

Nevada Science HSPE
 Benchmarks/Item Specifications Edited 10/13/05

Strand/ Benchmark	Nevada Science HSPE Benchmarks Description/Specification
C1 Physical Science	
P.12.A.1	<p>Students know different molecular arrangements and motions account for the different physical properties of solids, liquids, and gases. E/S</p> <p>Distinguish between solids, liquids, and gases in models and diagrams of molecular arrangement and/or motion.</p> <p>Describe the motion of particles in solids, liquids, and gases and use kinetic-molecular theory to explain properties of the states of matter.</p>
P.12.A.2	<p>Students know elements in the periodic table are arranged into groups and periods by repeating patterns and relationships. E/S</p> <p>Explain why elements in the main groups (metals, nonmetals, alkali metals, alkaline earths, halogens, and noble [inert] gases) on the periodic table have similar properties.</p> <p>Know the positions of metals and non-metals on the periodic table.</p> <p>Describe the differences between metals and non-metals.</p> <p>Describe periodic trends in atomic mass in atomic number.</p> <p>Distinguish between the atomic number and the atomic mass of an element.</p> <p>Given the atomic number and atomic mass for a given isotope of any element in the periodic table, determine the number of electrons, protons, and neutrons. (See also P.12.A.8.)</p>
P.12.A.3	<p>Students know identifiable properties can be used to separate mixtures. E/S</p> <p>Distinguish between mixtures and compounds.</p> <p>Distinguish between heterogeneous and homogeneous mixtures.</p> <p>Design separation processes based on properties (e.g., magnetism, solubility, density, boiling point, and properties that lend themselves to mechanical sorting).</p>
P.12.A.4	<p>Students know atoms bond with one another by transferring or sharing electrons. E/S</p> <p>Know that bonding electrons are outer electrons.</p> <p>Distinguish between ionic and covalent bonding in terms of electron configurations before and after bond formation.</p> <p>Predict bond type based on relative positions in periodic table (e.g., alkali metal and halogen, and typical organic compounds).</p>
P.12.A.5	<p>Students know chemical reactions can take place at different rates, depending on a variety of factors (i.e. temperature, concentration, surface area, and agitation). E/S</p> <p>Describe factors affecting the rate at which a reaction proceeds and predict the result of a given factor on the reaction rate.</p> <p>Explain chemical changes in terms of the motion of atoms and molecules and relate changes in motion to changes in factors affecting reaction rate.</p> <p>Understand the effect of catalysts on reaction rate.</p>
P.12.A.6	<p>Students know chemical reactions either release or absorb energy. E/S</p> <p>Distinguish between and give examples of endothermic and exothermic reactions.</p>
P.12.A.7	<p>Students know that, in chemical reactions, elements combine in predictable ratios, and the numbers of atoms of each element do not change. I/S</p> <p>Identify the reactants and products in a simple chemical reaction.</p> <p>Explain how a chemical reaction satisfies the law of conservation of mass.</p> <p>Interpret chemical equations to determine the relative number of atoms of reactants and products.</p> <p>Explain how the law of definite proportions allows for predictions of reaction amounts.</p>

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P.12.A.8	<p>Students know most elements have two or more isotopes, some of which have practical applications. I/S</p> <p>Know that isotopes of an element have different numbers of neutrons and the same number of protons.</p> <p>Describe practical applications of isotopes of various elements (e.g., hydrogen [deuterium and tritium], carbon-14, uranium-235, and cobalt-60).</p> <p>Know the meanings of subscripts and superscripts in a nuclear symbol. (See also P.12.A.2 and P.12.C.4.)</p>
P.12.A.9	<p>Students know the number of electrons in an atom determines whether the atom is electrically neutral or an ion. I/S</p> <p>Know that the numbers of protons and electrons determine whether an atom is neutral, or has an electrical charge.</p> <p>Given the number protons and electrons, determine the magnitude and sign of the charge on an ion.</p>
P.12.B.1	<p>Students know laws of motion can be used to determine the effects of forces on the motion of objects. E/S</p> <p>Apply Newton's three laws of motion to physical situations. (Knowing the number of each law is not core knowledge.)</p> <p>Understand how the strength of the net force and mass of an object determine the amount of change in an object's motion (includes the effects of the force of gravity on objects).</p> <p>Explain how friction affects the motion of an object.</p> <p>Given distance vs. time and velocity vs. time plots, interpret, predict, and draw conclusions about different types of motion. (See also N.12.A.1.)</p> <p>Identify simple machines and understand how they change and/or redirect force, and know that the amount of work remains unchanged.</p>
P.12.B.2	<p>Students know magnetic forces and electric forces can be thought of as different aspects of electromagnetic force. I/S</p> <p>Describe the relationship between electric currents and magnetic fields.</p> <p>Use the concept of electromagnetic induction to explain the operation of generators and transformers.</p>
P.12.B.3	<p>Students know the strength of the electric force between two objects increases with charge and decreases with distance. I/S</p> <p>Explain how electric forces change when the distance between the two charges changes and/or when the magnitude of the charges changes.</p>
P.12.B.4	<p>Students know the strength of the gravitational force between two objects increases with mass and decreases rapidly with distance. I/S</p> <p>Distinguish between mass and weight.</p> <p>Define gravitational force and gravitational potential energy.</p> <p>Explain that gravitational force becomes stronger as the masses increase and rapidly become weaker as the distance between the objects increases.</p>
P.12.C.1	<p>Students know waves (i.e. sound, seismic, electromagnetic) have energy that can be transferred when the waves interact with matter. E/S</p> <p>Distinguish between transverse waves and longitudinal waves.</p> <p>Know that waves transfer energy without transferring matter.</p> <p>Describe how waves behave when they meet an obstacle, pass into another medium, or encounter another wave.</p>
P.12.C.2	<p>Students know energy forms can be converted. E/S</p> <p>Know that heat is often produced as a byproduct when one form of energy is converted to another form (e.g., when machines and living organisms convert stored energy to motion).</p> <p>Understand that energy cannot be created or destroyed, but only changed from one form to another.</p>

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P.12.C.3	<p>Students know nuclear reactions convert a relatively small amount of material into a large amount of energy. I/S</p> <p>Distinguish between fission and fusion, and provide examples of each.</p> <p>Know that a large amount of energy is produced from a relatively small amount of material in a nuclear reaction.</p>
P.12.C.4	<p>Students know characteristics, applications and impacts of radioactivity. E/S</p> <p>Describe the dangers and possible health hazards caused by of exposure to nuclear radiation.</p> <p>Identify several beneficial uses of nuclear radiation.</p> <p>Explain the benefits and drawbacks of nuclear power related to radiation. (See also P.12.A.8.)</p>
P.12.C.5	<p>Students know the relationship between heat and temperature. I/S</p> <p>Distinguish between heat and temperature in terms of the kinetic energy of particles.</p>
P.12.C.6	<p>Students know electricity is transferred from generating sources for consumption and practical uses. I/S</p> <p>Describe various methods for generating electricity.</p> <p>Understand the processes by which various forms of energy (e.g., chemical, mechanical, and electromagnetic) are converted to energy in the form of electrical current.</p> <p>Diagram or trace the transfer of electricity from generating sources to end uses by consumers.</p>

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C2 Life Science	
L.12.A.1	<p>Students know genetic information passed from parents to offspring is coded in the DNA molecule. E/S</p> <p>Know the location of the DNA molecule and the shape of its double helix structure.</p> <p>Know that DNA copies itself.</p> <p>Understand that DNA contains hereditary information.</p>
L.12.A.2	<p>Students know DNA molecules provide instructions for assembling protein molecules. E/S</p> <p>Know that DNA code carries instructions for making protein molecules.</p>
L.12.A.3	<p>Students know all body cells in an organism develop from a single cell and contain essentially identical genetic instructions. E/S</p> <p>Understand that organisms grow when their cells divide and differentiate.</p> <p>Know that all body cells in an organism have fundamentally the same DNA.</p>
L.12.A.4	<p>Students know several causes and effects of somatic versus sex cell mutations. E/S</p> <p>Describe the difference between sex cells and somatic cells in an organism.</p> <p>Recognize that DNA in sperm cells is different from DNA in egg cells.</p> <p>Know that mutations in sex cells may be passed on to offspring.</p> <p>Know that mutations in somatic cells are not passed on to offspring.</p> <p>Understand that environmental factors may cause mutations in DNA in both somatic cells and sex cells.</p>
L.12.A.5	<p>Students know how to predict patterns of inheritance. E/S</p> <p>Explain how reproduction is responsible for genetic variation.</p> <p>Use a Punnett Square to predict the proportion of specific genetic traits in offspring.</p>
L.12.B.1	<p>Students know cell structures and their functions. E/S</p> <p>Identify cell structures and their functions (i.e., nucleus, chloroplasts, cell wall, cell membrane, mitochondria, and vacuoles).</p> <p>Distinguish between plant and animal cells based on their structures.</p>
L.12.B.2	<p>Students know the human body has a specialized anatomy and physiology composed of a hierarchical arrangement of differentiated cells. E/S</p> <p>Identify human body systems and describe their functions (i.e., respiratory, circulatory, skeletal, digestive, reproductive, muscular, and nervous).</p> <p>Distinguish relationships among cells, tissues, organs, organ systems and organisms and know their hierarchical order.</p>
L.12.B.3	<p>Students know disease disrupts the equilibrium that exists in a healthy organism. E/S</p> <p>Recognize that pathogens and environmental and genetic factors disrupt system functions.</p> <p>Describe ways that an imbalance in one organ system affects the entire organism.</p>
L.12.C.1	<p>Students know relationships of organisms and their physical environment E/S</p> <p>Describe the energy relationships in an ecosystem.</p> <p>Know how to classify an organism by the manner in which it obtains energy.</p> <p>Describe how an organism's needs are met by aspects of its physical environment.</p>

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L.12.C.2	<p>Students know how changes in an ecosystem can affect biodiversity and biodiversity's contribution to an ecosystem's stability. E/S</p> <p>Relate changes in ecosystem stability to biodiversity.</p> <p>Recognize that ecosystems change over time.</p> <p>Predict consequences of an environmental change.</p>
L.12.C.3	<p>Students know the amount of living matter an environment can support is limited by the availability of matter, energy, and the ability of the ecosystem to recycle materials. E/S</p> <p>Understand that different environments have different carrying capacities, know the factors that affect carrying capacity, and predict the result of changing one of the factors.</p>
L.12.C.4	<p>Students know the unique geologic, hydrologic, climatic, and biological characteristics of Nevada's bioregions. E/S</p> <p>Recognize the distinguishing characteristics of the Mojave Desert, alpine forest, and basin and range bioregions.</p>
L.12.D.1	<p>Students know organisms can be classified based on evolutionary relationships. E/S</p> <p>Know the types of evolutionary relationships and explain how each type provides evidence of evolution (e.g., DNA, morphology, physiology, and fossils).</p>
L.12.D.2	<p>Students know similarity of DNA sequences gives evidence of relationships between organisms. E/S</p> <p>Know that biochemical evidence for evolution is based on DNA data.</p> <p>Identify relationships between organisms based on similarities in DNA sequences.</p>
L.12.D.3	<p>Students know the fossil record gives evidence for natural selection and its evolutionary consequences. E/S</p> <p>Recognize patterns of diversity observed throughout geologic history.</p> <p>Identify evidence for biological evolution gathered by scientists and others from the fields of biology (including biochemistry and molecular genetics) and geology.</p>
L.12.D.4	<p>Students know the extinction of species can be a natural process. E/S</p> <p>Recognize that most species that have lived on Earth are now extinct.</p> <p>Understand that extinction can be slow or rapid.</p>
L.12.D.5	<p>Students know biological evolution explains diversity of life. E/S</p> <p>Understand that organisms change over time as a result of biological evolution.</p> <p>Know that all populations have some genetic variations.</p>
L.12.D.6	<p>Students know the concepts of natural and artificial selection. E/S</p> <p>Understand that naturally occurring genetic variation may result in reproductive advantages.</p> <p>Understand that humans use artificial selection to produce desired traits in other organisms.</p>

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C3 Earth and Space Science	
E.12.A.1	<p>Students know the Sun is the major source of Earth's energy, and provides the energy driving Earth's weather and climate. E/S</p> <p>Explain how solar energy powers the water cycle.</p> <p>Explain how uneven heating of Earth's surface determines weather and climate patterns.</p>
E.12.A.2	<p>Students know the composition of Earth's atmosphere has changed in the past and is changing today. I/S</p> <p>Explain how variations in the ozone layer affect the amount of ultraviolet radiation entering the Earth's atmosphere.</p> <p>Describe how life forms have affected the composition of the atmosphere over time.</p> <p>Describe how natural events have affected the composition of the atmosphere over time (e.g., volcanoes and meteorites).</p>
E.12.A.3	<p>Students understand the role of the atmosphere in Earth's greenhouse effect. E/S</p> <p>Understand how the proportions of gases in the atmosphere affect weather and climate.</p> <p>Identify sources of greenhouse gases.</p> <p>Understand why a certain level of greenhouse effect is essential for life on Earth.</p>
E.12.A.4	<p>Students know convection and radiation play important roles in moving heat energy in the Earth system. E/S</p> <p>Explain how the processes of radiation, conduction, and convection occur in the atmosphere and how these processes affect weather and climate.</p>
E.12.A.5	<p>Students know Earth's rotation affects winds and ocean currents. I/S</p> <p>Understand that wind and ocean currents form global patterns based on Earth's rotation.</p>
E.12.B.1	<p>Students know common characteristics of stars. I/S</p> <p>Understand that stars have a life cycle.</p> <p>Know that stars change in temperature, size, color, and brightness as they age.</p> <p>Know the general relationship between the color and temperature of stars.</p>
E.12.B.2	<p>Students know stars are powered by nuclear fusion of lighter elements into heavier elements, which results in the release of large amounts of energy. I/S</p> <p>Know that stars are composed mostly of hydrogen and helium and ultimately produce all other elements through nuclear reactions.</p>
E.12.B.3	<p>Students know ways in which technology has increased understanding of the universe. I/S</p> <p>Describe the uses of optical and radio telescopes, probes, and artificial satellites in astronomy.</p>
E.12.B.4	<p>Students know the on-going processes involved in star formation and destruction. W/L</p>
E.12.B.5	<p>Students know scientific evidence suggest that the universe is expanding. I/S</p> <p>Understand the red shift effect and know that the most distant objects have the greatest degree of red shift.</p>

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E.12.C.1	<p>Students know how successive rock strata and fossils can be used to confirm the age, history, and changing life forms of the Earth, including how this evidence is affected by the folding, breaking, and uplifting of layers. E/S</p> <p>Explain how sedimentary rocks form.</p> <p>Know the basics of the process of fossil formation.</p> <p>Apply the principles of superposition to relative dating of rock layers.</p> <p>Understand the principles of absolute dating.</p>
E.12.C.2	<p>Students understand the concept of plate tectonics including the evidence that supports it (structural, geophysical and paleontological evidence). E/S</p> <p>Know that the locations and shapes of continents have varied over time based on tectonic plate movement resulting from convection in Earth's mantle.</p> <p>Describe the evidence for seafloor spreading.</p> <p>Describe the three major types of tectonic plate boundaries.</p>
E.12.C.3	<p>Students know elements exist in fixed amounts and move through solid earth, oceans, atmosphere and living things as part of biogeochemical cycles. E/S</p> <p>Understand the dynamics of the rock cycle, the carbon cycle, the nitrogen cycle, and the water cycle.</p>
E.12.C.4	<p>Students know processes of obtaining, using, and recycling of renewable and non-renewable resources. E/S</p> <p>Distinguish between renewable and non-renewable resources.</p> <p>Describe how recycling reduces the rate of depletion of nonrenewable resources.</p> <p>Identify the processes used to obtain natural resources (e.g., mining, oil production, water, and agriculture).</p>
E.12.C.5	<p>Students know soil, derived from weathered rocks and decomposed organic material, is found in layers. E/S</p> <p>Describe the structure of soil, its components, and how it is formed.</p>

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C4 Nature of Science	
N.12.A.1	<p>Students know tables, charts, illustrations and graphs can be used in making arguments and claims in oral and written presentations. E/S</p> <p>Given a choice of several graphs, select the one most appropriate to display a collection of data or to illustrate a concept or conclusion.</p> <p>Interpret a graph, table, or chart and analyze the data display to reveal information.</p> <p>Predict (extrapolate and interpolate) from a data display. (See also P.12.B.1.)</p>
N.12.A.2	<p>Students know scientists maintain a permanent record of procedures, data, analyses, decisions, and understandings of scientific investigations. I/S</p> <p>Recognize proper data collection and recording procedures in various scenarios.</p>
N.12.A.3	<p>Students know repeated experimentation allows for statistical analysis and unbiased conclusions. E/S</p> <p>Understand that repeated trials and increased sample size increase the validity of experimental results.</p> <p>Explain the importance of independent replication of experimental results.</p> <p>Given two or more sets of data among which there is some disagreement, discuss conclusions that can or cannot be supported based on the combined data.</p>
N.12.A.4	<p>Students know how to safely conduct an original scientific investigation using the appropriate tools and technology. E/S</p> <p>Understand the use of proper experimental controls and control groups in experimental designs.</p> <p>Recognize a testable question.</p> <p>Describe proper and appropriate use of lab equipment.</p> <p>Understand safety considerations in lab procedures.</p> <p>Evaluate an experimental design.</p>
N.12.A.5	<p>Students know models and modeling can be used to identify and predict cause-effect relationships. I/S</p> <p>Describe how models are used in science.</p> <p>Use models and modeling to illustrate relationships and predict outcomes.</p> <p>Evaluate the appropriateness of a model.</p>
N.12.A.6	<p>Students know organizational schema can be used to represent and describe relationships of sets. E/S</p> <p>Recognize that each branch of science has developed classification systems based on observable characteristics.</p> <p>Understand that scientists use various classification systems to organize information.</p> <p>Understand that classification systems can be modified over time to account for new information.</p>

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N.12.B.1	<p>Students know science, technology, and society influenced one another in both positive and negative ways. E/S</p> <p>Describe how science and technology benefit each other.</p> <p>Describe how scientific events and discoveries have positively and negatively influenced society.</p> <p>Describe how technology has positively and negatively affected society.</p> <p>Describe how societal needs and pressures influence the course of scientific research and technological advances.</p> <p>Describe how technological advances frequently have unintended consequences that are not initially evident.</p>
N.12.B.2	<p>Students know consumption patterns, conservation efforts, and cultural or social practices in countries have varying environmental impacts. E/S</p> <p>Identify the benefits and hazards of the environmental impact of human activities (e.g., consumption, conservation, and cultural and social practices).</p>
N.12.B.3	<p>Students know the influence of ethics on scientific enterprise. E/S</p> <p>Identify “ethical” and “unethical” practices in scientific research and describe the differences between them (e.g., treatment of test subjects and falsifying data).</p> <p>Identify potential sources of intentional bias in scientific endeavors and explain the motives and consequences (e.g., financial pressures related to funding and choosing experiments most likely to support a favored hypothesis).</p>
N.12.B.4	<p>Students know scientific knowledge builds on previous information. E/S</p> <p>Understand that existing theories are modified as new information is added.</p> <p>Understand that occasionally a completely new theory changes the way we interpret information and understand phenomenon.</p> <p>Understand the significance of the history of science in relation to the step-by-step development of our current scientific understanding of the natural world.</p>