Course/Grade Level: Eighth Earth/Physical Grade Science Curriculum

S.8.1 Students will develop, operate, evaluate and analyze scientific investigations.

Students will…

S.8.1.1 ▲ actively engage in investigations, including developing questions, gathering and analyzing data, and designing and conducting research. (HS.1.1.2)

Additional Specifity: the scientific investigations includes, when appropriate:

a. formulate a testable hypothesis
b. identifying and testing variables (independent, dependent, and variables to be kept constant)
c. using methods for gathering data that is observable, measurable, and replicable
d. analyzing and evaluating the results in order to clarify the questions and hypothesis, and to refine methods for further research

S.8.1.2 ▲ actively engage in using technological tools and mathematics in their own scientific investigations. (HS.1.1.3)

Additional Specifity:

a. using a variety of technologies, such as hand tools, measuring instruments, calculators, and computers as an integral component of scientific investigations
b. using common mathematical functions to analyze and describe data
c. using statistical and graphing data analysis techniques
d. recognizing that the accuracy and precision of the data, and therefore the quality of the investigation, depends on the instruments used
e. using equipment properly and safely

S.8.1.3 ▲ recognize that technology is the application of scientific knowledge for functional purposes. (HS.5.1.1)

Additional Specificity:

a. technology is driven by the need to meet human needs and solve human problems
b. engineering is the practical application of science to commerce or industry
c. medicine is a practical application of science to human health
d. all technological advances contain a potential for both gains and risks for society

S.8.2 Students will demonstrate a knowledge of various aspects of chemistry.

Students will…

S.8.2.1 ▲ demonstrate an understanding that atoms, the fundamental organizational unit of matter, are composed of subatomic particles. (Chemists are primarily interested in the protons, electrons, and neutrons found in atom.) (HS.2a.1.1)

Additional Specifity:

a. All atoms are identified by the number of protons in the nucleus, i.e. the atomic number. The protons have a positive charge and a mass of 1 amu. Protons and neutrons are found in the small, dense nucleus.
b. Neutrons have a neutral charge and a mass of 1 amu.
c. The electrons have a negative charge and are found outside the nucleus in an electron cloud. The mass of an electron is approximately 2,000 times smaller than a proton. The electrons determine the size and chemical properties of the atom.
d. The number of electrons is equal to the number of protons in a neutral atom. Ions have a different number of electrons than protons.

S.8.2.2 ▲ tell how chemists use kinetic and potential energy to explain the physical and chemical properties of matter on earth that may exist in any of these three states: solids, liquids, and gases. (HS2a.2.1)

Additional Specifity: Elements and molecules may exist as gases, liquids, or solids. Ionic compounds most commonly exist as solids.

S.8.2.3 ▲ analyze how the periodic table lists elements according to increasing atomic number. (This table organizes physical and chemical trends by groups, periods, and sub-categories.) (HS.2a.2.2)

Additional Specifity:

a. Elements in the same group have the same number of valence electrons and can be used to predict similar physical and chemical properties. Elements are grouped by similar ground state valence electron configurations. (HS.2a.2.2a)
b. Sub-categories are regions such as metals, non-metals, and transition elements. Nonmetals have different physical and chemical properties than metals. For example, nonmetals have lower melting points, lower density, and are poorer conductors of electricity and heat. Chemical properties depend on the sub-shell of the valence electron which are different for metals and non-metals. (HS.2a.2.2c)

S.8.2.4 ▲ explain how a chemical reaction occurs when one or more substances (reactants) react to form a different chemical substance(s) (products). There are different types of chemical reactions all of which demonstrate the Law of Conservation of Matter and Energy. (HS.2a.3.1)

Additional Specifity: Chemical reactions are written as balanced chemical equations. In ordinary chemical reactions, the number and kind of atoms must be conserved.

S.8.2.5 ▲ explain how chemical bonds result when valence electrons are transferred or shared between atoms. (HS.2a.2.3)

Additional Specificity:

a. ionic compounds result from transferring electrons.
b. Molecular compounds, which are always covalently bonded, result from atoms sharing electrons.
c. Valence electrons are gained, lost, or shared to achieve a more stable configuration, similar to the noble gases. (HS2a.2.3a)
d. The two classifications of covalent bonds are non-polar and polar. (HS2a.2.3c)

S.8.3 Students will demonstrate an understanding of the earth's processes.

Students will…

S.8.3.1 explain that the constructive and destructive processes, including weathering, erosion, and deposition, dynamically reshape the surface of the earth.

Additional Specificity:

a. The rock cycle describes constructive and destructive processes that change the forms of rocks and soil (solid earth).
b. Water, glaciers, winds, waves, and gravity are weathering and erosion agents.

Vocabulary: constructive process, destructive process, weathering, erosion, deposition, rock cycle

S.8.3.2 show how water cycles through surface water (oceans, lakes, streams, glaciers), ground water (aquifers), and the atmosphere (hydrologic cycle).

Additional Specificity:

a. Processes of evaporation, condensation, precipitation, transpiration, runoff, and filtration move water through the water cycle.
b. Weather in the troposphere redistributes water on the surface of the earth through the water cycle.
c. Ground water is stored in aquifers and moved through underground streams.
d. Water in the atmosphere is in the form of water vapor and clouds.

Vocabulary: water (hydrologic cycle), ground water (aquifers), surface water, atmosphere, evaporation, condensation, precipitation, transpiration, runoff, filtration

S.8.4 Students will state how solar energy affects global climate and weather.

Students will…

S.8.4.1 ▲ explain that the ultimate source of atmospheric and oceanic energy comes from the sun; energy flow drives global climate and weather; and climate and weather are influenced by geographic features, cloud cover, and Earth's rotation. (HS.4.1.3)

Additional Specifity:

a. Energy from the sun heats the oceans and the atmosphere, and drives oceanic and atmospheric circulation.
b. Human activity impacts global climate. Example: Burning of fossil fuels produces ground level ozone that hinders plant growth.
c. The composition and structure of earth's atmosphere is one factor in the earth's suitability to support life.
d. Weather patterns and seasonal weather changes are multi-variable phenomena.
e. Biogeochemical cycles are an example of the integration of earth, physical, and biological science concepts.
f. Weather in the troposphere redistributes water on the surface of the earth through the water cycle.
g. The ozone layer in the upper stratosphere filters UV radiation, which is harmful to living things.
h. Gamma radiation and other high energy radiation from the sun are filtered by the upper atmosphere.
I. Concepts and skills include basic weather forecasting, weather maps, fronts, pressure systems, sever storms, and safety precautions.

Vocabulary: weather patterns, seasons, atmospheric layers, fronts, pressure systems, global climate, biogeochemical cycles, ozone layer

S.8.5 Students will demonstrate knowledge of geological time and plate tectonics.

Students will…

S.8.5.1 ▲ show how geological time is used to understand the earth's past. (HS.4.2.1)

Additional Specificity:

a. Radioactive dating and relative dating (i.e. stratigraphy, fossils) are used to estimate the time rocks were formed.
b. Earth changes can be short term (during a human's lifetime) such as earthquakes and volcanic eruptions, or long term (over a geological time scale), such as mountain building and plate movements.
c. The earth's atmosphere has changed over time. For example: The dramatic changes in earth's atmosphere (i.e. introduction of O_2) which are affected by the emergence of life on earth.
d. Relates geologic evidence to a record of earth's history.
e. Matching coastlines, similarities in rock types, similarities in fossils and life forms suggest that today's continents are separated parts of what was long ago a single continent.

Vocabulary: geologic time, geological time scale, radiometric dating, relative dating, radioactive decay, geological time scale, mass extinction, glaciations, climatic change, principle of superposition

S.8.5.2 ▲ tell how the theory of Plate Tectonics explains that internal energy drives the earth's ever changing structure. (HS.4.1.2)

Additional Specificity:

a. ▲ Moveable continental and oceanic plates make up earth's surface; the hot, convecting mantle is the energy source for plate movement. (HS.4.1.2a)
b. ▲ Convection circulation in the mantle is driven by the outward transfer of earth's internal heat. (HS.4.1.2c)
c. Essentially all energy on earth originates with the sun, is generated by radioactive decay in earth's interior, or is left over from earth's formation.
d. Systems on earth's surface are powdered principally by the sun and contain an essentially fixed amount of each stable chemical atom or element.
e. Rocks, water, CO_2/O, carbon, and other nutrients cycle through different forms as a result of cycle biological and geologic processes.

Vocabulary: plate tectonics, convection circulation, mantle, convection currents, continental drift, seismic activity, convergent plate boundary, divergent plate boundary, transform or slip, rock cycle, water cycle, CO_2 / O_2 cycle, carbon cycle, nutrient cycle, radioactive decay

S.8.6 Students will show knowledge of various aspects of space science.

Students will…

S.8.6.1 ▲ explain how the gravitational attraction of objects in the solar system keeps solar system objects in orbit. (HS.4.3.1)

Additional Specificity:

a. Kepler's law describe planetary motion
b. Newton's laws of inertia and gravity explain orbital motion
c. Because of the sun's large mass, the sun in primary gravitational force in the solar system

Vocabulary: gravitational force, Kepler's Laws of Planetary Motion, orbital motion

S.8.6.2 ▲ identify the relationship between the earth, moon, and sun, and explain the seasons, the tides and moon phases. (HS.4.3.2)

Additional Specifity:

a. The angle of incidence of solar energy striking earth's surface effect the amount of heat energy absorbed at the earth's surface.
b.. The gravitational relationship between the earth, moon, and sun causes tides.

Vocabulary: seasons, tides, moon phases (new, crescent, waxing, waning, first, third, quarter, gibbous, full), lunar eclipse, solar eclipse, earth, moon, sun, angle of incidence

S.8.6.3 ▲ describe stellar evolution. (HS.4.4.1)

Additional Specificity:

a. Condensation of gases, due to gravity, is a foundation for the formation of stars.
b. The life cycle of the star begins with the nebula, which contains mostly hydrogen and helium. Heavier elements were, and continue to be, made by the nuclear fusion reactions in stars.
c. The Hertzsprung-Russell (H-R) diagram is used to classify stars. The sun is a main sequence star.
d. Stars are classified by their color, temperature, age, apparent brightness and distance from earth.

Vocabulary: Stellar evolution, Nebula, Hertzsprung-Russell (H-R) diagram, apparent magnitude, nuclear fusion, main sequence, giants, dwarfs

S.8.6.4 demonstrate the current scientific explanation of the origin and structure of the universe. (HS.4.4.2)

Additional Specificity:

a. The formation of the universe began with an expansion of gases from a hot, dense state. By studying the light emitted from distant galaxies, it has been found that galaxies are moving apart from one another.
b. The red shift of light, within the Doppler effect, emitted by distant galaxies supports the conclusion that the universe is expanding.
c. Galaxies are a level of organization of the universe. There are at least 100 billion galaxies in the observable universe. Galaxies are organized into super clusters with large voids between them.
d. The sun is a second-generation star, which, along with our galaxy (The Milky Way, which includes about 100 billion stars), formed billions of years after the Big Bang.

Vocabulary: Doppler Effect, red shift, clusters, super clusters, levels of organization (sun, solar system, galaxy, cluster, super cluster, universe), Big Bang theory

S.8.6.5 describe how the tools of astronomy have revolutionized the study of the universe. (HS.4.4.3)

Additional Specificity:

a. Current telescopes can measure across the Electromagnetic-Spectrum.
b. Spectral analysis is used to determine chemical composition and energy of stars.
c. Relative mass of objects can be determined by observing motion of objects in space and the effect one object's gravity has on another.
d. The tools and skills of astronomers have changed through time: ancient astronomy (Stonehenge, Greeks, Chinese, Aristotle) through modern astronomy (Copernicus to present).
e. Astronomical tools and skills allow astronomers to research phenomena and objects that cannot be observed and measured directly.

Vocabulary: telescope, spectral analysis, galaxies, electromagnetic-spectrum, space shuttle, space probe, space station

S.8.7 Students will explain the importance of natural resources.

Students will…

S.8.7.1 ▲ demonstrate an understanding that natural resources from the lithosphere and ecosystems are required to sustain human populations. (HS.6.3.1)

Additional Specificity:

a. These processes of ecosystems include maintenance of the atmosphere, generations of soils, control of the hydrologic cycle, and recycling of nutrients. Humans are altering many of these processes, and the changes may be detrimental, beneficial, or both to ecosystem function.

b. Natural systems can reuse waste, but this capacity is limited. Recycling and environmentally sound decisions improve the quality of human life.