Carbon Footprint Core Content

Elementary School

SC-E-1.1.1 Objects have many observable properties such as size, mass, shape, color, temperature, magnetism, and the ability to react with other substances. Some properties can be measured using tools such as metric rulers, balances, and thermometers.

SC-EP-1.1.2 Students will understand that objects have many observable properties such as size, mass, shape, color, temperature, magnetism, and the ability to interact and/or to react with other substances. Some properties can be measured using tools such as metric rulers, balances, and thermometers.

SC-E-1.1.3 Materials can exist in different states--solid, liquid, and gas. Some common materials, such as water, can be changed from one state to another by heating or cooling.

SC-EP-1.1.3 Students will describe the properties of water as it occurs as a solid, liquid or gas. Matter (water) can exist in different states--solid, liquid and gas. Properties of those states of matter can be used to describe and classify them. DOK 2

SC-04-1.1.1 Students will explain how matter, including water, can be changed from one state to another. Materials can exist in different states--solid, liquid and gas. Some common materials, such as water, can be changed from one state to another by heating or cooling. Resulting cause and effect relationships should be explored, described and predicted. DOK 3

SC-E-2.1.2 Earth materials provide many of the resources humans use. The varied materials have different physical and chemical properties, which make them useful in different ways, for example, as building materials (e.g., stone, clay, marble), as sources of fuel (e.g., petroleum, natural gas), or growing the plants we use as food.

Middle School

SC-07-2.3.1 Students will make inferences and predictions related to changes in the Earth’s surface or atmosphere based on data/evidence.

The Earth’s processes we see today, including erosion, movement of lithospheric plates and changes in atmospheric composition, are predictable and similar to those that occurred in the past. Analysis of evidence from Earth’s history substantiates the conclusion that the planet has also been influenced by occasional catastrophes such as the impact of an asteroid or comet.

SC-06-3.5.2 Students will understand that regulation of an organism’s internal environment involves sensing the internal environment and changing physiological activities to keep conditions within the range required to survive. Maintaining a stable internal environment is essential for an organism’s survival.

SC-06-4.6.1

The BioEnergy Activity Module (BEAM) Initiative is a project of Eastern Kentucky University’s Center for Renewable and Alternative Fuel Technologies (CRAFT) and is funded in whole or in part by the Appalachian Regional Commission.
Students will describe or explain the cause and effect relationships between oceans and climate. Oceans have a major effect on climate, because water in the oceans holds a large amount of heat. DOK 2

**SC-07-4.6.1**

*Students will understand that Earth systems have sources of energy that are internal and external to the Earth. The Sun is the major external source of energy.*

**SC-08-4.6.1**

Students will:
- explain the cause and effect relationships between global climate and energy transfer;
- use evidence to make inferences or predictions about global climate issues.

Global climate is determined by energy transfer from the Sun at and near Earth’s surface. DOK 3

**SC-06-4.6.2**

Students will describe:
- the effect of the Sun’s energy on the Earth system;
- the connection/relationship between the Sun’s energy and seasons.

The Sun is the major source of energy for Earth. The water cycle, winds, ocean currents and growth of plants are affected by the Sun’s energy. Seasons result from variations in the amount of the Sun’s energy hitting Earth’s surface. DOK 3

**SC-07-4.6.2**

Students will:
- describe the transfer and/or transformations of energy which occur in examples that involve several different forms of energy (e.g., heat, electrical, light, motion of objects and chemical).
- Explain, qualitatively or quantitatively, that heat lost by hot object equals the heat gained by cold object.

The transfer and transformation of energy can be examined in a variety of real life examples. Models are an appropriate way to convey the abstract/invisible transfer of energy in a system. Heat energy is the disorderly motion of molecules. Heat can be transferred through materials by the collisions of atoms or across space by radiation. If the material is fluid, currents will be set up in it that aid the transfer of heat. To change something’s speed, to bend or stretch things, to heat or cool them, to push things together, to expand or contract them or tear them apart all require transfers (and some transformations) of energy. Heat lost by hot object equals the heat gained by cold object. This is an energy conservation statement. Whenever hot and cold objects are put in contact, heat energy always transfers from the hot object to the cold object and this continues until all the mass is at the same temperature. Students should understand that heat produced by burning comes from the release of chemical energy of the substance. DOK 3

**SC-08-4.6.2**

Students will:
- describe or explain energy transfer and energy conservation;
- evaluate alternative solutions to energy problems.

Energy can be transferred in many ways, but it can neither be created nor destroyed.
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**SC-07-4.6.3**

*Students will understand that waves are one way that energy is transferred. Types of waves include sound, light, earthquake, ocean and electromagnetic.*

**SC-08-4.6.4**

*Students will:*
*analyze information/data about waves and energy transfer;*
*describe the transfer of energy via waves in real life phenomena.*

Waves, including sound and seismic waves, waves on water and electromagnetic waves, can transfer energy when they interact with matter.
DOK 2

**SC-07-4.6.4**

*Students will describe or represent the flow of energy in ecosystems, using data to draw conclusions about the role of organisms in an ecosystem.*

For most ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis. That energy then passes from organism in food webs.
DOK 3

**SC-08-4.6.5**

*Students will:*
*describe the relationships between organisms and energy flow in ecosystems (food chains and energy pyramids);*
*explain the effects of change to any component of the ecosystem.*

Energy flows through ecosystems in one direction from photosynthetic organisms to herbivores to carnivores and decomposers

**SC-06-4.7.1**

*Students will describe the consequences of change in one or more abiotic factors on a population within an ecosystem.*

The number of organisms an ecosystem can support depends on the resources available and abiotic factors (e.g., quantity of light and water, range of temperatures, soil composition).
DOK 2

**SC-08-4.7.1**

*Students will describe the interrelationships and interdependencies within an ecosystem and predict the effects of change on one or more components within an ecosystem.*

Organisms both cooperate and compete in ecosystems. Often changes in one component of an ecosystem will have effects on the entire system that are difficult to predict. The interrelationships and interdependencies of these organisms may generate ecosystems that are stable for hundreds or thousands of years.

**SC-08-4.7.1**

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**High School**

**SC-HS-4.6.1**
Students will:
- explain the relationships and connections between matter, energy, living systems and the physical environment;
- give examples of conservation of matter and energy.
As matter and energy flow through different organizational levels (e.g., cells, organs, organisms, communities) and between living systems and the physical environment, chemical elements are recombined in different ways. Each recombination results in storage and dissipation of energy into the environment as heat. Matter and energy are conserved in each change.

**SC-HS-4.6.2**
Students will:
- predict wave behavior and energy transfer;
- apply knowledge of waves to real life phenomena/investigations.
Waves, including sound and seismic waves, waves on water and electromagnetic waves, can transfer energy when they interact with matter. Apparent changes in frequency can provide information about relative motion.

**SC-HS-4.6.5**
Students will describe and explain the role of carbon-containing molecules and chemical reactions in energy transfer in living systems.
Living systems require a continuous input of energy to maintain their chemical and physical organization since the universal tendency is toward more disorganized states. The energy for life primarily derives from the Sun. Plants capture energy by absorbing light and using it to break weaker bonds in reactants (such as carbon dioxide and water) in chemical reactions that result in the formation of carbon-containing molecules. These molecules can be used to assemble larger molecules (e.g., DNA, proteins, sugars, fats). In addition, the energy released when these molecules react with oxygen to form very strong bonds can be used as sources of energy for life processes.

**SC-HS-4.6.9**
Students will:
- explain the cause and effect relationship between global climate and weather patterns and energy transfer (cloud cover, location of mountain ranges, oceans);
- predict the consequences of changes to the global climate and weather patterns.
Global climate is determined by energy transfer from the Sun at and near Earth’s surface. This energy transfer is influenced by dynamic processes such as cloud cover and the Earth’s rotation and static conditions such as the position of mountain ranges and oceans.

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SC-HS-4.7.1
Students will:
- analyze relationships and interactions among organisms in ecosystems;
- predict the effects on other organisms of changes to one or more components of the ecosystem.

Organisms both cooperate and compete in ecosystems. Often changes in one component of an ecosystem will have effects on the entire system that are difficult to predict. The interrelationships and interdependencies of these organisms may generate ecosystems that are stable for hundreds or thousands of years.

SC-HS-4.7.2
Students will:
- evaluate proposed solutions from multiple perspectives to environmental problems caused by human interaction;
- justify positions using evidence/data.

Human beings live within the world's ecosystems. Human activities can deliberately or inadvertently alter the dynamics in ecosystems. These activities can threaten current and future global stability and, if not addressed, ecosystems can be irreversibly affected.

DOK 3

SC-HS-4.7.3
Students will:
predict the consequences of changes to any component (atmosphere, solid Earth, oceans, living things) of the Earth System;
propose justifiable solutions to global problems.
Interactions among the solid Earth, the oceans, the atmosphere and living things have resulted in the ongoing development of a changing Earth system.
DOK 3

SC-HS-4.7.5
Students will:
- predict the consequences of changes in resources to a population;
- select or defend solutions to real-world problems of population control.

Living organisms have the capacity to produce populations of infinite size. However, behaviors, environments and resources influence the size of populations. Models (e.g., mathematical, physical, conceptual) can be used to make predictions about changes in the size or rate of growth of a population.