversity affect humans?

Concepts

Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy.

Competencies

Recognize and compare patterns in the embryological development across different species to identify relationships not evident in the fully formed anatomy.

Vocabulary

Embryological

Relationship

Standard(s)

3.1.8.C

3.4.8.E

Eligible Content

S8.B.2.1.2

S8.B.2.1.5

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Big Idea

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Essential Questions

How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms? How does biodiversity affect humans?

Concepts

In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding.

Competencies

Communicate explanations of ways technologies enable humans to influence the inheritance of certain traits in plants and animals.

Vocabulary

Technology

Selective Breeding

Standard(s)

3.1.8.A

3.1.8.C

3.4.8.B

3.4.8.E

4.4.8.A

4.5.8.A

4.5.8.C

4.5.8.D

Eligible Content

S8.B.2.1.4

S8.A.1.2.1

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Big Idea

Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.

Essential Questions

How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms? How does biodiversity affect humans?

Concepts

Natural selection leads to the predominance of certain traits in a population, and the suppression of others.

Competencies

Communicate explanations for how genetic variations of traits in a population increase some individual's probability of surviving and reproducing.

Vocabulary

Natural Selection

Predominance

Suppression

Standard(s)

3.1.8.C

3.4.8.E

Eligible Content

S8.B.2.1.1

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Essential Questions

How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms? How does biodiversity affect humans?

Concepts

Natural selection leads to the predominance of certain traits in a population, and the suppression of others.

Competencies

Use models to explain how natural selection over many generations results in changes within species in response to environmental conditions that increase or decrease certain traits in a population.

Vocabulary

Natural Selection

Environmental Conditions

Standard(s)

3.1.8.C

3.4.8.E

Eligible Content

S8.B.2.1.5

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Big Idea

Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.

Essential Questions

How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms? How does biodiversity affect humans?

Concepts

Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions.

Competencies

Obtain and evaluate information about how two populations of the same species in different environments have evolved to become separate species.

Vocabulary

Evolve

Natural Selection

Standard(s)

3.1.8.C

3.4.8.E

Eligible Content

S8.B.2.1.1

S8.B.2.1.2

S8.B.2.1.3

- Grade

7

Big Idea

Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.

Essential Questions

How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?

Concepts

Genetic contribution from each parent through sexual reproduction results in variation in offspring, and asexual reproduction results in offspring with identical genetic information.

Competencies

Use models to demonstrate genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes.

Vocabulary

Genes

Chromosomes

Variants

Asexual Reproduction

Sexual Reproduction

Standard(s)

3.1.8.C

Eligible Content

S8.B.2.2.2

- Grade

7

Big Idea

Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.

Essential Questions

How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?

Concepts

Genetic contribution from each parent through sexual reproduction results in variation in offspring, and asexual reproduction results in offspring with identical genetic information.

Competencies

Use models to demonstrate that sexual reproduction provides for transmission of genetic information to offspring through egg and sperm cells.

Vocabulary

Egg Cells

Sperm Cells

Standard(s)

3.1.8.A

3.1.8.C

3.4.8.B

4.4.8.A

4.5.8.A

4.5.8.C

4.5.8.D

Eligible Content

S8.B.2.2.2

S8.A.1.2.3

- Grade

7

Big Idea

Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.

Essential Questions

How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?

Concepts

Genetic contribution from each parent through sexual reproduction results in variation in offspring, and asexual reproduction results in offspring with identical genetic information.

Competencies

Describe how variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited or (more rarely) from mutations.

Vocabulary

Mutations

Standard(s)

3.1.8.C

Eligible Content

S8.B.2.2.1

- Grade

7

Big Idea

Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.

Essential Questions

How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?

Concepts

Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits.

Competencies

Provide an explanation for the relationship among changes (mutations) to genes, changes to the formation of proteins, and the effect on the structure and function of the organism and thereby traits.

Vocabulary

Proteins

Standard(s)

3.1.8.C

3.4.8.E

Eligible Content

S8.B.2.1.3

- Grade

7

Big Idea

Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.

Essential Questions

How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?

Concepts

In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring.

Competencies

Use models to demonstrate that offspring acquire genes from each parent.

Vocabulary

Genes

Standard(s)

3.1.8.C

3.4.8.E

Eligible Content

S8.B.2.1.1

S8.B.2.2.2

- Grade

7

Big Idea

Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.

Essential Questions

How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?

Concepts

In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations.

Competencies

Describe how some genetic mutations are beneficial, others harmful, and some neutral to the organism.

Vocabulary

Genetic Mutation

Standard(s)

3.1.8.C

3.4.8.E

Eligible Content

S8.B.2.1.3

- Grade

7

Big Idea

Interactions between any two objects can cause changes in one or both between and within atoms.

Essential Questions

How can one explain and predict interactions between objects within systems?

Concepts

Long-range gravitational interactions govern the evolution and maintenance of large-scale systems in space, such as galaxies or the solar system, and determine the patterns of motion within those structures.

Competencies

Use a model or various representations to describe the relationship among gravitational force, the mass of the interacting objects, and the distance between them.

Vocabulary

Gravitational Interaction

Standard(s)

3.2.6.B1

3.2.5.B1

3.2.7.B1

Eligible Content

- Grade

7

Big Idea

Interactions between any two objects can cause changes in one or both between and within atoms.

Essential Questions

How can one explain and predict interactions between objects within systems?

Concepts

Forces that act at a distance (gravitational, electric, and magnetic) can be explained by force fields that extend through space and can be mapped by their effect on a test object.

Competencies

Plan and carry out investigations to demonstrate that some forces act at a distance through fields.

Vocabulary

Gravitational Interactions

Electrical Interactions

Magnetic Interactions

Standard(s)

3.2.6.B1

3.2.5.B1

3.2.7.B1

Eligible Content

- Grade

7

Big Idea

Interactions between any two objects can cause changes in one or both between and within atoms.

Essential Questions

How can one explain and predict interactions between objects within systems?

Concepts

Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun.

Competencies

Develop a simple model using given data that represents the relationship of gravitational interactions and the motion of objects in space.

Vocabulary

Gravitational Forces

Mass

Standard(s)

3.2.6.B1

3.2.5.B1

3.2.7.B1

Eligible Content

- Grade

7

Big Idea

Interactions between any two objects can cause changes in one or both between and within atoms.

Essential Questions

How can one explain and predict interactions between objects within systems?

Concepts

In order to share information about an object's direction of force and motion with other people, a frame of reference must also be shared.

Competencies

Formulate questions arising from investigating how an observer’s frame of reference and the choice of units influence how the motion and position of an object can be described and communicated to others.

Vocabulary

Frame of Reference

Position

Relative Motion

Standard(s)

3.4.7.C

3.6.7.C

Eligible Content

S8.C.3.1

S8.A.1.3

S8.A.2.2

S8.A.2.1

- Grade

7

Big Idea

Interactions between any two objects can cause changes in one or both between and within atoms.

Essential Questions

How can one explain and predict interactions between objects within systems?

Concepts

The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change.

Competencies

Communicate observations and information graphically and mathematically to represent how an object's relative position, velocity, and direction of motion are affected by forces acting on the object.

Vocabulary

Net Force

Force

Position

Velocity

Acceleration

Standard(s)

Eligible Content

- Grade

7

Big Idea

Interactions between any two objects can cause changes in one or both between and within atoms.

Essential Questions

How can one explain and predict interactions between objects within systems?

Concepts

The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change.

Competencies

Analyze and interpret data to determine the cause and effect relationship between the motion of an object and the sum of the forces acting upon it.

Vocabulary

Net Force

Acceleration

Standard(s)

3.2.6.B1

3.2.5.B1

3.2.7.B1

Eligible Content

S8.A.1.3

S8.A.2.2

S8.A.2.1

- Grade

7

Big Idea

Interactions between any two objects can cause changes in one or both between and within atoms.

Essential Questions

How can one explain and predict interactions between objects within systems?

Concepts

The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion.

Competencies

Use mathematical concepts and observations to describe the proportional relationship between the acceleration of an object and the force applied upon the object, and the inversely proportional relationship of acceleration to its mass.

Vocabulary

mass

Force

Acceleration

Standard(s)

3.2.6.B1

3.2.5.B1

3.2.7.B1

Eligible Content

S8.A.1.3

S8.A.2.2

S8.A.2.1

- Grade

7

Big Idea

Interactions between any two objects can cause changes in one or both between and within atoms.

Essential Questions

How can one explain and predict interactions between objects within systems?

Concepts

Forces on an object can change its shape or orientation.

Competencies

Plan and carry out investigations to identify the effect forces have on an object's shape and orientation.

Vocabulary

Force

Standard(s)

3.2.6.B1

3.2.5.B1

3.2.7.B1

Eligible Content

S8.A.1.3

S8.A.2.2

S8.A.2.1

- Grade

7

Big Idea

Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.

Essential Questions

How is energy transferred and conserved?

Concepts

Energy is transferred from hotter regions or objects and into colder ones by the processes of conduction, convection, and radiation.

Competencies

Use and/or construct models to communicate the means by which thermal energy is transferred during conduction, convection, and radiation.

Vocabulary

Thermal Energy

Energy Transfer

Conduction

Convection

Radiation

Standard(s)

3.4.7.B

4.2.7.B

3.2.7.B3,

3.2.6.B3,

3.2.6.B6

Eligible Content

S8.C.2.1

S8.A.1.3

S8.A.2.2

S8.A.2.1

- Grade

7

Big Idea

Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.

Essential Questions

How is energy transferred and conserved?

Concepts

Whenever a transformation of energy occurs, some of the energy in the system appears as thermal energy.

Competencies

Compare, evaluate, and design a device that maximizes or minimizes thermal energy transfer, and defend the selection of materials chosen to construct the device.

Vocabulary

Thermal Energy

Energy Transfer

Standard(s)

3.2.5.B3

3.2.7.B6

Eligible Content

S8.A.1.3

S8.A.2.2

S8.A.2.1

- Grade

7

Big Idea

Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.

Essential Questions

How is energy transferred and conserved?

Concepts

Whenever a transformation of energy occurs, some of the energy in the system appears as thermal energy.

Competencies

Design and evaluate solutions that minimize and/or maximize friction and energy transfer in everyday machines.

Vocabulary

Thermal Energy

Energy Transfer

Friction

Machine

Standard(s)

3.2.5.B3

3.2.7.B6

Eligible Content

S8.A.1.3

S8.A.2.2

S8.A.2.1

- Grade

7

Big Idea

Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.

Essential Questions

How is energy transferred and conserved?

Concepts

The term “heat” as used in everyday language refers both to thermal motion (the motion of atoms or molecules within a substance) and electromagnetic radiation (particularly infrared and light). Temperature is not a measure of energy; the relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present.

Competencies

Use a simulation or mechanical model to determine the effect on the temperature and motion of atoms and molecules of different substances when thermal energy is added or removed from the substance.

Vocabulary

Heat

Temperature

Atoms

Molecules

Substance

Electromagnetic Radiation

Standard(s)

3.4.7.B,

4.2.7.B

3.2.5.B3

3.2.6.B3

3.2.8.B3

Eligible Content

S8.C.2.1

S8.A.1.3

S8.A.2.2

S8.A.2.1

- Grade

7

Big Idea

Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.

Essential Questions

How is energy transferred and conserved?

Concepts

The term “heat” as used in everyday language refers both to thermal motion (the motion of atoms or molecules within a substance) and electromagnetic radiation (particularly infrared and light). Temperature is not a measure of energy; the relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present.

Competencies

Construct an argument that explains the effect of adding or removing thermal energy to a pure substance in different phases and during a phase change in terms of atomic and molecular motion.

Vocabulary

Heat

Temperature

Atoms

Molecules

Substance

Electromagnetic Radiation

Phase Change

Standard(s)

3.4.7.B

4.2.7.B

3.2.5.B3

3.2.6.B3

3.2.8.B3

Eligible Content

S8.C.2.1

S8.A.1.3

S8.A.2.2

S8.A.2.1

- Grade

7

Big Idea

Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.

Essential Questions

How is energy transferred and conserved?

Concepts

Motion energy is called kinetic energy; it is proportional to the mass of the moving object

and grows with the square of its speed.

Competencies

Construct an explanation of the proportional relationship pattern between the kinetic energy of an object and its mass and speed.

Vocabulary

Kinetic Energy

Mass

Speed

Standard(s)

3.2.6.B2

Eligible Content

S8.A.1.3

S8.A.2.2

S8.A.2.1

- Grade

7

Big Idea

Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.

Essential Questions

How is energy transferred and conserved?

Concepts

A system of objects may contain stored (potential) energy, depending on their relative positions.

Competencies

Use representations of potential energy to construct an explanation of how much energy an object has when it's in different positions in an electrical, gravitational, and magnetic field.

Vocabulary

System

Potential Energy

Electrical Field

Gravitational Field

Magnetic Field

Standard(s)

3.2.6.B2

Eligible Content

S8.A.1.3

S8.A.2.2

S8.A.2.1

- Grade

7

Big Idea

Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.

Essential Questions

How is energy transferred and conserved?

Concepts

Potential energy is decreased in some chemical reactions and increased in others.

Competencies

Plan and carry out investigations to show that in some chemical reactions energy is released or absorbed.

Vocabulary

Potential Energy

Chemical Reactions

Exothermic

Endothermic

Standard(s)

3.2.6.B2

Eligible Content

S8.A.1.3

S8.A.2.2

S8.A.2.1

- Grade

7

Big Idea

Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.

Essential Questions

How is energy transferred and conserved?

Concepts

Potential energy is decreased in some chemical reactions and increased in others.

Competencies

Use and/or construct models to communicate the means by which thermal energy is transferred during conduction, convection, and radiation.

Vocabulary

Potential Energy

Chemical Reactions

Thermal Energy

Conduction

Convection

Radiation

Standard(s)

3.2.7.B3

Eligible Content

S8.A.1.3

S8.A.2.2

S8.A.2.1

- Grade

7

Big Idea

Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.

Essential Questions

How is energy transferred and conserved?

Concepts

Temperature is a measure of the average kinetic energy of particles of matter.

Competencies

Use and/or construct models to communicate the means by which thermal energy is transferred during conduction, convection, and radiation.

Vocabulary

Potential Energy

Chemical Reactions

Thermal Energy

Conduction

Convection

Radiation

Temperature

Kinetic Energy

Standard(s)

3.2.7.B3

Eligible Content

S8.A.1.3

S8.A.2.2

S8.A.2.1

- Grade

7

Big Idea

Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.

Essential Questions

How is energy transferred and conserved?

Concepts

Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present.

Competencies

Collect data and generate evidence to examine the relationship between the change in the temperature of a sample and the nature of the matter, the size of the sample, and the environment.

Vocabulary

Temperature

System

Total Energy

Potential Energy

Kinetic Energy

Standard(s)

3.2.8.B3

Eligible Content

S8.A.1.3

S8.A.2.2

S8.A.2.1

- Grade

7

Big Idea

Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.

Essential Questions

How is energy transferred and conserved?

Concepts

The amount of energy transfer needed to change the temperature of a sample depends on the nature of the matter, the size of the sample, and the environment.

Competencies

Collect data and generate evidence to examine the relationship between the change in the temperature of a sample and the nature of the matter, the size of the sample, and the environment.

Vocabulary

Specific Heat

Energy Transfer

Standard(s)

3.4.7.B

4.2.7.B

3.2.7.B3

3.2.6.B3

3.2.6.B6

Eligible Content

S8.C.2.1

S8.A.1.3

S8.A.2.2

S8.A.2.1

- Grade

7

Big Idea

Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.

Essential Questions

How is energy transferred and conserved?

Concepts

A stable system is one in which any small change results in forces that return the system to its prior state.

Competencies

Develop or modify models to demonstrate that systems can withstand small changes, relying on feedback mechanisms to maintain stability.

Vocabulary

Stable System

Feedback

Standard(s)

S8.C.3.1

3.4.7.C

3.6.7.C

Eligible Content

S8.A.1.3

S8.A.2.2

S8.A.2.1