Power Indicators
Grade 9 - Science

Earth and Space

9.1.1 Describe that stars produce energy from nuclear reactions and that processes in stars have led to the formation of all elements beyond hydrogen and helium.

9.1.2 Describe the current scientific evidence that supports the theory of the explosive expansion of the universe, the Big Bang, over 10 billion years ago.

9.1.3 Explain that gravitational forces govern the characteristics and movement patterns of the planets, comets, and asteroids in the solar system.

9.1.5 Explain how the slow movement of materials within Earth results from:
a. thermal energy transfer (conduction and convection) from the deep interior;
b. the action of gravitational forces on regions of different density.

9.1.6 Explain the results of plate tectonic activity (e.g. magma generation, igneous intrusion, metamorphism, volcanic action, earthquakes, faulting and folding).

9.1.7 Explain sea-floor spreading and continental drift using scientific evidence (e.g., fossil distributions, magnetic reversals, and radiometric dating).

9.1.8 Use historical examples to explain how new ideas are limited by the context in which they are conceived; are often initially rejected by the scientific establishment; sometimes spring from unexpected findings; and usually grow slowly through contributions from many different investigators (e.g., Heliocentric Theory and Plate Tectonics Theory).

Life Sciences – N/A

Physical Science

9.3.3 Describe radioactive substances as unstable nuclei that undergo random spontaneous nuclear decay emitting particles and/or high energy wavelike radiation.

9.3.12 Explain how an object's kinetic energy depends on its mass and its speed ($KE = \frac{1}{2} mv^2$).

9.3.14 Summarize how nuclear reactions convert a small amount of matter into a large amount of energy. (Fission involves the splitting of a large nucleus into smaller nuclei; fusion is the joining of two small nuclei into a larger nucleus at extremely high energies.)

9.3.15 Trace the transformations of energy within a system (e.g., chemical to electrical to mechanical) and recognize that energy is conserved. Show that these transformations involve the release of some thermal energy.

9.3.17 Demonstrate that thermal energy can be transferred by conduction, convection, or radiation (e.g., through materials by the collision of particles, moving air masses or across empty space by forms of electromagnetic radiation.)

9.3.18 Demonstrate that electromagnetic radiation is a form of energy. Recognize that light acts as a wave. Show that visible light is a part of the electromagnetic spectrum (e.g., radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, and gamma rays).

9.3.19 Show how the properties of a wave depend on the properties of the medium through which it travels. Recognize that electromagnetic waves can be propagated without a medium.

9.3.20 Describe how waves can superimpose on one another when propagated in the same medium. Analyze conditions in which waves can bend around corners, reflect off surfaces, are absorbed by materials they enter, and change direction and speed when entering a different material.

9.3.21 Demonstrate that motion is a measurable quantity that depends on the observer's frame of reference and describe the object's motion in terms of position, velocity, acceleration, and time.

9.3.22 Demonstrate that any object does not accelerate (remains at rest or maintains a constant speed and direction of motion) unless an unbalanced (net) force acts on it.

9.3.23 Explain the change in motion (acceleration) of an object. Demonstrate that the acceleration is proportional to the net force acting on the object and inversely proportional to the mass of the object. ($F = ma$. Note that weight is the gravitational force on a mass.)

9.3.24 Demonstrate that whenever one object exerts a force on another, an equal amount of force is exerted back on the first object.

9.3.25 Demonstrate the ways in which frictional forces constrain the motion of objects (e.g., a car traveling around a curve, a block on an inclined plane, a person running, an airplane in flight).

Science and Technology

9.4.2 Identify a problem or need, propose designs, and choose among alternative solutions for the problem

9.4.3 Explain why a design should be continually assessed and the ideas of the design should be tested, adapted, and refined.

Scientific Inquiry

9.5.2 Research and apply appropriate safety precautious when designing and conducting scientific investigations (e.g., OSHA, Material Safety Data Sheets (MSDS), eyewash, goggles, and ventilation).

9.5.3 Construct, interpret, and apply physical and conceptual models that represent or explain systems, objects, events, or concepts.

9.5.6 Draw logical conclusions based on scientific knowledge and evidence from investigations.

Scientific Ways of Knowing

9.6.1 Comprehend that many scientific investigations require the contributions of women and men from different disciplines in and out of science. These people study different topics, use different techniques, and have different standards of evidence but share a common purpose – to better understand a portion of our universe.

9.6.2 Illustrate that the methods and procedures used to obtain evidence must be clearly reported to enhance opportunities for further investigations.

9.6.3 Demonstrate that reliable scientific evidence improves the ability of scientists to offer accurate predictions.

9.6.6 Explain that inquiry fuels observation and experimentation that produce data that are the foundation of scientific disciplines. Theories are explanations of these data.

9.6.8 Illustrate that much can be learned about the internal workings of science and the nature of science from the study of scientists, their daily work. And their efforts to advance scientific knowledge in their area of study.

9.6.9 Investigate how the knowledge, skills, and interests learned in science classes apply to the careers students plan to pursue.