Ethanol 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-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-E-3.1.1** Things in the environment are classified as living, nonliving, and once living. Living things differ from nonliving things. Organisms are classified into groups by using various characteristics (e.g., body coverings, body structures).

**SC-E-3.1.2** Organisms have basic needs. For example, animals need air, water, and food; plants need air, water, nutrients, and light. Organisms can survive only in environments in which their needs can be met.

**SC-E-2.2.1** The Sun provides the light and heat necessary to maintain the temperature of Earth. The Sun’s light and heat are necessary to sustain life on Earth.

Middle School

**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. DOK 3

**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-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. DOK 2

**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-4.6.7**

Students will:  
- explain real world applications of energy using information/data;  
- evaluate explanations of mechanical systems using current scientific knowledge about energy.  
The universe becomes less orderly and less organized over time. Thus, the overall effect is that the energy is spread out uniformly. For example, in the operation of mechanical systems, the useful energy output is always less than the energy input; the difference appears as heat.
SC-HS-4.6.8
Students will:
- describe the connections between the functioning of the Earth system and its sources of energy (internal and external);
- predict the consequences of changes to any component of the Earth system. Earth systems have sources of energy that are internal and external to the Earth. The Sun is the major external source of energy. Two primary sources of internal energy are the decay of radioactive isotopes and the gravitational energy from Earth’s original formation. DOK 3

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.

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.