

NEVADA GRADE HS SCIENCE
Benchmarks and Item Specifications – July 2009

C-1 PHYSICAL SCIENCE		
Standard	Matter – Matter has various states with unique properties that can be used as basis for organization. The relationship between the properties of matter and its structure is an essential component of study in the physical sciences. The understanding of matter and its properties leads to practical applications, such as the capability to liberate elements from ore, create new drugs, manipulate the structure of genes and synthesize polymers.	
Indicator	DOK**	Item Specifications
P.12.A.1 Students know different molecular arrangements and motions account for the different physical properties of solids, liquids, and gases. E/S	DOK 2	<ul style="list-style-type: none"> • Given a diagram, choose the molecular arrangement that best describes a solid, liquid, or gas • Recognize the differences between solids, liquids, and gases. • Analyze the motion of particles in solids, liquids, and gases. • Explain properties of the states of matter using kinetic-molecular theory.
P.12.A.2 Students know elements in the periodic table are arranged into groups and periods by repeating patterns and relationships. E/S	DOK 2	<ul style="list-style-type: none"> • 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. • Identify the positions of metals and non-metals on the periodic table. • Classify elements as metals and non-metals. • Predict periodic trends in atomic mass and atomic number. • Recognize the difference between the atomic number and the atomic mass of an element. • Calculate the number of electrons, protons, and neutrons given the atomic number and atomic mass for a given isotope of any element in the periodic table. (See also P.12.A.8.)
P.12.A.3 Students know identifiable properties can be used to separate mixtures. E/S	DOK 2	<ul style="list-style-type: none"> • Identify mixtures and compounds. • Identify heterogeneous and homogeneous mixtures. • Design separation processes based on properties (e.g., magnetism, solubility, density, boiling point, and properties that lend themselves to mechanical sorting).
P.12.A.4 Students know atoms bond with one another	DOK 2	<ul style="list-style-type: none"> • Recognize that bonding electrons are outer electrons.

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by transferring or sharing electrons. E/S		<ul style="list-style-type: none"> • Explain the difference between ionic and covalent bonding. • Predict bond type based on relative positions in periodic table (e.g., alkali metal and halogen, and typical organic compounds).
P.12.A.5 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	DOK 2	<ul style="list-style-type: none"> • Describe factors affecting the rate at which a reaction proceeds. • Predict the result of a given factor on the reaction rate. • Identify the effect of catalysts on reaction rate. • Design an experiment that can change the rate of a reaction.
P.12.A.6 Students know chemical reactions either release or absorb energy. E/S	DOK 2	<ul style="list-style-type: none"> • Identify the presence of energy as a component of every chemical reaction. • Given an energy diagram, predict whether a process is exothermic or endothermic.
P.12.A.7 Students know that, in chemical reactions, elements combine in predictable ratios, and the numbers of atoms of each element do not change. I/S	DOK 2	<ul style="list-style-type: none"> • Explain how a chemical reaction satisfies the law of conservation of mass. • Balance simple chemical reaction equations using simple whole number ratios and the conservation of mass principle. • Recognize that the reactions of photosynthesis and aerobic respiration involve energy changes. • Explain that the law of definite proportions allows for predictions of reaction amounts.
P.12.A.8 Students know most elements have two or more isotopes, some of which have practical applications. I/S	DOK 2	<ul style="list-style-type: none"> • Know that isotopes of an element have different numbers of neutrons and the same number of protons. • Identify that practical applications of isotopes arise from the nature of radioactivity and that atoms are the building blocks of all things. • Calculate the numbers of protons and neutrons given a nuclear symbol. (See also P.12.A.2 and P.12.C.4.)
P.12.A.9 Students know the number of electrons in an atom determines whether the atom is electrically neutral or an ion. I/S	DOK 1	<ul style="list-style-type: none"> • Calculate the number of protons and electrons to determine the electrical charge of an atom. • Calculate the magnitude and sign of the charge on an ion given the number protons and electrons.

** DOK essence – on state level assessments, at least 50% of items at the indicted DOK level or above

C-1 PHYSICAL SCIENCE

Standard	Force and Motion – The laws of motion are used to describe the effects of forces on the movement of objects.	
Indicator	DOK**	Item Specifications
P.12.B.1 Students know laws of motion can be used to determine the effects of forces on the motion of objects. E/S	DOK 2	<ul style="list-style-type: none"> • Apply Newton’s three laws of motion to physical situations (knowing the number of each law is not core knowledge). • Describe 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). • Explain how friction affects the motion of an object. • Given distance vs. time and velocity vs. time plots, interpret and predict different types of motion. (See also N.12.A.1.) • Identify how an example may illustrate a change and/or redirection of force where the amount of work remains unchanged.
P.12.B.2 Students know magnetic forces and electric forces can be thought of as different aspects of electromagnetic force. I/S	DOK 2	<ul style="list-style-type: none"> • Describe the relationship between electric currents and magnetic fields. • Apply the concept of electromagnetic induction to explain the operation of generators and transformers.
P.12.B.3 Students know the strength of the electric force between two objects increases with charge and decreases with distance. I/S	DOK 1	<ul style="list-style-type: none"> • Explain how electric forces change when the distance between the two charges changes and/or when the magnitude of the charges changes.
P.12.B.4 Students know the strength of the gravitational force between two objects increases with mass and decreases rapidly with distance. I/S	DOK 2	<ul style="list-style-type: none"> • Identify the components of gravitational force and gravitational potential energy. • Explain that gravitational force becomes stronger as the masses increase and become weaker as the distance between the objects increases. • Explain that in some cases weight could change while mass stays the same.

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C-1 PHYSICAL SCIENCE		
Standard	Energy – The total energy of the universe is constant. All events involve the transfer of energy in one form or another. In all energy transfers, the overall effect is that energy is spread out uniformly.	
Indicator	DOK**	Item Specifications
P.12.C.1 Students know waves (i.e. sound, seismic, electromagnetic) have energy that can be transferred when the waves interact with matter. E/S	DOK 2	<ul style="list-style-type: none"> Identify transverse waves and longitudinal waves. Explain that waves transfer energy without transferring matter. Describe how waves behave when they meet an obstacle, pass into another medium, or encounter another wave.
P.12.C.2 Students know energy forms can be converted. E/S	DOK 2	<ul style="list-style-type: none"> Explain 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). From an example, identify that energy cannot be created or destroyed, but only changed from one form to another. Recognize that photosynthesis is a process that converts light energy to chemical energy.
P.12.C.3 Students know nuclear reactions convert a relatively small amount of material into a large amount of energy. I/S	DOK 2	<ul style="list-style-type: none"> Identify fission and fusion. Recognize that a large amount of energy is produced from a relatively small amount of material in a nuclear reaction.
P.12.C.4 Students know characteristics, applications and impacts of radioactivity. E/S	DOK 2	<ul style="list-style-type: none"> Identify the difference between ionizing and non-ionizing radiation. Identify characteristics of radioactivity, including differences between alpha, beta, gamma rays. Recognize applications of radioactivity from examples Evaluate the impacts of radioactivity.
P.12.C.5 Students know the relationship between heat and temperature . I/S	DOK 2	<ul style="list-style-type: none"> Describe heat and temperature using the kinetic energy of particles.
P.12.C.6 Students know electricity is transferred from generating sources for consumption and practical uses. I/S	DOK 2	<ul style="list-style-type: none"> Describe various methods for generating electricity. Identify the processes by which various forms of energy (e.g., chemical, mechanical, and electromagnetic) are converted to electricity. Use a diagram to trace the transfer of electricity from generating sources to end uses by consumers.

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C-2 LIFE SCIENCE

Standard	Heredity – Heredity is the genetic passing of a set of instructions from generation to generation. These instructions are encoded as DNA and may manifest themselves as characteristics. Some characteristics are inherited, and some result from interactions with the environment	
Indicator	DOK**	Item Specifications
L.12.A.1 Students know genetic information passed from parents to offspring is coded in the DNA molecule. E/S	DOK2	<ul style="list-style-type: none"> • Identify the location of the DNA molecule and the shape of its double helix structure. • Explain that DNA copies itself. • Explain that DNA contains hereditary information. • Describe the process of DNA replication in the formation of sex cells.
L.12.A.2 Students know DNA molecules provide instructions for assembling protein molecules. E/S	DOK 2	<ul style="list-style-type: none"> • Recognize that the DNA code carries instructions for making protein molecules.
L.12.A.3 Students know all body cells in an organism develop from a single cell and contain essentially identical genetic instructions. E/S	DOK 2	<ul style="list-style-type: none"> • Explain how organisms grow through the processes of cellular division and differentiation. • Recognize that all body cells in an organism have fundamentally the same DNA.
L.12.A.4 Students know several causes and effects of somatic versus sex cell mutations. E/S	DOK 2	<ul style="list-style-type: none"> • Describe the difference between sex cells and somatic cells in an organism. • Explain that mutations in sex cells may be passed on to offspring. • Explain that mutations in somatic cells are not passed on to offspring. • Explain that environmental factors may cause mutations in DNA in both somatic cells and sex cells. • Recognize that mutations result from changes in DNA.
L.12.A.5 Students know how to predict patterns of inheritance. E/S	DOK 2	<ul style="list-style-type: none"> • Explain how reproduction is responsible for genetic variation. • Use a Punnett Square to predict the proportion of specific genetic traits in offspring.

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C-2 LIFE SCIENCE		
Standard	Structure of Life – All living things are composed of cells. Cells can range from very simple to very complex and have structures which perform functions for the organism. Cells and cell structures can be damaged or fail because of intrinsic failures or disease.	
Indicator	DOK**	Item Specifications
L.12.B.1 Students know cell structures and their functions. E/S	DOK 2	<ul style="list-style-type: none"> Identify major cell structures (i.e., nucleus, cells membrane, cell wall, chromosomes, chloroplast, vacuole, mitochondria, endoplasmic reticulum) and their functions. Identify the differences between plant and animal cells based on their structures and functions. Identify how materials move into and out of a cell. Explain conceptually, the processes of photosynthesis and cellular respiration.
L.12.B.2 Students know the human body has a specialized anatomy and physiology composed of a hierarchical arrangement of differentiated cells. E/S	DOK 2	<ul style="list-style-type: none"> Identify human body systems and describe their general functions. Identify relationships among cells, tissues, organs, organ systems and organisms and know their hierarchical order.
L.12.B.3 Students know disease disrupts the equilibrium that exists in a healthy organism. E/S	DOK 2	<ul style="list-style-type: none"> Evaluate how a disease disrupts the homeostasis of an organism. Describe ways that an imbalance in one organ system affects the entire organism.

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C-2 LIFE SCIENCE		
Standard	Organisms and their Environment – A variety of ecosystems and communities exist on Earth. Ecosystems are dynamic interactions of organisms and their environment. Ecosystems have distinct characteristics and components that allow certain organisms to thrive. Change in one of more components can affect the entire ecosystem.	
Indicator	DOK**	Item Specifications
L.12.C.1 Students know relationships of organisms and their physical environment. E/S	DOK 2	<ul style="list-style-type: none"> Identify the energy relationships in an ecosystem. Classify an organism by the manner in which it obtains energy. Describe how an organism’s needs are met by aspects of its physical environment.
L.12.C.2 Students know how changes in an ecosystem can affect biodiversity and biodiversity’s contribution to an ecosystem’s stability. E/S	DOK 2	<ul style="list-style-type: none"> Predict how changes in an ecosystem’s stability impact biodiversity. Recognize that ecosystems change over time. Predict consequences of an environmental change.
L.12.C.3 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	DOK 2	<ul style="list-style-type: none"> Explain that different environments have different carrying capacities. Identify the factors that affect carrying capacity. Predict the result of changing a factor on the carrying capacity of an ecosystem.
L.12.C.4 Students know the unique geologic, hydrologic, climatic, and biological characteristics of Nevada’s bioregions. E/S	DOK 2	<ul style="list-style-type: none"> Recognize the distinguishing characteristics of the Mojave Desert, Intermountain desert, alpine forest, and basin and range bioregions.

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C-2 LIFE SCIENCE		
Standard	Diversity of Life – Evidence suggests that living things change over periods of time. These changes can be attributed to genetic and/or environmental influences. This process of change over time is called biological evolution. The Diversity of life on Earth is classified using objective characteristics. Scientific classification uses a hierarchy of groups and subgroups based on similarities that reflect evolutionary relationships.	
Indicator	DOK**	Item Specifications
L.12.D.1 Students know organisms can be classified based on evolutionary relationships. E/S	DOK 2	<ul style="list-style-type: none"> Use evolutionary relationships to classify organisms. Identify how different types of evidence can be used to

		provide evidence of evolution (e.g., morphology, physiology, fossils, DNA).
L.12.D.2 Students know similarity of DNA sequences gives evidence of relationships between organisms. E/S	DOK 2	<ul style="list-style-type: none"> Describe DNA as biochemical evidence for evolution. Identify relationships between organisms based on similarities in DNA sequences.
L.12.D.3 Students know the fossil record gives evidence for natural selection and its evolutionary consequences. E/S	DOK 2	<ul style="list-style-type: none"> Recognize patterns of diversity observed throughout geologic history. Identify evidence for biological evolution gathered by scientists and others from the fields of biology (including biochemistry and molecular genetics) and geology.
L.12.D.4 Students know the extinction of species can be a natural process. E/S	DOK 2	<ul style="list-style-type: none"> Recognize that most species that have lived on Earth are now extinct. Explain that extinction can be slow or rapid.
L.12.D.5 Students know biological evolution explains diversity of life. E/S	DOK 2	<ul style="list-style-type: none"> Explain that organisms change over time as a result of biological evolution. Recognize that all populations have some genetic variations.
L.12.D.6 Students know the concepts of natural and artificial selection. E/S	DOK 2	<ul style="list-style-type: none"> Explain how naturally occurring genetic variation may result in reproductive advantages. Describe how humans use artificial selection to produce desired traits in other organism

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C-3 EARTH/SPACE SCIENCE		
Standard	Atmospheric Processes and the Water Cycle - Earth systems have internal and external sources of energy, both of which create heat. Driven by sunlight and Earth's internal heat, a variety of cycles connect and continually circulate energy and material through the components of the earth systems.	
Indicator	DOK**	Item Specifications
E.12.A.1 Students know the Sun is the major source of Earth's energy, and provides the energy driving Earth's weather and climate. E/S	DOK 2	<ul style="list-style-type: none"> Explain how solar energy powers the water cycle. Explain how uneven heating of Earth's surface determines weather and climate patterns.
E.12.A.2 Students know the composition of Earth's	DOK 2	<ul style="list-style-type: none"> Explain how variations in the ozone layer affect the amount of

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atmosphere has changed in the past and is changing today. I/S		<ul style="list-style-type: none"> ultraviolet radiation entering the Earth's atmosphere. Describe how life forms have affected the composition of the atmosphere over time. Describe how natural events have affected the composition of the atmosphere over time (e.g., volcanoes and meteorites).
E.12.A.3 Students understand the role of the atmosphere in Earth's greenhouse effect. E/S	DOK 2	<ul style="list-style-type: none"> Explain how the proportions of gases in the atmosphere affect weather and climate. Identify sources of greenhouse gases. Explain why a certain level of greenhouse effect is essential for life on Earth.
E.12.A.4 Students know convection and radiation play important roles in moving heat energy in the Earth system. E/S	DOK 2	<ul style="list-style-type: none"> Explain how the processes of radiation, conduction, and convection occur in the atmosphere. Explain how the processes of radiation, conduction, and convection affect weather and climate.
E.12.A.5 Students know Earth's rotation affects winds and ocean currents. I/S	DOK 2	<ul style="list-style-type: none"> Identify that wind and ocean currents form global patterns based on Earth's rotation. Coriolis Effect

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C-3 EARTH/SPACE SCIENCE		
Standard	Solar System and Universe - The universe is a dynamic system of matter and energy. The universe is extremely large and massive with its components separated by vast distances. Tools of technology will continue to aid in the investigation of the components, origins, processes and age of the universe. Earth is one part of our solar system, which is within the Milky Way galaxy. The Sun is the energy producing star for our solar system. Most objects in our solar system are in predictable motion, resulting in phenomena such as day/night, year, phases of the moon, tides, and eclipses.	
Indicator	DOK**	Item Specifications
E.12.B.1 Students know common characteristics of stars. I/S	DOK 2	<ul style="list-style-type: none"> Identify the processes of stellar evolution. Recognize that stars change in temperature, luminosity, mass, size, color, and brightness as they age. Demonstrate the general relationship between the color and temperature of stars.

E.12.B.2 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	DOK 1	<ul style="list-style-type: none"> Know that stars are composed mostly of hydrogen and helium and ultimately produce all other elements through nuclear reactions.
E.12.B.3 Students know ways in which technology has increased understanding of the universe. I/S	DOK 2	<ul style="list-style-type: none"> Describe the uses of optical and radio telescopes, probes, and artificial satellites in astronomy.
E.12.B.4 Students know the on-going processes involved in star formation and destruction. I/S	DOK 2	<ul style="list-style-type: none"> Identify and explain the processes of stellar evolution. Recognize the life-cycles of mid-size and massive stars and their stellar remnants
E.12.B.5 Students know scientific evidence suggest that the universe is expanding. I/S	DOK 2	<ul style="list-style-type: none"> Recognize the red shift effect and know that the most distant objects have the greatest degree of red shift. Evaluate scientific theories regarding the evolution of the universe.

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C-3 EARTH/SPACE SCIENCE		
Standard	Earth's Composition and Structure - Earth is composed of materials that move through the biogeochemical cycles. Earth's features are shaped by ongoing and dynamic processes. These processes can be constructive or destructive and occur over geologic time scales.	
Indicator	DOK**	Item Specifications
E.12.C.1 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	DOK 2	<ul style="list-style-type: none"> Explain the basics of the process of fossil formation. Apply the principles of superposition to relative dating of rock layers. Describe the process of absolute dating. Sequence the age, history, and changing life forms of Earth using strata and fossil evidence. Describe how folding, breaking, and uplifting of strata complicate geological evidence. Describe the formation of sedimentary rock.
E.12.C.2 Students understand the concept of plate tectonics including the evidence that supports it (structural, geophysical and paleontological evidence). E/S	DOK 2	<ul style="list-style-type: none"> Describe how convection in Earth's mantle has changed the locations and shapes of continents based on tectonic plate movement. Identify the evidence for seafloor spreading.

		<ul style="list-style-type: none"> Identify the three major types of tectonic plate boundaries.
E.12.C.3 Students know elements exist in fixed amounts and move through solid earth, oceans, atmosphere and living things as part of biogeochemical cycles. E/S	DOK 2	<ul style="list-style-type: none"> Explain how matter and energy are transferred chemically through systems that include living and non-living components.
E.12.C.4 Students know processes of obtaining, using, and recycling of renewable and non-renewable resources. E/S	DOK 2	<ul style="list-style-type: none"> Identify the differences between renewable and non-renewable resources. Explain how recycling reduces the rate of depletion of nonrenewable resources. Identify the processes used to obtain natural resources (e.g., mining, oil production, water, and agriculture).
E.12.C.5 Students know soil, derived from weathered rocks and decomposed organic material, is found in layers. E/S	DOK 2	<ul style="list-style-type: none"> Describe the structure of soil, its components, and its formation. Describe the processes of weathering.

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C-4 NATURE OF SCIENCE		
Standard	<p>Inquiry - Scientific Inquiry is the process by which humans systematically examine the natural world. Scientific inquiry is a human endeavor and involves observation, reasoning, insight, energy, skill, and creativity. Scientific inquiry is used to formulate and test explanations of nature through observation, experiments and theoretical or mathematical models. Scientific explanations and evidence are constantly reviewed and examined by others. Questioning, response to criticism and open communication are integral to the process of science.</p>	
Indicator	DOK**	Item Specifications
N.12.A.1 Students know tables, charts, illustrations and graphs can be used in making arguments and claims in oral and written presentations. E/S	DOK 2	<ul style="list-style-type: none"> Given a choice of several graphs, select the one most appropriate to display a collection of data or to illustrate a concept or conclusion. Interpret a graph, table, or chart and analyze the data display to reveal information. Predict (extrapolate and interpolate) from a data display. (See also P.12.B.1.)

N.12.A.2 Students know scientists maintain a permanent record of procedures, data, analyses, decisions, and understandings of scientific investigations. I/S	DOK 2	<ul style="list-style-type: none"> Recognize proper data collection and recording procedures in scientific investigations.
N.12.A.3 Students know repeated experimentation allows for statistical analysis and unbiased conclusions. E/S	DOK 2	<ul style="list-style-type: none"> Explain that repeated trials and increased sample size increase the validity of experimental results. Explain the importance of independent replication of experimental results. 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
N.12.A.4 Students know how to safely conduct an original scientific investigation using the appropriate tools and technology. E/S	DOK 2	<ul style="list-style-type: none"> Explain the use of proper experimental controls and control groups in experimental designs. Explain the components of a scientific investigation. Describe proper and appropriate use of lab equipment. Explain safety considerations in lab procedures. Explain how inquiry drives the processes of science. Analyze an experimental design.
N.12.A.5 Students know models and modeling can be used to identify and predict cause-effect relationships. I/S	DOK 2	<ul style="list-style-type: none"> Describe how models are used in science. Use models and modeling to illustrate relationships and predict outcomes. Evaluate the appropriateness of a model.
N.12.A.6 Students know organizational schema can be used to represent and describe relationships of sets. E/S	DOK 2	<ul style="list-style-type: none"> Recognize that each branch of science has developed classification systems based on observable characteristics. Explain that scientists use various classification systems to organize information. Explain that classification systems can be modified over time to account for new information.

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C-4 NATURE OF SCIENCE

Standard	Science, Technology, and Society - Technology defines a society or era. It can shape the environment in which people live, and it has increasingly become a larger part of people’s lives. While many of technology’s effects on society are regarded as desirable, other effects are seen as less desirable. These concepts are shared across subject areas such as science, math, technology, social studies, and language arts. The development and use of technology affects society and the environment in which we live, and at the same time, society influences the development of technology and its impact on culture.	
Indicator	DOK**	Item Specifications
N.12.B.1 Students know science, technology, and society influenced one another in both positive and negative ways. E/S	DOK 2	<ul style="list-style-type: none"> • Explain with examples how science and technology benefit each other. • Explain with examples how scientific events and discoveries have positively and negatively influenced society. • Explain with examples how technology has positively and negatively affected society. • Explain with examples how societal needs and pressures influence the course of scientific research and technological advances. • Explain with examples how technological advances frequently have unintended consequences that are not initially evident.
N.12.B.2 Students know consumption patterns, conservation efforts, and cultural or social practices in countries have varying environmental impacts. E/S	DOK 2	<ul style="list-style-type: none"> • Identify the benefits and hazards of the environmental impact of human activities (e.g., consumption, conservation, and cultural and social practices).
N.12.B.3 Students know the influence of ethics on scientific enterprise. E/S	DOK 2	<ul style="list-style-type: none"> • Identify “ethical” and “unethical” practices in scientific research and describe the differences between them (e.g., treatment of test subjects and falsifying data). • 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).
N.12.B.4 Students know scientific knowledge builds on previous information. E/S	DOK 3	<ul style="list-style-type: none"> • Explain that existing theories are modified as new information is added. • Explain that occasionally a completely new theory changes the way we interpret information and understand phenomenon. • Explain the significance of the history of science in relation to the step-by-step development of our current scientific understanding of the natural world.

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