Virtual Learning Academy
Jefferson County Educational Service Center
Academic Content Standards
Differentiated Physical Science 9

Lesson 01: Observation and Inference

(D) Observation and Inference

Standard Benchmark and Indicator
S05. Scientific Inquiry
A. Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations. (09-10)
01. Distinguish between observations and inferences given a scientific situation. (09)

Lesson 02: Scientific Method, Lab Safety and Scientific Investigation

(D) Scientific Method, Lab Safety and, Scientific Investigations

Standard Benchmark and Indicator
S05. Scientific Inquiry
A. Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations. (09-10)
02. Research and apply appropriate safety precautions when designing and conducting scientific investigations (e.g., OSHA, Material Safety Data Sheets [MSDS], eyewash, goggles and ventilation). (09)

Lesson 03: Contributions of Science, Accuracy and Ethical Practices

(D) Contributions of Science, Accuracy and Ethical Practices

Standard Benchmark and Indicator
S06. Scientific Ways of Knowing
A. Explain that scientific knowledge must be based on evidence, be predictive, logical, subject to modification and limited to the natural world. (09-10)
01. 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. (09)
C. Describe the ethical practices and guidelines in which science operates. (09-10)
02. Illustrate that the methods and procedures used to obtain evidence must be clearly reported to enhance opportunities for further investigations. (09)
04. Explain how support of ethical practices in science (e.g., individual observations and confirmations, accurate reporting, peer review and publication) are required to

reduce bias. (09)

Lesson 04: Parts of an Atom and Charge of Atomic Particles

(D) Parts of an Atom and Charge of Atomic Particles

Standard Benchmark and Indicator
S03. Physical Sciences
A. Describe that matter is made of minute particles called atoms and atoms are comprised of even smaller components. Explain the structure and properties of atoms. (09-10)
01. Recognize that all atoms of the same element contain the same number of protons, and elements with the same number of protons may or may not have the same mass. Those with different masses (different numbers of neutrons) are called isotopes. (09)
02. Illustrate that atoms with the same number of positively charged protons and negatively charged electrons are electrically neutral. (09)

Lesson 05: Ions, Electric Forces, and Formation of Compounds

(D) Ions, Electric Forces, and Formation of Compounds

Standard Benchmark and Indicator
S03. Physical Sciences
A. Describe that matter is made of minute particles called atoms and atoms are comprised of even smaller components. Explain the structure and properties of atoms. (09-10)
05. Describe how ions are formed when an atom or a group of atoms acquire an unbalanced charge by gaining or losing one or more electrons. (09)
B. Explain how atoms react with each other to form other substances and how molecules react with each other or other atoms to form even different substances. (09-10)
06. Explain that the electric force between the nucleus and the electrons hold an atom together. Relate that on a larger scale, electric forces hold solid and liquid materials together (e.g., salt crystals and water). (09)
07. Show how atoms may be bonded together by losing, gaining or sharing electrons and that in a chemical reaction, the number, type of atoms and total mass must be the same before and after the reaction (e.g., writing correct chemical formulas and writing balanced chemical equations). (09)

Lesson 06: Periodic Properties

(D) Periodic Properties, Atomic Number, and Electron Configurations

Standard Benchmark and Indicator

atoms. (09-10)
04. Show that when elements are listed in order according to the number of protons (called the atomic number), the repeating patterns of physical and chemical properties identify families of elements. Recognize that the periodic table was formed as a result of the repeating pattern of electron configurations. (09)

Lesson 07: Compounds and Writing Formulas

(D) Compounds and Writing Formulas for Compounds

Standard Benchmark and Indicator
S03. Physical Sciences
B. Explain how atoms react with each other to form other substances and how molecules react with each other or other atoms to form even different substances. (09-10)
07. Show how atoms may be bonded together by losing, gaining or sharing electrons and that in a chemical reaction, the number, type of atoms and total mass must be the same before and after the reaction (e.g., writing correct chemical formulas and writing balanced chemical equations). (09)

Lesson 08: Chemical Equations and Writing Formulas for Compounds

(D) Chemical Equations and Writing Formulas for Compounds

Standard Benchmark and Indicator
S03. Physical Sciences
B. Explain how atoms react with each other to form other substances and how molecules react with each other or other atoms to form even different substances. (09-10)
07. Show how atoms may be bonded together by losing, gaining or sharing electrons and that in a chemical reaction, the number, type of atoms and total mass must be the same before and after the reaction (e.g., writing correct chemical formulas and writing balanced chemical equations). (09)

Lesson 09: Acids, bases and the PH Scale

(D) Acids, Bases, and the pH Scale

Standard Benchmark and Indicator
S03. Physical Sciences
B. Explain how atoms react with each other to form other substances and how molecules react with each other or other atoms to form even different substances. (09-10)
08. Demonstrate that the pH scale (0-14) is used to measure acidity and classify substances or solutions as acidic, basic, or neutral. (09)

Lesson 10: Properties of pure substances and Mixtures and Conductivity of Different Materials

(D) Properties of Pure Substances and Mixtures and Conductivity of Different Materials

Standard Benchmark and Indicator
S03. Physical Sciences
C. Describe the identifiable physical properties of substances (e.g., color, hardness, conductivity, density, concentration and ductility). Explain how changes in these properties can occur without changing the chemical nature of the substance. (09-10)
09. Investigate the properties of pure substances and mixtures (e.g., density, conductivity, hardness, properties of alloys, superconductors and semiconductors). (09)
10. Compare the conductivity of different materials and explain the role of electrons in the ability to conduct electricity. (09)

Lesson 11: Thermal Energy

(D) Thermal Energy, Potential Energy and Kinetic Energy

Standard Benchmark and Indicator
S03. Physical Sciences
E. Demonstrate that energy can be considered to be either kinetic (motion) or potential (stored). (09-10)
12. Explain how an object's kinetic energy depends on its mass and its speed ((09)
13. Demonstrate that near Earth's surface an object's gravitational potential energy depends upon its weight ((09)
F. Explain how energy may change form or be redistributed but the total quantity of energy is conserved. (09-10)
11. Explain how thermal energy exists in the random motion and vibrations of atoms and molecules. Recognize that the higher the temperature, the greater the average atomic or molecular motion, and during changes of state the temperature remains constant. (09)

Lesson 12: Transformation of Energy, Fission , Fusion and Exothermic and Endothermic

(D) Transformation of Energy, Fission, Fusion, and Exothermic and Endothermic

Standard Benchmark and Indicator
S03. Physical Sciences
F. Explain how energy may change form or be redistributed but the total quantity of energy is conserved. (09-10)

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.) (09)
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. (09)
16. Illustrate that chemical reactions are either endothermic or exothermic (e.g., cold packs, hot packs and the burning of fossil fuels). (09)

Lesson 13: Transformation of Energy, Conduction, Convection, and Radiation

(D) Transformation of Energy, Conduction, Convection, and Radiation

Standard Benchmark and Indicator
S03. Physical Sciences
F. Explain how energy may change form or be redistributed but the total quantity of energy is conserved. (09-10)
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). (09)

Lesson 14: Electromagnetic Radiation and Properties of Waves

(D) Electromagnetic Radiation and Properties of Waves

Standard Benchmark and Indicator
S03. Physical Sciences
G. Demonstrate that waves (e.g., sound, seismic, water and light) have energy and waves can transfer energy when they interact with matter. (09-10)
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). (09)
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. (09)

Lesson 15: Wave Interactions and Properties of Waves

(D) Wave Interactions and Properties of Waves

Standard Benchmark and Indicator
S03. Physical Sciences
F. Explain how energy may change form or be redistributed but the total quantity of energy is conserved. (09-10)
03. Describe radioactive substances as unstable nuclei that undergo random spontaneous nuclear decay emitting particles and/or high energy wavelike radiation.

03. Describe radioactive substances as unstable nuclei that undergo random spontaneous nuclear decay emitting particles and/or high energy wavelike radiation. (09)

Lesson 16: Forces and Motion, and Frame of Reference

(D) Forces and Motion, and Frame of Reference

Standard Benchmark and Indicator
S03. Physical Sciences
D. Explain the movement of objects by applying Newton's three laws of motion. (09-10)
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. (09)

Lesson 17: Forces and Motion, and Relationship Between Forces and Motion

(D) Forces and Motion, and Relationship Between Forces and Motion

Standard Benchmark and Indicator
S03. Physical Sciences
D. Explain the movement of objects by applying Newton's three laws of motion. (09-10)
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. (09)
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 (09)

Lesson 18: Forces and Friction

(D) Forces and Friction

Standard Benchmark and Indicator
S03. Physical Sciences
D. Explain the movement of objects by applying Newton's three laws of motion. (09-10)
24. Demonstrate that whenever one object exerts a force on another, an equal amount of force is exerted back on the first object. (09)
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). (09)

Lesson 19: Historical Perspectives, and Growth Throughout History

(D) Historical Perspectives and Growth Throughout History

Standard Benchmark and Indicator
S03. Physical Sciences
H. Trace the historical development of scientific theories and ideas, and describe emerging issues in the study of physical sciences. (09-10)
26. 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., atomic theory, quantum theory and Newtonian mechanics). (09)
27. Describe advances and issues in physical science that have important, long-lasting effects on science and society (e.g., atomic theory, quantum theory, Newtonian mechanics, nuclear energy, nanotechnology, plastics, ceramics and communication technology). (09)

Lesson 20: Benefits and Risks of Technology and Public Information

(D) Benefits and Risks of Technology and Public Information

Standard Benchmark and Indicator
S04. Science and Technology
B. Explain that science and technology are interdependent; each drives the other. (09-10)
01. Describe means of comparing the benefits with the risks of technology and how science can inform public policy. (09)

Lesson 21: Identify a Problem, Propose Solutions, and Assessment of Designs

(D) Identify a Problem, Propose Solutions and Assessment of Designs

Standard Benchmark and Indicator
S04. Science and Technology
A. Explain the ways in which the processes of technological design respond to the needs of society. (09-10)
02. Identify a problem or need, propose designs and choose among alternative solutions for the problem. (09)
03. Explain why a design should be continually assessed and the ideas of the design should be tested, adapted and refined. (09)

Lesson 22: Significant Figures, Precision, and Accuracy

(D) Significant Figures, Precision and Accuracy

Standard Benchmark and Indicator
S05. Scientific Inquiry
A. Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations. (09-10)
04. Decide what degree of precision based on the data is adequate and round off the results of calculator operations to the proper number of significant figures to reasonably reflect those of the inputs. (09)

Lesson 23: Inquiry, Theory, and Building of Scientific Knowledge

(D) Inquiry, Theory and Building of Scientific Knowledge

Standard Benchmark and Indicator
S06. Scientific Ways of Knowing
B. Explain how scientific inquiry is guided by knowledge, observations, ideas and questions. (09-10)
06. Explain that inquiry fuels observation and experimentation that produce data that are the foundation of scientific disciplines. Theories are explanations of these data. (09)
07. Recognize that scientific knowledge and explanations have changed over time, almost always building on earlier knowledge. (09)

Lesson 24: Science and Careers

(D) Science and Careers

Standard Benchmark and Indicator
S06. Scientific Ways of Knowing
D. Recognize that scientific literacy is part of being a knowledgeable citizen. (09-10)
09. Investigate how the knowledge, skills and interests learned in science classes apply to the careers students plan to pursue. (09)

Lesson 25: Stars

(D) Stars

Standard Benchmark and Indicator
S01. Earth and Space Sciences
A. Explain how evidence from stars and other celestial objects provide information about the processes that cause changes in the composition and scale of the physical universe. (09-10)
01. 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. (09)

01. 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. (09)

Lesson 26: Big Bang Theory

(D) Big Bang Theory

Standard Benchmark and Indicator
S01. Earth and Space Sciences
A. Explain how evidence from stars and other celestial objects provide information about the processes that cause changes in the composition and scale of the physical universe. (09-10)
02. Describe the current scientific evidence that supports the theory of the explosive expansion of the universe, the Big Bang, over 10 billion years ago. (09)

Lesson 27: Plate Tectonics and Landforms

(D) Plate Tectonics and Landforms

Standard Benchmark and Indicator
S01. Earth and Space Sciences
B. Explain that many processes occur in patterns within the Earth's systems. (09-10)
04. Explain the relationships of the oceans to the lithosphere and atmosphere (e.g., transfer of energy, ocean currents and landforms). (09)

Lesson 28: Conduction, Convection and Energy Transfer

(D) Conduction, Convection and Energy Transfer

Standard Benchmark and Indicator
S01. Earth and Space Sciences
E. Explain the processes that move and shape Earth's surface. (09-10)
05. Explain how the slow movement of material within Earth results from: (09)

Lesson 29: Earth Quakes, Faults and Volcanoes

(D) Earthquakes, Faults and Volcanoes

Standard Benchmark and Indicator

E. Explain the processes that move and shape Earth's surface. (09-10)
06. Explain the results of plate tectonic activity (e.g., magma generation, igneous intrusion, metamorphism, volcanic action, earthquakes, faulting and folding). (09)

Lesson 30: Sea Floor Spreading, Continental Drift, and Fossils

(D) Sea Floor Spreading, Continental Drift and Fossils

Standard Benchmark and Indicator
S01. Earth and Space Sciences
E. Explain the processes that move and shape Earth's surface. (09-10)
07. Explain sea-floor spreading and continental drift using scientific evidence (e.g., fossil distributions, magnetic reversals and radiometric dating). (09)

Lesson 31: Conceptual Model

(D) Conceptual Model

Standard Benchmark and Indicator
S05. Scientific Inquiry
A. Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations. (09-10)
03. Construct, interpret and apply physical and conceptual models that represent or explain systems, objects, events or concepts. (09)

Lesson 32: Logical Conclusions, and Evidence From Investigations

(D) Logical Conclusions and Evidence From Investigations

Standard Benchmark and Indicator
S05. Scientific Inquiry
A. Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations. (09-10)
05. Develop oral and written presentations using clear language, accurate data, appropriate graphs, tables, maps and available technology. (09)

Lesson 33: Written Presentation, Accurate Data, and Clear Language

(D) Written Presentation, Accurate Data and Clear Language

Standard Benchmark and Indicator
S05. Scientific Inquiry
A. Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations. (09-10)
05. Develop oral and written presentations using clear language, accurate data, appropriate graphs, tables, maps and available technology. (09)
06. Draw logical conclusions based on scientific knowledge and evidence from investigations. (09)

Lesson 34: Radioactivity and Nuclear Decay

(D) Radioactivity and Nuclear Decay

Standard Benchmark and Indicator
S03. Physical Sciences
F. Explain how energy may change form or be redistributed but the total quantity of energy is conserved. (09-10)
03. Describe radioactive substances as unstable nuclei that undergo random spontaneous nuclear decay emitting particles and/or high energy wavelike radiation. (09)

Lesson 35: Gravitational Force and Planet Movement

(D) Gravitational Force and Planet Movement

Standard Benchmark and Indicator
S01. Earth and Space Sciences
C. Explain the 4.5 billion-year-history of Earth and the 4 billion-year-history of life on Earth based on observable scientific evidence in the geologic record. (09-10)
03. Explain that gravitational forces govern the characteristics and movement patterns of the planets, comets and asteroids in the solar system. (09)

Lesson 36: Science and Society

(D) Science and Society

Standard Benchmark and Indicator
S06. Scientific Ways of Knowing
D. Recognize that scientific literacy is part of being a knowledgeable citizen. (09-
08. Illustrate that much can be learned about the internal workings of science and

to advance scientific knowledge in their area of study. (09)