LCB File No. R041-05

PROPOSED REGULATION OF THE STATE BOARD OF EDUCATION

(This proposed regulation was previously adopted as T040-05)

NAC 389.244 Science. (NRS 385.080**,** 389.520**)** By the end of the second grade, pupils must know and be able to do everything required in the previous grades for courses in science offered in public schools. ~~[Instruction in the second grade in science must be designed so that pupils meet the following performance standards by the completion of the second grade:~~

~~1. For the area of physical science:~~

~~(a) Understand that gravitational, electrical and magnetic forces have an effect on the motion of objects, as demonstrated by the pupil's ability to:~~

~~(1) Show that objects move at different speeds, for example, a car speeds up or slows down or one person runs faster than another; and~~

~~(2) Use a model or pattern to demonstrate how to assemble or disassemble a structure, for example, by using an interlocking block tower, erector set crane or pattern block picture.~~

~~(b) Understand that materials have distinct properties which depend on the amount of matter present, its chemical composition and structure, as demonstrated by the pupil's ability to:~~

~~(1) Sort and describe objects in terms of some observable properties, for example, color, shape, size or texture; and~~

~~(2) Independently form large objects from smaller objects, for example, by putting together a puzzle or quilt.~~

~~(c) Understand that changes in temperature and pressure can alter states of matter and that energy exists in many forms and one form can change into another, as demonstrated by the pupil's ability to:~~

~~(1) Describe a variety of objects as being cold, cool, warm or hot;~~

~~(2) Describe the temperatures of similar objects in different outdoor locations and explain that heat from the sun warms the objects;~~

~~(3) Describe an object before and after a change in the state of the object occurs by using terms of observable properties; and~~

~~(4) Independently manipulate appropriate objects to produce various sounds by vibrating the objects and classify the sounds produced in terms of properties of pitch and tone.~~

~~(d) Understand that chemical reactions change substances into different substances.~~

~~(e) Understand that nuclear energy and electromagnetic energy are produced in many forms from natural and man-made sources.~~

~~2. For the area of life science:~~

~~(a) Understand that all life forms, at all levels of organization, use specialized structures and similar processes to meet the basic needs of life, as demonstrated by the pupil's ability to:~~

~~(1) Provide examples of how living things grow and change, with some minor errors in detail; and~~

~~(2) Classify living and nonliving things according to established criteria, with few errors.~~

~~(b) Understand that organisms respond to internal and external influences, as demonstrated by the pupil's ability to:~~

(1) Explain that germs cause some diseases and may be spread by people who have them; and

(2) Explain that washing hands thoroughly with soap and water reduces the number of germs and the spread of germs.

(c) Understand that life forms are diverse and that, through heredity, they pass some characteristics to their offspring, as demonstrated by the pupil's ability to:

(1) Describe, using common examples, that animals produce offspring that are like themselves, for example, dogs produce puppies and not kittens; and

(2) Sort a group of living things and describe how some living things have similar observable characteristics.

(d) Understand that life forms change over time through evolution and the process of biological change.

3. For the areas of earth and space sciences:

(a) Understand the structures of the earth and that the earth is composed of interrelated systems of rocks, water, air and life, as demonstrated by the pupil's ability to:

(1) Group rock samples according to a single attribute of shape, size, color, texture, or patterns of color or shading; and

(2) Provide justification for their grouping.

(b) Understand that the earth may be represented by a variety of maps and models.

(c) Understand the history of the earth and that the systems of the earth such as weather and the formation of mountains change or vary.

(d) Observe and describe changes that take place in nature, for example, weather, seasons, day and night.

(e) Understand that the systems of the earth have a variety of cycles through which energy and matter continually flow, as demonstrated by the pupil's ability to:

(1) Observe and describe the way the ground, water and air feel in the shade versus the sunlight; and

(2) Observe and describe how weather such as temperature, cloudiness and precipitation change from day to day and throughout the year.

(f) Understand the solar system and the universe and that the earth is part of a planetary system within the Milky Way Galaxy, which is part of the known universe, as demonstrated by the pupil's ability to:

(1) Identify from drawings or photographs the sun, moon and stars;

(2) Identify from drawings, photographs or verbal prompts that the earth is a planet; and

(3) Describe the movement of the sun across the sky and explain that the moon appears in different places at different times.

4. For the area of environmental sciences:

(a) Understand that ecosystems display patterns of organization, change and stability as a result of the interactions and interdependencies among the life forms and the physical components of the earth, as demonstrated by the pupil's ability to:

(1) Investigate, observe and discuss the interactions between plants as producers and animals as consumers; and

(2) Provide examples of interdependence between plants and animals.

(b) Understand that natural resources include renewable and nonrenewable materials and energy, that all organisms, including humans, use resources to maintain and improve their existence and that the use of resources can have positive and negative consequences, as demonstrated by the pupil's ability to:

~~(1) Demonstrate how some resources can be used and reused, for example, wastepaper and glass are recyclable; and~~

~~(2) Describe the various resources that provide the basic necessities used by people in their daily lives.~~

~~(c) Understand conservation and that humans have the unique ability to change personal and societal behavior based on ethical considerations regarding other organisms, the planet as a whole and future generations, as demonstrated by the pupil's ability to:~~

~~(1) Illustrate how people live in different places in different ways; and~~

~~(2) Illustrate how some things change in daily life and some things stay the same.~~

~~5. For the area of the nature and history of science:~~

~~(a) Understand that humans have the unique ability to change personal and societal behavior based on ethical considerations regarding other organisms, the planet as a whole and future generations, as demonstrated by the pupil's ability to:~~

~~(1) Generate an idea or invention with assistance from the teacher; and~~

~~(2) Provide examples of thinkers and inventors from around the world.~~

~~(b) Understand skills of reasoning and critical response and that many decisions require critical consideration of scientific evidence.~~

~~(c) Understand systems, models, risk and predictions and that a variety of models can be used to describe or predict occurrences and events.~~

~~(d) Understand scientific values and attitudes and that science is an active process of systematically examining the natural world, as demonstrated by the pupil's ability to:~~

~~(1) Make qualitative observations and provide pictorial or word descriptions of objects or phenomena; and~~

~~(2) Record in a notebook or journal, with minimal assistance from the teacher, observations of investigations over a period of time, for example, the growth of a plant, changes in weather or the growth and development of insects.~~

~~(e) Understand that a variety of methods of communication may be used to share scientific information, as demonstrated by the pupil's ability to:~~

~~(1) Generally follow verbal and written instructions accurately;~~

~~(2) Generally produce simple pictographs to describe observations; and~~

~~(3) Cooperate and contribute ideas within a group.~~

~~6. For the area of scientific inquiry, processes and skills:~~

~~(a) Understand that scientific inquiry is enhanced and often communicated through mathematics, as demonstrated by the pupil's ability to:~~

~~(1) Generally use mental computation to make rough estimates, for example, simple addition and subtraction problems; and~~

~~(2) Adequately identify unexpected or unusual results when counting or measuring using units of measurement that are not standard.~~

~~(b) Demonstrate laboratory skills and the appropriate and safe application of the tools and techniques of scientific inquiry by generally keeping accurate records of observations and measurements taken over time, such as plant growth, metamorphosis, evaporation and weather conditions.~~]

Instruction in grades K-2 must be designed so that pupils meet the following standards by the end of the second grade:

1. ***For the area of Science Inquiry: Students understand that science is an active process of systematically examining the natural world.***
   (a) Students know how to make observations and give descriptions using words, numbers, and drawings, and

(b) Students know tools can be used safely to gather data and extend the senses, and
(c) Students know observable patterns can be used to predict future events or sort items.

2. *For the area of Science, technology, and Society: Students understand that many people contribute to the field of science.*
   (a) Students know science engages men and women of all ages and backgrounds, and
   (b) Students know that, in science, it is helpful to work in a team and share findings with others.
3. *For the area of Matter: Students understand that matter has observable properties.*
   (a) Students know matter can exist as solids and as liquids, and
   (b) Students know some properties of materials can be changed by heating, freezing, mixing, cutting, or bending, and
   (c) Students know matter can be categorized by observable properties, such as color, size, shape, and weight, and
   (d) Students know different objects are made of many different types of materials.
4. *For the area of Force and Motion: Students understand that position and motion of objects can be described.*
   (a) Students know the position and motion of an object can be changed by pushing or pulling, and
   (b) Students know things move in many different ways and at different speeds (e.g., straight line, zigzag, vibration, circular motion, fast/slow), and
   (c) Students know magnets can be used to make some things move without being touched, and
   (d) Students know things fall to the ground unless something holds them up.
5. *For the area of Energy: Students know heat, light, and sound can be produced.*
   (a) Students know the Sun is a source of heat and light, and
   (b) Students know sound is produced by vibrating objects, and
   (c) Students know objects can be described as hot or cold relative to another object.
6. *For the area of Heredity: Students understand that offspring resemble their parents.*
   (a) Students know animals and plants have offspring that are similar to their parents, and
   (b) Students know differences exist among individuals of the same kind of plant or animal.
7. *For the area of Structure of Life: Students understand that living things have identifiable characteristics.*
   (a) Students know humans and other animals use their senses to know their world.
8. *For the area of Organisms and Their Environment: Students understand that living things live in different places.*
   (a) Students know plants and animals need certain resources for energy and growth, and
   (b) Students know a habitat includes food, water, shelter and space, and
   (c) Students know living things are found almost everywhere in the world.
9. *For the area of Diversity of Life: Students understand that there are many kinds of living things on Earth.*
   (a) Students know plants and animals can be sorted by observable characteristics and behaviors, and
   (b) Students know some plants and animals are extinct.
10. *For the area of Atmospheric Processes and the Water Cycle: Students understand that changes in weather often involve water changing from one state to another.*
    (a) Students know the Sun is a source of heat and light, and
    (b) Students know water on Earth can be a liquid (rain) or a solid (snow and ice), and can go back and forth from one form to the other, and

(c) Students know weather changes from day to day and seasonally, and
(d) Students know weather can be described by measurable quantities such as temperature, wind direction and speed, and precipitation.

11. For the area of Solar System and the Universe: Students understand there are objects in the sky, which display patterns.
(a) Students know objects in the sky display patterns in how they look, where they are located, and how they move, and
(b) Students know the Sun rises every day, and the Moon can rise during the day and/or the night, and
(c) Students know the Sun and Moon appear to move across the sky, and
(d) Students know the Moon appears to change shape over the course of a month.

12. For the area of Earth Composition and Structure: Students understand that Earth materials include rocks, soils, and water. Students understand that Earth materials include rocks, soils, and water.
(a) Students know Earth is composed of different kinds of materials (e.g. rocks, soils, and water), and
(b) Students know rocks come in many sizes and shapes, with various textures and colors, and
(c) Students know different objects are made of many different types of materials, and
(d) Students know soils have different colors or textures depending on their composition.

Instruction Through Third Grade

~~[NAC 389.256 Science. (NRS 385.080, 389.520) By the end of the third grade, pupils must know and be able to do everything required in the previous grades for courses in science offered in public schools. Instruction in the third grade must be designed so that pupils meet the following performance standards by the completion of the third grade:~~

~~1. For the area of physical science:~~

~~(a) Understand that gravitational, electrical and magnetic forces have an effect on the motion of objects, as demonstrated by the pupil's ability to:~~

~~(1) Demonstrate that a given push or pull, whether hard or soft, causes an object to change its speed or direction, or both;~~

~~(2) Predict whether or not an object will topple or balance; and~~

~~(3) Effectively manipulate simple tools such as hammer and nails, screwdriver and screws, and nuts and bolts, and demonstrate when to use specific tools.~~

~~(b) Understand that materials have distinct properties which depend on the amount of matter present, its chemical composition and structure, as demonstrated by the pupil's ability to:~~

~~(1) Describe objects in terms of observable properties such as color, texture, size, state of matter and symmetry;~~

~~(2) Sort objects on the basis of two or more observable characteristics or attributes such as dimensions, coloration, symmetry, parts and state of matter by using Venn diagrams or other schemes; and~~

~~(3) Identify or create a system of classification by observing objects that are grouped.~~

~~(c) Understand that changes in temperature and pressure can alter states of matter and that energy exists in many forms and one form can change into another, as demonstrated by the pupil's ability to:~~

(1) Use a thermometer to measure and record a range of temperatures and label each as hot, warm, cool or cold; and

(2) Investigate, using direct observations, and describe in detail how a solid changes into a liquid and water evaporates in an open container.

(d) Understand that chemical reactions change substances into different substances.

(e) Understand that nuclear energy and electromagnetic energy are produced in many forms from both natural and man-made sources.

2. For the area of life science:

(a) Understand that all life forms, at all levels of organization, use specialized structures and similar processes to meet the basic needs of life, as demonstrated by the pupil's ability to:

(1) Observe and describe the growth of a plant, such as a bean plant, over time and identify growth patterns, for example, the sprouting of seeds, the formation of roots, leaves and stems, and the development of flowers and seeds;

(2) Observe and describe the life cycle of a domestic animal and an animal that undergoes metamorphosis, such as a frog, butterfly or mealworm, and describe the needs of living organisms; and

(3) Classify, with few errors, plants and animals representative of major groups such as the evergreen versus deciduous trees, or animals with an external or internal skeleton or no skeleton.

(b) Understand that organisms respond to internal and external influences, as demonstrated by the pupil's ability to:

(1) Describe, using examples with minimal errors, how various living things behave differently under differing conditions such as migration, coloration and hibernation; and

(2) Explain that germs affect the functions of the body and identify the defenses that the human body has against germs, such as saliva, skin and special blood cells.

(c) Understand that life forms are diverse and that through heredity they pass some characteristics to their offspring, as demonstrated by the pupil's ability to:

(1) Give examples of how offspring may resemble parents and other siblings; and

(2) With minimal assistance from the teacher, sort a group of living things by appearance and behavior and give rational justification for the sorting.

(d) Understand evolution and that life forms change over time, as demonstrated by the pupil's ability to:

(1) Illustrate with diverse examples the many different kinds of living things that exist on the earth; and

(2) Provide general examples of how particular features of plants and animals help them live in different kinds of environments, for example, the thickened stems of cacti enable them to store water and live in the desert.

3. For the areas of earth and space sciences:

(a) Understand that the earth is composed of interrelated systems of rocks, water, air and life, as demonstrated by the pupil's ability to:

(1) Identify, with few or no errors, various samples of the materials of the earth, such as rocks, minerals, soil, sand, gravel, water, ice and air;

(2) Identify landforms such as mountains and valleys;

(3) Describe the shape of the earth as "round like a ball" or as a sphere; and

(4) Compare, using maps and models, relative areas of ocean and land on the surface of the earth.

(b) Understand that the earth may be represented by a variety of maps and models, as demonstrated by the pupil's ability to:

(1) Indicate any one of three directions on a map, as requested by the teacher, when given the fourth direction by the teacher; and

(2) Locate the State of Nevada on a national map and the city or town in which the pupil resides on a map of the State of Nevada.

(c) Understand that the systems of the earth such as weather and the formation of mountains change or vary, as demonstrated by the pupil's ability to observe and describe, with examples, how some changes are hard to see while they happen because they are:

(1) Slow, such as the growth of a plant and the movement of an hour hand on a clock; or

(2) Fast, such as lightning strikes, eye blinks and the change from dark to light when a light is turned on.

(d) Understand that the systems of the earth have a variety of cycles through which energy and matter continually flow, as demonstrated by the pupil's ability to:

(1) Observe and describe that some objects that give off light, such as light bulbs or the sun, also give off heat;

(2) With minimal assistance from the teacher, observe, record and describe by using words, numbers and drawings, the seasonal differences, for example, changes in the weather and the leaves of deciduous trees; and

(3) Observe and describe that water can be a liquid or a solid, and explain that changes in temperature can cause water to go back and forth from one form to the other.

(e) Understand that the earth is part of a planetary system within the Milky Way Galaxy, which is part of the known universe, as demonstrated by the pupil's ability to:

(1) Identify the sun, the moon and the earth as components of our solar system; and

(2) Explain that there are more stars in the sky than anyone could easily count.

4. For the area of environmental sciences:

(a) Understand that ecosystems display patterns of organization, change and stability as a result of the interactions and interdependencies among the life forms and the physical components of the earth, as demonstrated by the pupil's ability to:

(1) Identify, with appropriate examples, similarities and differences found in animals and plants that help them live in their unique habitats; and

(2) Describe, with the use of diagrams or illustrations, ways in which organisms interact with each other.

(b) Understand that natural resources include renewable and nonrenewable materials and energy, and that all organisms, including humans, use resources to maintain and improve their existence, and the use of resources can have positive and negative consequences, as demonstrated by the pupil's ability to:

(1) Explain, with multiple examples, that natural resources are used for many purposes, for example, trees are used for construction, paper and fuel; and

(2) Describe how humans have obtained natural resources for thousands of years through farming, mining, hunting and gathering.

(c) Understand conservation and that humans have the unique ability to change personal and societal behavior based on ethical considerations regarding other organisms, the planet as a whole and future generations, as demonstrated by the pupil's ability to:

(1) Provide examples of materials that can be recycled and used again, including materials that may be used in different forms; and

(2) Make a reasonable prediction of the continuation of a pattern based on a given pattern of observable change.

5. For the area of the nature and history of science:

(a) Understand that humans have the unique ability to change personal and societal behavior based on ethical considerations regarding other organisms, the planet as a whole and future generations, as demonstrated by the pupil's ability to:

(1) With the assistance of the teacher, make observations, ask questions and seek answers;

(2) Generally observe and record accurately to compare findings with others;

(3) Identify women and men of different ages and backgrounds who have made contributions to science;

(4) Identify the benefits of working with a team and sharing findings; and

(5) Competently use tools such as hammers, screwdrivers, balances, hand lens, pencil sharpeners and levers to make a task easier.

(b) Understand that many decisions require critical consideration of scientific evidence.

(c) Understand that a variety of models can be used to describe or predict things and events, as demonstrated by the pupil's ability to:

(1) Compare and contrast a model with what it represents;

(2) Identify and represent observable patterns and correctly predict the next likely event based on the pattern, for example, life cycles, seasonal changes in the weather or phases of the moon; and

(3) Demonstrate, with an example, that when parts or substances are joined or mixed they can do things together they could not have done by themselves, such as bread and its ingredients or a model car and its parts.

(d) Understand that science is an active process of systematically examining the natural world, as demonstrated by the pupil's ability to:

(1) Observe and raise questions about the world, for example, about the actions of toys or the development and characteristics of schoolyard plants, and seek answers through investigations; and

(2) Record in a notebook or journal observations of investigations over time, such as changes in a terrarium or changes in a tadpole as it matures.

(e) Understand that a variety of methods of communication may be used to share scientific information, as demonstrated by the pupil's ability to:

(1) Follow verbal and written instructions to complete a procedure;

(2) Create adequate illustrations, graphs and charts that are easy to understand and that convey ideas and record observations; and

(3) Cooperate and contribute ideas within a group.

6. For the area of scientific inquiry, processes and skills:

(a) Understand that scientific inquiry is enhanced and often communicated through mathematics, as demonstrated by the pupil's ability to:

(1) Use mental computation to make rough estimates, such as using addition, subtraction, multiplication, division and measurement; and

(2) Determine whether measurements and descriptions are reasonably accurate, for example, comparing objects by measuring lengths, weights and capacities or verifying the reasonableness of results by checking the measurements against known values, such as the length of the classroom or the capacity of a quart of milk.

(b) Appropriately and safely apply the tools and techniques of scientific inquiry, as demonstrated by the pupil's ability to:

(1) Consistently use equipment properly and safely during all science activities; and

(2) Identify and gather tools and materials necessary for a scientific investigation.]

NAC 389.2947 Science. (NRS 385.080**,** 389.520**)** By the end of the fifth grade, pupils must know and be able to do everything required in the previous grades for courses in science offered in public schools. ~~[Instruction in the fifth grade in science must be designed so that pupils meet the following perfor mance standards by the completion of the fifth grade:~~

~~1. For the areas of physical science:~~

~~(a) Understand that gravitational, electrical and magnetic forces have an effect on the motion of objects, as demonstrated by the pupil's ability to:~~

~~(1) Demonstrate and describe that the greater the push or pull on an object, the greater the change in motion of that object;~~

~~(2) Give examples of falling objects and explain that a gravitational force is pulling them down;~~

~~(3) Categorize objects that move in different directions, such as forward, back and sideways, in a variety of ways, for example, rotating, rolling or revolving, and with varying ease of movement and friction;~~

~~(4) Accurately predict which objects will sink or float in air or water and classify those objects accordingly; and~~

~~(5) Predict, sort and classify objects and materials that magnets attract and describe and demonstrate that like magnetic poles repel.~~

~~(b) Understand that materials have distinct properties which depend on the amount of matter present, its chemical composition and structure, as demonstrated by the pupil's ability to:~~

~~(1) Separate the components of a mixture based on their properties, for example, separating sand and sugar from a mixture of sand and sugar or separating sugar from a solution of water and sugar, and describe why the technique worked;~~

~~(2) Compare and contrast elements, compounds and mixtures and give common examples of elements, compounds and mixtures;~~

~~(3) Investigate and describe how patterns of crystals are formed after water has evaporated from a solution;~~

~~(4) Describe the properties of large and small pieces of a material and explain that the properties are the same, such as a sheet of paper versus pieces of paper, a chunk of rock and fragments of rock or a cinnamon stick and powdered cinnamon;~~

~~(5) Describe observable properties such as the state of matter, ductility, malleability, color, strength and shape of various materials and suggest uses for these materials based on their properties; and~~

~~(6) Compare and contrast the properties and composition of various materials.~~

~~(c) Understand that changes in temperature and pressure can alter states of matter and that energy exists in many forms, as demonstrated by the pupil's ability to:~~

~~(1) Gather data to describe the cooling of warm objects and the warming of cool objects when brought together and make accurate observations;~~

~~(2) Investigate how energy and matter interact when water changes phases from solid to liquid to gas and vice versa, explain these interactions and diagram the water cycle, indicating whether energy is absorbed or released in each change;~~

~~(3) Demonstrate how changes in sound can be made given appropriate supplies such as a uniform set of eight glasses or test tubes, a metal spoon, a chopstick and a container of water, and record and summarize the findings; and~~

~~(4) Follow instructions to build a simple series electrical circuit and describe the use of various components such as switches, wires, batteries, sockets, motor and lights.~~

(d) Understand that chemical reactions change substances into different substances, as demonstrated by the pupil's ability to:

(1) Observe and record the effects of common physical and chemical changes, for example, melting and burning candle wax, dissolving sugar in water and heating sugar and mixing baking soda with vinegar to bake a cake; and

(2) Distinguish between a phase and a chemical change.

(e) Understand that nuclear energy and electromagnetic energy are produced in many forms from both natural and man-made sources.

2. For the area of life science:

(a) Understand that all life forms, at all levels of organization, use specialized structures and similar processes to meet the basic needs of life, as demonstrated by the pupil's ability to:

(1) Observe, draw, label, compare and contrast, with minor errors or omissions, the essential features of the life cycles of representative plants and animals, including birth or germination, the development of plants such as seeds to roots, stems and leaves to flowers to seeds, and the development of animals such as the frog, silk moth or cricket;

(2) Classify, with minor errors, structures of various organisms according to their functions; and

(3) Give examples of specific features that enable a wide variety of plants and animals to live in their environments.

(b) Understand that organisms respond to internal and external influences, as demonstrated by the pupil's ability to:

(1) With reasonable assistance from the teacher, relate sensory input to behavioral response, for example, plants turn toward the sun and animals turn toward sound;

(2) Develop a reasonable plan to teach an organism a learned behavior; and

(3) Make reasonable predictions that some environmental conditions are more favorable than others to living things, for example, that there is a far greater diversity of life in a rain forest than in a desert or tundra.

(c) Understand that life forms are diverse and that they pass some characteristics to their offspring, as demonstrated by the pupil's ability to:

(1) Differentiate inherited traits from learned traits and illustrate with appropriate examples;

(2) Explain that living things are classified by similar features, behaviors and habits and provide some examples;

(3) Illustrate, by providing several examples, that there are variations among individuals within a population of certain species; and

(4) Relate reproduction to the continuation of a species.

(d) Understand that life forms change over time through evolution and the process of biological change, as demonstrated by the pupil's ability to:

(1) Classify animals and plants according to their physical characteristics;

(2) Identify examples of environmental changes that have allowed some species to survive and caused others to become extinct; and

(3) Identify examples of how differences in individual characteristics may give an advantage for survival.

3. For the areas of earth and space sciences:

(a) Understand that the earth is composed of interrelated systems of rocks, water, air and life, as demonstrated by the pupil's ability to:

(1) Describe the mineral content of a rock sample in terms of easily observed properties of the minerals it contains, for example, the color and darkness of minerals and the size of crystals;

(2) Describe relationships, using models and firsthand observations, between:

(I) Increase in slope and increase in the rate of erosion;

(II) Increase in slope and decrease in the rate of deposition; and

(III) Ways in which the activities of humans can increase the rate of erosion, for example, through deforestation and removal of the soil, or decrease the rate of erosion, for example, through reforestation or construction that has a minimum impact on the environment;

(3) Describe, using models or maps, the flat, protruding and depressed features of the surface of the earth, including features of the ocean floor; and

(4) Describe the composition of samples of soil in terms of constituents such as rock and mineral fragments, organic material, moisture content and organisms, and compare and contrast soil samples from different places.

(b) Understand that the earth may be represented by a variety of maps and models, as demonstrated by the pupil's ability to:

(1) Identify, given a map, the directions northeast, northwest, southeast and southwest;

(2) With minimal assistance from the teacher, use a road map of the State of Nevada to plan a route between various points of interest in this State, for example, from the residence of the pupil to a point of interest such as the Berlin Ichthyosaur or Lehman Caves; and

(3) With minimal assistance from the teacher, construct a map of a local or regional feature such as the classroom, school grounds or neighborhood.

(c) Understand that the systems of the earth, such as weather and the formation of mountains, change or vary, as demonstrated by the pupil's ability to:

(1) Compare and contrast, using various laboratory, print, multimedia and Internet resources, the amount of time required to cause various changes on the surface of the earth, for example, weathering, erosion, earthquakes and volcanic eruptions; and

(2) With minimal assistance from the teacher, simulate and describe, by using hands-on materials, the various ways that fossils form, such as cast and mold formation and imprints.

(d) Understand that the systems of the earth have a variety of cycles through which energy and matter continually flow, as demonstrated by the pupil's ability to:

(1) Investigate and explain, with examples, how the sun is the main source of energy for people;

(2) Analyze, using print, maps, models, multimedia resources and the Internet, various meteorological events, such as storms, flooding and drought, including their causes and effects;

(3) Conduct investigations that demonstrate relationships among temperature, relative humidity, air movement, and rates of evaporation and condensation; and

(4) Observe natural outdoor and artificial systems, for example, terraria, decomposition columns, aquariums, stream tables, gardens and school environments, and describe the physical changes, such as pH, temperature, relative humidity, changes in state of water, weathering and erosion, and biological changes, such as patterns of behavior and seasonal changes in form, that take place in those systems.

(e) Understand that the earth is part of a planetary system within the Milky Way Galaxy, which is part of the known universe, as demonstrated by the pupil's ability to:

(1) Compare and contrast, citing print, multimedia or Internet resources, the general features of planets and their moons, asteroids, comets and the sun; and

(2) Describe, using daily and nightly observations or simulations, such as a classroom ceiling star projector or college planetarium, the:

(I) Motion of the sun, moon, stars and some planets across the sky; and

(II) Distribution, brightness and color of some major stars and constellations.

4. For the area of environmental sciences:

(a) Demonstrate an understanding that ecosystems display patterns of organization, change and stability as a result of the interactions and interdependencies among the life forms and physical components of the earth, as demonstrated by the pupil's ability to:

(1) Describe, using examples, several ways organisms interact with each other and with their nonliving habitat, including dead plants and animals;

(2) Match plants and animals that will survive well, less well, or will not survive in particular environments;

(3) Explain why energy is required in an ecosystem, identify the sun as the energy source and identify other requirements for life that are met by the environment; and

(4) List and describe unique characteristics of representative local ecosystems.

(b) Understand that natural resources include renewable and nonrenewable materials and energy, and that all organisms, including humans, use resources to maintain and improve their existence, and that the use of resources can have positive and negative consequences, as demonstrated by the pupil's ability to:

(1) Observe samples of various materials, such as wood, cloth, paper, metal, plastic and composites, and describe their properties, for example, how they respond to various stresses, how they react with other materials and chemicals, what happens in the presence of heat and fire, and their electrical and magnetic properties;

(2) Identify ways that observed properties of samples of materials make them useful for various activities of humans;

(3) Investigate and describe the extent to which samples of man-made items, such as objects made of cloth, glass, paper, metal, plastic, composites or ceramics, may be used over and over;

(4) Describe how a device can be made to operate with less energy, for example, reducing friction by applying a lubricant such as graphite or using more aerodynamic and lightweight materials;

(5) Describe, using information from state and federal agencies, the kinds and uses of natural resources found in the State of Nevada, for example, water, gold, gypsum, petroleum, wildlife and ranch, farm and recreation land;

(6) Describe, using print, multimedia or Internet resources, the kinds and uses of natural resources acquired nationally or globally, such as lumber, grain, fish and coal; and

(7) Contrast the basic needs of humans for resources, such as food, water, shelter and warmth, to the actual use of resources by humans and suggest ways in which personal use of limited resources may be reduced.

(c) Understand that through conservation humans have the unique ability to change personal and societal behavior based on ethical considerations regarding other organisms, the planet as a whole and future generations, as demonstrated by the pupil's ability to:

(1) Describe how the patterns of consumption of people living in the same period of time vary from place to place;

(2) Describe the components of an ecosystem that have changes which can be observed and the components of an ecosystem that do not change; and

(3) Identify changes in environments as being natural events or influenced by the activities of humans.

5. For the area of the nature and history of science:

(a) Understand that humans have the unique ability to change personal and societal behavior based on ethical considerations regarding other organisms, the planet as a whole and future generations, as demonstrated by the pupil's ability to:

(1) Develop a systematic approach to solving a problem;

(2) Use actual observations and results of scientific investigation to form a possible explanation;

(3) Research and use biographical information to make a written or oral report that describes past discoveries and inventions;

(4) Explain, with multiple examples, that working on a team brings greater results than working alone, for example, Apollo 13 and Thomas Edison's work on the light bulb;

(5) Use technological devices that may be used to determine motion, such as stopwatches and radar guns; and

(6) Identify a question for further study while doing a scientific investigation, for example, factors affecting plant growth.

(b) Understand that many decisions require critical consideration of scientific evidence, as demonstrated by the pupil's ability to:

(1) Justify conclusions or explanations using data and logical argument; and

(2) Recognize the limits of generalizations, assumptions, analogies and models, for example, the solar system, evolution or model of atoms.

(c) Understand that a variety of models can be used to describe or predict things and events, as demonstrated by the pupil's ability to:

(1) Use a physical model to explain how something works or is constructed;

(2) Explain, with examples, that the probability of an event happening depends on how closely current conditions correspond with previous conditions, for example, weather and accidents; and

(3) Describe and compare the components and interrelationships of a simple system, for example, tracing the flow of water through an aquarium, a filter and a pump.

(d) Understand that science is an active process of systematically examining the natural world, as demonstrated by the pupil's ability to:

(1) Keep accurate records of investigations and observations without changing those records later so that the records will fit the norm;

(2) Make conscientious observations, test things more than once and use repeated observations or trials to verify results; and

(3) Offer reasons for the findings and consider the suggestions of others.

(e) Understand that a variety of methods of communication may be used to share scientific information, as demonstrated by the pupil's ability to:

(1) Provide written or oral instructions that others are able to follow;

(2) Organize information into charts, tables and graphs according to established criteria; and

(3) Collaborate on a group project.

6. For the area of scientific inquiry, processes and skills:

(a) Understand that scientific inquiry is enhanced and often communicated by using mathematics, as demonstrated by the pupil's ability to:

(1) Investigate the change in the result of a simple experiment when one of the experimental conditions is altered, for example, how the length of the string affects the swing of a pendulum;

(2) Explain the strategy and thinking used to solve a particular problem;

(3) Make acceptable quantitative estimates of familiar lengths, weights and intervals of time and check the estimates by accurate measurements;

(4) Select the appropriate types of units for a particular measurement, such as meters for length, seconds for time and kilograms for mass, and the appropriate magnitude of units for a particular measurement, such as meters, not centimeters, for measuring swimming pools; and

~~(5) Recognize that there may be inconsistent results if everyone in the class makes a particular measurement.~~

~~(b) Appropriately and safely apply the tools and techniques of scientific inquiry, as demonstrated by the pupil's ability to:~~

~~(1) Consistently use safety equipment and attire;~~

~~(2) Measure and mix dry and liquid materials safely in prescribed amounts;~~

~~(3) Properly use materials that are provided to construct objects for a particular task;~~

~~(4) Label measurements, graphs and diagrams correctly;~~

~~(5) Select and use a range of instruments to measure physical quantities, for example, length, volume, weight, time and temperature, and record data using traditional lab equipment as well as computers; and~~

~~(6) Given a set procedure, manipulate objects and observe events in an experiment.~~]

Instruction in the third to fifth grades in science must be designed so that pupils meet the following standards by the completion of the fifth grade:

1. ***For the area of Science Inquiry: Students understand that science involves asking and answering questions and comparing the answers to what scientists know about the world.***
   (a) Students know scientific progress is made by conducting careful investigations, recording data, and communicating the results in an accurate method, and
   (b) Students know how to compare the results of their experiments to what scientists already know about the world, and
   (c) Students know how to draw conclusions from scientific evidence, and
   (d) Students know graphic representations of recorded data can be used to make predictions, and
   (e) Students know how to plan and conduct a safe and simple investigation, and
   (f) Students know models are tools for learning about the things they are meant to resemble.
2. ***For the area of Science, Technology, and Society: Students understand that many people, from all cultures and levels of ability, contribute to the fields of science and technology.***
   (a) Students know that, throughout history, people of diverse cultures have provided scientific knowledge and technologies, and
   (b) Students know technologies impact society, both positively and negatively, and
   (c) Students know the benefits of working with a team and sharing findings.
3. ***For the area of Matter: Students understand properties of objects and materials.***
   (a) Students know matter exists in different states (i.e., solid, liquid, gas) which have distinct physical properties, and
   (b) Students know heating or cooling can change some common materials, such as water, from one state to another, and
   (c) Students know materials can be classified by their observable physical and chemical properties (e.g., magnetism, conductivity, density, and solubility), and
   (d) Students know that, by combining two or more materials, the properties of that material can be different from the original materials, and
   (e) Students know the mass of a material remains constant whether it is together, in parts, or in a different state, and
   (f) Students know materials are composed of parts that are too small to be seen without magnification.
4. ***For the area of Force and Motion: Students understand that forces can change the position and motion of an object.***

(a) Students know that, when an unbalanced force is applied to an object, the object either speeds up, slows down, or goes in a different direction, and
(b) Students know how the strength of a force and mass of an object influence the amount of change in an object's motion, and
(c) Students know a magnetic force causes certain kinds of objects to attract and repel each other, and
(d) Students know electrically charged particles can attract or repel other electrically-charged material (eg., static electricity), and
(e) Students know Earth's gravity pulls any object toward it without touching it.

5. *For the area of Energy: Students understand that energy exists in different forms.*
(a) Students know light can be described in terms of simple properties (e.g., color, brightness, reflection), and
(b) Students know the wave characteristics of sound, and
(c) Students know 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), and
(d) Students know heat can move from one object to another by conduction, and some materials conduct heat better than others, and
(e) Students know the organization of a simple electrical circuit (i.e., battery or generator, wire, a complete loop through which the electrical current can pass).
6. *For the area of Heredity: Students understand that some characteristics are inherited and some are not.*
(a) Students know some physical characteristics and behaviors that are inherited in animals and plants, and
(b) Students know reproduction is an essential characteristic for the continuation of every species, and
(c) Students know that, while offspring resemble their parents and each other, they also exhibit differences in characteristics, and
(d) Students know how to observe and describe variations among individuals within the human population, and
(e) Students know some animal behaviors are learned.
7. *For the area Structure of Life: Students understand that living things have specialized structures that perform a variety of life functions.*
(a) Students know plants and animals have structures that enable them to grow, reproduce, and survive, and
(b) Students know living things have predictable life cycles.
8. *For the area Organisms and their Environments: Students understand that there is a variety of ecosystems on Earth and organisms interact within their ecosystems.*
(a) Students know the organization of simple food webs, and
(b) Students know organisms interact with each other and with the non-living parts of their ecosystem, and
(c) Students know changes to an environment can be beneficial or detrimental to different organisms, and
(d) Students know all organisms, including humans, can cause changes in their environments, and
(e) Students know plants and animals have adaptations allowing them to survive in specific ecosystems.

9. For the area Diversity of Life: Students understand that living things can be classified according to physical characteristics, behaviors, and habitats.
(a) Students know animals and plants can be classified according to their observable characteristics, and
(b) Students know fossils are evidence of past life, and
(c) Students know differences among individuals within a species give them advantages and/or disadvantages in surviving and reproducing.
10. For the area: Atmospheric Processes and the Water Cycle: Students understand the water cycle's relationship to weather.
(a) Students know the Sun is the main source of energy for planet Earth, and
(b) Students know the processes of the water cycle, including the role of the Sun, and
(c) Students know most of Earth's surface is covered with fresh or salt water, and
(d) Students know the role of water in many phenomena related to weather (e.g., thunderstorms, snowstorms, flooding, drought), and
(e) Students know air is a substance that surrounds us, takes up space, and moves around us as wind.
11. For the area of Solar System and Universe: Students understand that there are many components in the solar system including Earth.
(a) Students know there are more stars than anyone can easily count, but they are not scattered evenly, and they are not all the same in brightness or color, and
(b) Students know the solar system includes the Sun, planets, and moons, and
(c)Students know stars are like the Sun, but they are so far away that they look like points of light, and
(d) Students know there are cyclical patterns of observable objects in the solar system, and
(e) Students know the patterns of stars in the sky stay the same (e.g., the constellations), although they appear to move across the sky nightly, and different stars can be seen in different seasons.
12. For the area Earth's Composition and Structure: Students understand that features on the Earth's surface are constantly changed by a combination of slow and rapid processes.
(a) Students know fossils are evidence of past life, and
(b) Students know water, wind, and ice constantly change the Earth's land surface by eroding rock and soil in some places and depositing them in other areas, and
(c) Students know landforms may result from slow processes (e.g. erosion and deposition) and fast processes (e.g. volcanoes, earthquakes, landslides, flood, and human activity), and
(d) Students know rock is composed of different combinations of minerals, and
(e) Students know soil varies from place to place and has both biological and mineral components.

NAC 389.411 Science. (NRS 385.080**,** 389.520**)** By the end of the eighth grade, pupils must know and be able to do everything required in the previous grades for courses in science offered in public schools. ~~[Instruction in the eighth grade in science must be designed so that pupils meet the following performance standards by the completion of the eighth grade:~~
~~1. For the area of physical science:~~
~~(a) Understand that gravitational, electrical and magnetic forces have an effect on the motion of objects, as demonstrated by the pupil's ability to:~~
~~(1) Explain how multiple forces acting on an object along a straight line will affect the motion of the object, for example, the forces may be acting in the same direction or in opposite~~

directions, the forces may be of equal magnitude or different magnitudes, or the object may be in motion or at rest;

(2) Explain that every object in the universe is attracted to every other object in the universe and that the larger the masses, the greater the force of attraction, and that the greater the distance between the objects, the weaker the force of attraction;

(3) Use a simple machine to solve a problem, such as moving an object from one place to another, and describe how simple machines change force and distance to accomplish a task;

(4) Describe the relationship between buoyancy and the apparent weight of an object in liquid; and

(5) Investigate the use of direct observations, and describe that electric current produces magnetic forces and moving magnets produce electric forces in conductors.

(b) Understand that materials have distinct properties which depend on the amount of matter present, its chemical composition and structure, as demonstrated by the pupil's ability to:

(1) Use simple models, such as particle models, and measurements to explain observed properties of matter;

(2) Separate substances based on their physical and chemical properties, for example, color, solubility, chemical reactivity, melting point and boiling point;

(3) Use models or diagrams to describe how atoms form molecules;

(4) Explain that all atoms consist of protons, electrons and neutrons;

(5) Explain the three states of matter, solid, liquid and gas, as systems of particles of varying densities and degrees of organization; and

(6) Explain, with examples, how atoms of different elements can combine to form all known substances.

(c) Understand that changes in temperature and pressure can alter states of matter and that energy exists in many forms and one form can change into another, as demonstrated by the pupil's ability to:

(1) Describe the movement of heat from object to object and incorporate the concepts of composition and proximity of the objects;

(2) Identify in general terms which kinds of substances will conduct heat most readily;

(3) Describe, using such terms as "melting point" and "boiling point," the specific changes in energy that must occur for a substance to change states, for example, by diagramming a heating or cooling curve that identifies the changes which are taking place;

(4) Investigate and describe the characteristics of waves using such things as ropes, water tables and springs;

(5) Describe that waves move at different speeds if traveling in different materials, for example, sound waves traveling in air as opposed to water;

(6) Describe:

(I) The electromagnetic spectrum and how wavelength changes from one end to the other; and

(II) That the energy of waves can be changed into other forms of energy;

(7) Create parallel, series and combination circuits and describe:

(I) Very simple properties of parallel and combination circuits, for example, current is distributed among the branches of the circuits; and

(II) More sophisticated properties of series circuits, for example, voltage, resistance and current;

(8) Describe various ways energy can be transferred between systems or objects and the different forms of energy, such as radiant, chemical, electrical, nuclear and mechanical; and

(9) Distinguish between potential and kinetic energy and give specific examples of each.

(d) Understand that chemical reactions change substances into different substances, as demonstrated by the pupil's ability to:

(1) Apply the concept of the conservation of mass to a given chemical reaction specifying the total mass of reactants and products and confirm that the same elements are present in the products as were present in the reactants;

(2) Carry out simple investigations and describe how the rate of a reaction can be changed when variables such as temperature, pH and light are changed, and give examples of applications of this concept such as storing certain substances in brown bottles, refrigeration or the effect of acid rain;

(3) Observe and describe, using commonplace examples, chemical reactions that either require or release energy; and

(4) Describe the basic organization of the periodic table, patterns, such as location of metals, nonmetals, metalloids and noble gases, and chemical reactivity.

(e) Understand that nuclear energy and electromagnetic energy are produced in many forms from both natural and man-made sources, as demonstrated by the pupil's ability to:

(1) Investigate and describe the interaction of light with matter, for example, the transmission, absorption and scattering of light;

(2) Explain radioactive isotopes and describe their application to medicine, age dating and nuclear power plants;

(3) Define high-level and low-level nuclear wastes and describe their associated hazards;

(4) Describe the electromagnetic spectrum and qualitatively identify the waves produced by the sun within the electromagnetic spectrum;

(5) Compare and contrast the nuclear processes that occur in the sun and other stars with fusion, nuclear reactors and fission; and

(6) Explain, with examples, how nuclear reactions convert small amounts of matter into a relatively large amount of energy.

2. For the area of life science:

(a) Understand that all life forms, at all levels of organization, use specialized structures and similar processes to meet the basic needs of life, as demonstrated by the pupil's ability to:

(1) With minimal assistance from the teacher, explain that diseases result from breakdowns in the structures or functions of an organism;

(2) Explain, with an example, that life functions may occur at different levels of organization through specialized tissues, organs and systems, for example, oxygen is exchanged at the lungs, transported in the blood and used by the cells of the body;

(3) Identify various plant structures and systems and give the function of each with minimal errors; and

(4) Explain, in general terms, that cellular functions are guided by information stored in DNA.

(b) Understand that organisms respond to internal and external influences, as demonstrated by the pupil's ability to:

(1) Identify a given behavior as innate or learned and provide multiple, accurate examples of innate and learned behavior;

(2) Explain that behavior may be based on experience and evolutionary history;

(3) Accurately relate a given behavior to the stimulus that prompted the behavior; and

(4) Explain that various viruses, bacteria, fungi and parasites may infect the human body and interfere with its functions and give an example of each.

(c) Understand that life forms are diverse and that through heredity they pass some characteristics to their offspring, as demonstrated by the pupil's ability to:

(1) Adequately explain how Mendel's model of heredity predicts the passage of genetic instructions from one generation to another;

(2) Classify living things on the basis of similar characteristics and explain why certain organisms are grouped together;

(3) Explain that selective breeding has resulted in new varieties of domestic animals and plants, giving examples of both plants and animals;

(4) Distinguish between processes involved in sexual and asexual reproduction;

(5) Demonstrate that pairs of genes may control patterns of inheritance, using, for example, Punnett squares;

(6) Describe species as organisms that can mate with each other and produce fertile offspring; and

(7) Explain that changes in the genes of sex cells may affect offspring.

(d) Understand that life forms change over time through evolution and the process of biological change, as demonstrated by the pupil's ability to:

(1) Investigate and provide an estimate of the number of species of animals, plants and microorganisms that are alive today;

(2) Explain differences and similarities between species in terms of biological evolution;

(3) Give multiple examples of how organisms have adaptive characteristics that have allowed them to survive and therefore reproduce;

(4) Explain that all organisms show general similarities of internal structures and chemical processes; and

(5) Outline by using drawings, diagrams or charts major lines of evidence that support evolutionary relationships among species, for example, fossil record, DNA sequences or anatomical similarities.

3. For the areas of earth and space sciences:

(a) Understand that the earth is composed of interrelated systems of rocks, water, air and life, as demonstrated by the pupil's ability to:

(1) Describe mineral samples on the basis of physical properties, such as hardness, luster, color, streak, cleavage and crystal shape;

(2) Describe rock samples on the basis of obvious physical features, for example, sedimentary structures such as ripple marks, metamorphic structures such as foliation and igneous structures such as interlocking crystals;

(3) Explain, using models such as stream tables and clay layers, how erosion, deposition, and pushing and pulling forces inside the earth create landforms like mountains and valleys;

(4) Describe, using three-dimensional models or drawings, the internal layers of the earth, for example:

(I) Continental and oceanic crust;

(II) A hot, convecting mantle; and

(III) A dense, metallic core;

(5) Compare and contrast the properties of various soil samples, such as color, texture and capacity to retain water;

(6) Explain by using observations of actual soil samples that soil contains materials that are required for things that live in the soil;

(7) List the major components of the atmosphere at the surface of the earth and their relative abundance, such as nitrogen is the largest component, followed by oxygen, with other gases like carbon dioxide and water vapor in smaller amounts;

(8) Describe how temperature, density, pressure and the composition of the atmosphere vary with elevation; and

(9) Describe the causes and effects of geologic events, such as earthquakes, landslides, volcanoes and floods.

(b) Understand that the earth may be represented by a variety of maps and models, as demonstrated by the pupil's ability to:

(1) Locate positions on the surface of the earth using degrees of latitude and longitude coordinates;

(2) Compare and contrast the kinds of features found on various kinds of maps, including, without limitation, contour, physical, political and geological maps;

(3) Find the State of Nevada or identifiable features of the State of Nevada, depending on the map scale, on various kinds of maps, including contour, physical, political and geological maps;

(4) Use a color-coded map to compare and contrast various features such as temperature, density of population, geology and precipitation; and

(5) Determine the time of day in various places throughout the world, but not across the International Date Line, given the local time of day.

(c) Understand that the systems of the earth such as weather and formation of the mountains can change or vary, as demonstrated by the pupil's ability to:

(1) Identify the key processes and rates of change that occurred in the formation of a landform, for example, the slow processes of weathering, erosion and deposition, and the relatively fast processes of volcanism and mass wasting;

(2) Apply, using actual, replica or graphic reproductions of fossils, the following evidence to show that life forms and environmental conditions change over time:

(I) The fossil record reflects a pattern of change in organisms over time; and

(II) Many fossils are similar to organisms that are alive today, allowing logical comparisons of past and present environments;

(3) Describe reasons that fossil evidence may not form or may be destroyed, for example, scavenger and decomposer activity, and the effects of weathering and erosion; and

(4) Provide a reasonable description of how weathering, erosion, deposition, radioactive decay, volcanic activity, plate tectonics and many other natural processes that occur in the present day are the same as those that occurred in the past.

(d) Understand that the systems of the earth have a variety of cycles through which energy and matter continually flow, as demonstrated by the pupil's ability to:

(1) Explain, using diagrams and words, that the sun is the ultimate source of energy for the major processes of the earth, for example:

(I) From the sun to plant to fossil fuel; and

(II) From the sun to evaporation to precipitation to weathering and erosion caused by water;

(2) Explain, citing direct observations of the high specific heat of water, the moderating effect that large bodies of water have on the weather and climate because of the relatively high capacity of water to absorb heat and release heat slowly;

(3) Explain, using weather maps, the weather that occurs near boundaries between air masses;

(4) Describe the formation and types of clouds and how these types of clouds are associated with particular patterns of weather, for example, particular clouds often precede particular kinds of fronts between air masses, and that cumulonimbus clouds are typically associated with thunderstorms;

(5) Explain the relationship between temperature, moisture and origin of air masses, for example, air masses that form over land tend to be dry and air masses that form in polar regions tend to be cold;

(6) Explain, citing firsthand observations such as radiation striking a surface from a light bulb at various angles of incidence, the relationship between changes in the aspect of the earth's axis relative to the sun and the incidence of solar radiation;

(7) Explain, using climate and weather data, diagrams, maps and models, how long-term patterns of air movement combined with regional topography affect regional climate, for example, rain-shadow deserts caused by coastal mountain ranges;

(8) Explain, using a model or a diagram, how water circulates through the earth, oceans and atmosphere through interlinked cycles of evaporation, condensation, transpiration, runoff and ground water percolation;

(9) Describe, using climate and weather data, drawings and maps, how climate is affected by proximity to large bodies of water, patterns of atmospheric movement, latitude and altitude;

(10) Observe and describe some processes that are reversible, such as pH indicator changes or stretching a spring within its elastic limit, and others that are practically irreversible, such as burning, stretching a spring beyond its elastic limit and extinction of a species;

(11) Explain, citing firsthand observations such as the conservation of energy in calorimeter experiments, that the energy the earth receives over geologic time approximately equals the energy that the earth loses; and

(12) Describe, using diagrams and models, the relationships among geothermal and tectonic processes, for example, geothermal processes occur near lithosphere plate boundaries or where lithosphere plates are fractured or relatively thin.

(c) Understand that the earth is part of a planetary system within the Milky Way Galaxy, which is part of the known universe, as demonstrated by the pupil's ability to:

(1) Investigate and describe the principle characteristics of the planets in the solar system, using print, multimedia or Internet resources and drawings or models;

(2) Investigate, using print, multimedia or Internet resources, and describe, using drawings or models, how seasons, eclipses, moon phases and tides are caused by the effects of relative motion and positions of the sun, earth and moon;

(3) Explain that billions of galaxies form most of the visible mass in the universe and compare the chemical composition of galaxies to that of the earth;

(4) Explain how various tools, such as optical and radio telescopes and unmanned robotic spacecraft, allow us to investigate objects in the sky that are too distant, faint or bright to observe directly from the earth; and

(5) Describe the historical development of some of the laws of motion, for example, the laws of Kepler and Newton, that apply to the motion of objects in the solar system.

4. For the area of environmental sciences:

(a) Understand that ecosystems display patterns of organization, change and stability as a result of the interactions and interdependencies among the life forms and the physical components of the earth, as demonstrated by the pupil's ability to:

(1) Develop a presentation to represent visually and explain how organisms interact with the living and nonliving components of their ecosystems, including food chains and food webs;

(2) Characterize organisms in a variety of ecosystems by their function, for example, producer, consumer, predator, prey, parasite, host, scavenger or decomposer;

(3) Analyze, citing specific examples, the role of predators as a stabilizing factor in an ecosystem and explain how they can prevent habitat destruction or extinction of a species;

(4) Trace the flow of energy in an ecosystem, noting the dissipation of heat at each energy transfer point, and describe the impact on the ecosystem, for example, by comparing the implications on resources of a vegetarian diet to one with high meat consumption; and

(5) Identify similarities and differences found in geographically distinct ecosystems.

(b) Understand that natural resources include renewable and nonrenewable materials and energy and that all organisms, including humans, use resources to maintain and improve their existence, and that the use of resources can have positive and negative consequences, as demonstrated by the pupil's ability to:

(1) Observe and describe the identifying characteristics of renewable and nonrenewable resources;

(2) Explain how some natural resources are limited in their abundance or accessible location, for example, water in the desert;

(3) Investigate and describe the location and distribution of nonrenewable energy resources by using print, multimedia or Internet resources;

(4) Observe directly and use print, multimedia and Internet resources to describe how organisms alter their local environment through their use of natural resources;

(5) Describe how the unintended consequences of technology can cause:

(I) The depletion of resources, such as internal combustion engines burning fossil fuels that are nonrenewable; and

(II) Environmental degradation, such as internal combustion engines causing air pollution; and

(6) Describe how technology can increase the availability of resources, for example:

(I) Internal combustion engines allow the harvest and transport of resources more efficiently and mitigate environmental degradation;

(II) Improvements in design and fuel of internal combustion engines can lower rates of air pollution; and

(III) Improvements in mining technology make it financially feasible to mine ores previously considered too low-grade to be profitable.

(c) Understand that through conservation humans have the unique ability to change personal and societal behavior based on ethical considerations regarding other organisms, the planet as a whole and future generations.

5. For the area of the nature and history of science:

(a) Understand that humans have the unique ability to change personal and societal behavior based on ethical considerations regarding other organisms, the planet as a whole and future generations, as demonstrated by the pupil's ability to:

(1) Demonstrate that scientific investigations involve:

(I) The use of logic, for example, step-by-step thinking;

(II) Respect for the rules of evidence, such as generally using a truthful, careful and accurate collection of evidence and information in a scientific investigation;

(III) Adherence to the standards for keeping a science notebook;

(IV) Openness to criticism, for example, respectfully considering constructive criticism and review by peers;

(V) Respectfully offering constructive criticism and review of peers; and

(VI) Public reporting of methods and procedures;

(2) Successfully carry out at least one of the following kinds of investigations:

(I) A controlled experiment;

(II) A field study; or

(III) A research report using multiple sources;

(3) Explain, using examples, that people from ancient times have provided knowledge about the natural world that is still regarded as valid today, even though that knowledge may not have originated by scientific methods;

(4) Understand that scientists may work in teams or scientists may work alone, but scientists should communicate extensively with each other, for example, by conducting investigations and sharing results with other scientists conducting similar work;

(5) Compare and contrast scientific inquiry and technological design using multiple and related examples of research and the application of the research to technology, for example, fish ladders, habitats and walkways for tortoises, access for the handicapped and pacemakers for the heart;

(6) Critique the results, techniques and processes used in a scientific investigation; and

(7) Compare and contrast the strengths and limitations of science as related to other social and intellectual activities of humans.

(b) Understand that many decisions require critical consideration of scientific evidence, as demonstrated by the pupil's ability to:

(1) Identify and evaluate the use of statistics, data and graphs in a variety of scientific work;

(2) Give examples of human activities with their associated benefits, costs and risks, for example, cloning, electric automobiles and pest control;

(3) Analyze and describe a simple system, such as a pendulum, aquarium or toilet, in terms of its efficiency, optimal function and possible sources of malfunction; and

(4) Evaluate information to distinguish between fact and opinion when solving problems, for example, product advertising and early theories concerning flat earth versus round earth.

(c) Understand that a variety of models can be used to describe or predict things and events, as demonstrated by the pupil's ability to:

(1) Use two different models to demonstrate the same thing, such as a map and a globe;

(2) Use models to predict change, as in a stream table;

(3) Identify and illustrate natural cycles within systems, for example, water, planetary motion, climate and geological changes;

(4) Analyze data from two groups, comparing their means, medians, modes and ranges, and explain why these statistics are important; and

(5) Use a systematic approach to describe the risks and benefits of a situation.

(d) Understand that science is an active process of systematically examining the natural world, as demonstrated by the pupil's ability to:

(1) Clearly state reasons for keeping honest, clear and accurate records, for example, to maintain the integrity of the scientific process and to mitigate possible injury to persons, property or the environment;

(2) Explain that hypotheses are valuable even if they turn out to be incorrect; and

(3) Compare varying explanations given for a particular phenomenon, event or result.

(e) Understand that a variety of methods of communication may be used to share scientific information, as demonstrated by the pupil's ability to:

(1) Write clear, step-by-step instructions for a procedure;

(2) Organize information in tables and graphs and describe the relationships they reveal; and

(3) Discuss scientific topics by paraphrasing, asking for clarification or elaboration, and expressing alternative positions using print, Internet and multimedia resources.

6. For the area of scientific inquiry, processes and skills:

~~(a) Understand that scientific inquiry is enhanced and often communicated through the use of mathematics, as demonstrated by the pupil's ability to:~~

~~(1) Explain that quantities can vary in proportion to one another, such as the mass of a substance is directly proportional to its volume or the time it takes for a vehicle to travel is directly proportional to the distance that it travels;~~

~~(2) Explain in general terms the steps required to solve a given problem and why the steps are necessary;~~

~~(3) Explain, using examples, that probabilities are ratios and can be expressed as fractions, percentages or odds;~~

~~(4) Make reasonable estimates of outcomes in familiar situations, for example, the probability of being born a boy or girl, of being struck by lightening or of being involved in an automobile accident;~~

~~(5) Explain that, with very few exceptions, numbers in science are expressed with units;~~

~~(6) Consistently select and use the appropriate System International unit for a particular measurement, such as meters for length, seconds for time or kilograms for mass;~~

~~(7) Define accuracy and precision and determine if repeated measurements and computations of quantities are reasonably precise and accurate; and~~

~~(8) Make reasonable predictions on the basis of all known data from related studies carried out under similar conditions.~~

~~(b) Appropriately and safely apply the tools and techniques of scientific inquiry, as demonstrated by the pupil's ability to:~~

~~(1) Consistently use instruments and laboratory safety equipment properly;~~

~~(2) Consistently handle and dispose of chemicals according to established standards;~~

~~(3) Choose appropriate, available materials for making or repairing simple mechanical constructions, for example, designing an apparatus using simple machines;~~

~~(4) Keep accurate and organized records of scientific investigations;~~

~~(5) Use appropriate technology in laboratory procedures for measuring, recording, storing and analyzing data, such as computers, graphing calculators and probes; and~~

~~(6) Design and carry out a controlled experiment working in a small group.~~]

Instruction in the sixth through eighth grades in science must be designed so that pupils meet the following standards by the completion of the eighth grade:

1. ***For the area of Science Inquiry: Students understand that scientific knowledge requires critical consideration of verifiable evidence obtained from inquiry and appropriate investigations.***
   (a) Students know how to identify and critically evaluate information in data, tables, and graphs, and
   (b) Students know how to critically evaluate information to distinguish between fact and opinion, and
   (c) Students know different explanations can be given for the same evidence, and
   (d) Students know how to design and conduct a controlled experiment, and
   (e) Students know how to use appropriate technology and laboratory procedures safely for observing, measuring, recording, and analyzing data, and
   (f) Students know scientific inquiry includes evaluating results of scientific investigations, experiments, observations, theoretical and mathematical models, and explanations proposed by other scientists.
2. ***For the area of Science, Technology, and Society: Students understand the interactions of science and society in an ever-changing world.***

(a) Students understand that consequences of technologies can cause resource depletion and environmental degradation, but technology can also increase resource availability, mitigate environmental degradation, and make new resources economical, and
(b) Students know scientific knowledge is revised through a process of incorporating new evidence gained through on-going investigation and collaborative discussion.

3. *For the area of Matter: Students understand the properties and changes of properties in matter.*
(a) Students know particles are arranged differently in solids, liquids, and gases of the same substance, and
(b) Students know elements can be arranged in the periodic table which shows repeating patterns that group elements with similar properties, and
(c) Students know methods for separating mixtures based on the properties of the components, and
(d) Students know atoms often combine to form molecules, and that compounds form when two or more different kinds of atoms chemically bond, and
(e) Students know mass is conserved in physical and chemical changes, and
(f) Students know matter is made up of tiny particles called atoms, and
(g) Students know the characteristics of electrons, protons, and neutrons, and
(h) Students know substances containing only one kind of atom are elements which cannot be broken into smaller pieces by normal laboratory processes.
4. *For the area of Force and Motion: Students understand that position and motion of an object result from the net effect of the different forces acting on it.*
(a) Students know the effects of balanced and unbalanced forces on an object's motion, and
(b) Students know electric currents can produce magnetic forces and magnets can cause electric currents, and
(c) Students know every object exerts gravitational force on every other object, and the magnitude of this force depends on the mass of the objects and their distance from one another.
5. *For the area of Energy: Students understand transfer of energy.*
(a) Students know visible light is a narrow band within the electromagnetic spectrum, and
(b) Students know vibrations (e.g., sounds, earthquakes) move at different speeds in different materials, have different wavelengths, and set up wave-like disturbances that spread away from the source uniformly, and
(c) Students know physical, chemical, and nuclear changes involve a transfer of energy, and
(d) Students know energy cannot be created or destroyed, in a chemical or physical reaction, but only changed from one form to another, and
(e) Students know heat energy flows from warmer materials or regions to cooler ones through conduction, convection, and radiation, and
(f) Students know electrical circuits provide a means of transferring electrical energy to produce heat, light, sound, and chemical changes.
6. *For the area of Heredity: Students understand the role of genetic information in the continuation of a species.*
(a) Students know heredity is the passage of genetic instructions from one generation to the next generation, and
(b) Students know changes in genes of eggs and sperm can cause changes in inherited characteristics, and

(c) Students know organisms can be bred for specific characteristics, and
(d) Students know some characteristics of an organism are the result of a combination of interaction with the environment and genetic information.

7. *For the area of Structure of Life: Students understand that living things are composed of cells, which are specialized in multicellular organisms to perform a variety of life functions.*
   (a) Students know all organisms are composed of cells, which are the fundamental units of life, and
   (b) Students know cells grow, divide, and take in nutrients which they use to provide energy for cell functions, and
   (c) Students know some organisms are made of just one cell and that multicellular organisms can consist of thousands to millions of cells working together, and
   (d) Students know cells combine to form tissues that combine to form organs and organ systems that are specialized to perform life functions, and
   (e) Students know disease can result from defects in body systems or from damage caused by infection.
8. *For the area of Organisms and their Environment: Students understand how living and non-living components of ecosystems interact.*
   (a) Students know how matter and energy are transferred through food webs in an ecosystem, and
   (b) Students know how to characterize organisms in any ecosystem by their functions, and
   (c) Students will evaluate how changes in environments can be beneficial or harmful, and
   (d) Students know inter-related factors affect the number and type of organisms an ecosystem can support.
9. *For the area Diversity of Life: Students understand that life forms change over time, contributing to the variety of organisms found on the Earth.*
   (a) Students know species can be identified and classified based upon their characteristics, and
   (b) Students know fossils provide evidence of how life and environmental conditions have changed throughout geologic time, and
   (c) Students know an organism's behavior is based on both experience and on the species' evolutionary history.
10. *For the area of Atmospheric Processes and the Water Cycle: Students understand the relationship between the Earth's atmosphere, topography, weather and climate.*
    (a) Students know seasons are caused by variations in the amounts of the Sun's energy reaching Earth's surface due to the planet's axial tilt, and
    (b) Students know how the processes involved in the water cycle affect climatic patterns, and
    (c) Students know the properties that make water an essential component of the earth system, and
    (d) Students understand the composition of Earth's atmosphere, emphasizing the role of the atmosphere in Earth's weather and climate, and
    (e) Students know the difference between local weather and regional climate, and
    (f) Students know topography and patterns of global and local atmospheric movement influence local weather which occurs primarily in the lower atmosphere. E/S
11. *For the area of Solar System and Universe: Students understand characteristics of our solar system that is part of the Milky Way galaxy.*

(a) Students know the universe contains many billions of galaxies, and each galaxy contains many billions of stars, and
(b) Students know the solar system includes a great variety of planetary moons, asteroids, and comets, and
(c) Students know characteristics of the planets in our solar system, and
(d) Students know Earth is part of a solar system located within the Milky Way Galaxy, and
(e) Students know the Sun is many thousands of times closer to Earth than any other star, and billions of times closer than the far end of the Milky Way Galaxy, and
(f) Students know the Sun is a medium-sized star located in the Milky Way Galaxy, part of which can be seen as a glowing band of light spanning the clear night sky, and
(g) Students know regular and predictable motions of Earth around the Sun and the Moon around the Earth explain such phenomena as the day, the year, phases of the Moon, and eclipses.

12. For the area of Earth's Composition and Structure: Students understand that landforms result from a combination of constructive and destructive processes.
(a) Students know sedimentary rocks and fossils provide evidence for changing environments and the constancy of geologic processes, and
(b) Students know rocks at Earth's surface weather, forming sediments that are buried, then compacted, heated and often recrystallized into new rock, and
(c) Students know Earth is composed of a crust (both continental and oceanic); hot convecting mantle; and dense, a metallic core, and
(d) Students know the very slow movement of large crustal plates result in geological events, and
(e) Students know how geologic processes account for state and regional topography, and
(f) Students know minerals have different properties and different distributions according to how they form, and
(g) Students know the characteristics, abundances, and location of renewable and nonrenewable resources found in Nevada, and
(h) Students know soils have properties, such as color, texture, and water retention, and provide nutrients for life according to how they form.

NAC 389.491 Science: Generally. (NRS 385.080**,** 385.110**,** 389.520**)**

1. A local school district shall ensure that pupils, by the completion of the 12th grade, are able to comply with content ~~[and performance]~~ standards required for science adopted by the State Board of Education. In carrying out this requirement, the district shall:

(a) Develop courses which must encompass all of the content and performance standards required for science by the completion of the 12th grade; and

(b) Provide to each pupil, upon enrollment in high school, a listing of the courses that encompass all of the content and performance standards required for science by the completion of the 12th grade.

2. If a pupil enrolls in a science course listed under NAC 389.492 to 389.498, inclusive, the school district shall notify the pupil in writing at the time of enrollment in the course that:

(a) The objectives of the science course may include standards for science in addition to the standards that are required to be completed by the end of 12th grade; and

(b) The science courses listed under NAC 389.492 to 389.498, inclusive, are not designed to ensure that the content and performance standards for science that are required to be completed by the end of 12th grade will be met by completion of a course listed under NAC 389.492 to

389.498, inclusive, unless that course is included in the listing provided pursuant to paragraph (b) of subsection 1.

NAC 389.4915 Science: Performance standards. (NRS 385.080**,** 389.520**)** By the end of the 12th grade, pupils must know and be able to do everything required in the previous grades for courses in science offered in public schools. ~~[Instruction in the 12th grade must be designed so that pupils meet the following performance standards by the completion of the 12th grade:~~

~~1. For the area of physical science:~~

~~(a) Understand that gravitational, electrical and magnetic forces have an effect on the motion of objects, as demonstrated by the pupil's ability to:~~

~~(1) Use the laws of motion to correctly predict the motion of an object;~~

~~(2) Describe changes in the force of gravity based on different masses and distances and apply the principle of gravity to the motion of falling objects, for example, objects accelerate as they fall;~~

~~(3) Determine the mechanical advantage and efficiency of various simple machines, such as a screw, lever, pulley, wheel, axle and wedge, and evaluate the usefulness of various machines according to their function, efficiency and mechanical advantage;~~

~~(4) Explain and apply the relationship between force, pressure and area, P=F÷A, to common phenomena, for example, the change in gas pressure in an expanding container or the differences in pressure between sharp and dull objects;~~

~~(5) Investigate and describe the relationship between pressure and depth in a liquid;~~

~~(6) Describe or explain the relationship between electromagnetic forces and electromagnetic systems, such as generators, circuits and electric motors;~~

~~(7) Calculate variables for simple electromagnetic systems, such as current, resistance, wattage and voltage; and~~

~~(8) Investigate and describe that the electromagnetic spectrum, including radio waves, light and infrared, is a form of energy consisting of both electrical and magnetic energy.~~

~~(b) Understand that materials have distinct properties which depend on the amount of matter present, its chemical composition and structure, as demonstrated by the pupil's ability to:~~

~~(1) Investigate and describe the intrinsic physical properties of matter, such as color, odor and density, and the extrinsic physical properties of matter, such as mass and volume;~~

~~(2) Apply techniques of spectral analysis, such as flame tests and colorimetry, to the identification of elements and compounds;~~

~~(3) Distinguish among and describe various types of chemical bonds, such as covalent, ionic and metallic;~~

~~(4) Describe the major features of the quantum-mechanical model of atomic structure including the concepts of the probable locations of electrons, discrete energy levels, quantum numbers and electron configurations;~~

~~(5) Apply the Kinetic Molecular Theory and the concept of forces between particles to explain phase changes and the properties of the states of matter; and~~

~~(6) Explain how carbon atoms uniquely bond to one another to form a large variety of molecules including those necessary for life.~~

~~(c) Understand that changes in temperature and pressure can alter states of matter and that energy exists in many forms and one form can change into another, as demonstrated by the pupil's ability to:~~

(1) Explain, using multiple examples, that any transfer or transformation of energy results in some "loss" of energy in the form of heat which may spread by radiation, conduction or convection;

(2) Investigate, using firsthand observations, and explain that pressure may affect changes of state;

(3) Investigate, using firsthand observations, and describe how waves can superimpose on one another, bend around corners, reflect off surfaces, be absorbed by materials they enter and change directions when entering a new material;

(4) Investigate and describe, using firsthand observations, the properties of electrical circuits in terms of moving electrons, conductivity, resistance and electrical potential energy;

(5) Investigate how matter and energy may be changed and energy may be transferred in many ways by using firsthand observations such as data on conservation of momentum, predictions of projectile motion, careful measurements and calculations of transfer between potential and kinetic energy;

(6) Describe the conservation of mass-energy as it applies to a closed system, such as $E=mc^2$; and

(7) Describe the concept of entropy as it applies to a closed system, identify the tendency for disorder to increase, and, if given examples of chemical and physical changes, state which is favored by entropy.

(d) Understand that chemical reactions change substances into different substances, as demonstrated by the pupil's ability to:

(1) Write a balanced equation to describe a given chemical reaction and describe the information it conveys;

(2) Describe qualitatively the way in which various factors affect the rate of a chemical reaction, such as the temperature, particle size, pressure, presence of a catalyst, pH and concentration of reactants;

(3) Distinguish between endothermic and exothermic reactions, for example, redox reactions, burning fuel, photosynthesis, respiration and electrochemical reactions in batteries; and

(4) Relate the chemical reactivity of an element to its electron configuration and illustrate it with appropriate diagrams and examples.

(e) Understand that nuclear energy and electromagnetic energy are produced from both natural and man-made sources in many forms, as demonstrated by the pupil's ability to:

(1) Use lenses to demonstrate the interaction of light with matter, such as reflection and refraction;

(2) Diagram the converging and diverging lenses and describe their major applications;

(3) Estimate the age of some materials using predictable rates of nuclear reaction, for example, half-lives;

(4) Describe the differences in disposal techniques that are required for high-level and low-level nuclear wastes;

(5) Describe electromagnetic spectrum labeling, such as gamma rays, X rays, visible light, ultraviolet, infrared and radio waves;

(6) Communicate that the strong nuclear force that holds the nucleus together is greater than the weak forces that would tend to break it apart;

(7) Describe the release of energy during the nuclear processes of fission and fusion and give examples of elements that undergo fission and fusion respectively; and

(8) Compare the amount of energy in fission and fusion with that in chemical and phase changes.

2. For the area of life science:

(a) Understand that all life forms, at all levels of organization, use specialized structures and similar processes to meet the basic needs of life, as demonstrated by the pupil's ability to:

(1) Explain, with minor errors, the concept of equilibrium in organisms as related to disease processes;

(2) With minimal assistance from the teacher, distinguish among the systems of the human body, for example, the skeletal, nervous and digestive systems, and describe the different cells of each;

(3) With assistance from the teacher, trace the digestion, absorption and use of a food or group of foods through an organism; and

(4) Reasonably explain the process of photosynthesis.

(b) Understand that organisms respond to internal and external influences, as demonstrated by the pupil's ability to:

(1) Relate patterns of behavior to survival of a species and provide some examples;

(2) Give examples of a response in a plant and an animal to an environmental change that enhances its chance of survival;

(3) Describe the role of the nervous system in receiving input and generating responses in multicellular animals; and

(4) Develop a presentation suitable for pupils who are enrolled in junior high school and middle school that explains how the immune system works and how acquired immune deficiency syndrome (AIDS), a viral disease, destroys critical cells, thereby making the body vulnerable to infectious agents and cancerous cells.

(c) Understand that life forms are diverse and that through heredity they pass some characteristics to their offspring, as demonstrated by the pupil's ability to:

(1) Explain, in general terms, that all cells in the body of an organism are developed from a single set of genetic information and that different parts of the information are used in different kinds of cells;

(2) Explain, using diagrams or charts, how similarity among sequences of DNA may be used to estimate the degree of relatedness among organisms;

(3) Relate the great variety of possible gene combinations to sexual reproduction;

(4) Explain how DNA provides instructions for assembling proteins;

(5) Demonstrate, with minor errors, how multiple pairs of genes may control patterns of inheritance;

(6) Point out, with examples, how the diversity and variation of organisms increases the chance of survival when changes in the conditions of the environment occur; and

(7) Describe how a variety of influences may cause mutations of genes.

(d) Understand that life forms change over time through evolution and the process of biological change, as demonstrated by the pupil's ability to:

(1) Explain the basic concepts underlying the theory of evolution;

(2) Investigate and apply the concept of natural selection to explain incremental changes in the fossil record, using an example such as Eohippus;

(3) Relate adaptations of a species to the unique characteristics that favor an organism in a particular environment and use Kettlewell's study of England's peppered moths as an example of natural selection;

(4) Recognize that there are various lines of evidence which are used to establish an evolutionary relationship among species;

(5) Explain why most species that ever lived are extinct and why many human beings are concerned that endangered species be preserved;

(6) Provide examples of genetic and environmental influences that drive the process of evolution; and

(7) Cite evidence that cells with nuclei existed over 1 billion years ago and that these cells were the precursors to increasingly more complex organisms.

3. For the areas of earth and space sciences:

(a) Understand that the earth is composed of interrelated systems of rocks, water, air and life, as demonstrated by the pupil's ability to:

(1) Describe the general processes of formation of a given sample of rock, such as weathering, erosion, deposition, melting, heat and pressure;

(2) List uses for at least five common materials of the earth, such as gypsum in drywall and metals in electrical devices;

(3) Explain the formation of some topographical features, for example, volcanoes, rift valleys, ocean trenches and fault-block mountains, in terms of moving lithosphere plates;

(4) Explain how the earth is generally layered from the most dense material, such as solids like rocks, outward to less dense materials, such as liquids like oceans, lakes, and streams, with the outermost layer being the least dense with gases such as the atmosphere;

(5) Describe the origin of constituents in various samples of soil, for example, organic materials that come from decomposed plants and animals and mineral materials that come from weathered rock;

(6) Compare and contrast the composition and properties of different soil horizons;

(7) Describe, citing print, multimedia or Internet resources, some historical changes in the atmosphere of the earth, such as the change from a predominantly methane and ammonia atmosphere to its composition today;

(8) Describe, citing print, multimedia or Internet resources, present-day changes in the atmosphere of the earth, for example, the increase in carbon dioxide, ozone depletion and air pollution;

(9) Compare and contrast, using maps, models, photographs or field observations, large geologic features throughout the State of Nevada, such as basin and range fault-block mountains and Sierra batholiths; and

(10) Compare and contrast, using maps, models, photographs or field observations, specific local geologic features, such as the glacial features in Lamoille Canyon, the local beach benchmarks from ancient lakes and the thrust faults in the Spring Mountains.

(b) Understand that the earth may be represented by a variety of maps and models, as demonstrated by the pupil's ability to:

(1) Construct a contour map of a simple model landform and then build a model landform from a simple contour map;

(2) Define a location on the earth in terms of latitude and longitude to the precision of degrees, minutes and seconds; and

(3) Determine the time in any time zone given the time of day.

(c) Understand that the systems of the earth, such as weather and the formation of mountains, change or vary, as demonstrated by the pupil's ability to:

(1) Describe two ancient and two recent examples of catastrophic geologic events and analyze the causes of those events by using Internet, print or audiovisual materials;

(2) Create a representation of a stratigraphic column based on actual or photographic data that represent rock sequences and nonconformities, such as erosion surfaces; and

(3) Compare and contrast the variety of methods by which geologic time is determined, for example, radioactive dating, dendrochronology, stratigraphy and faunal succession.

(d) Understand that the systems of the earth have a variety of cycles through which energy and matter continually flow, as demonstrated by the pupil's ability to:

(1) Explain that the systems of the earth have two major internal sources of energy, decay of radioactive isotopes and gravitational energy, and one major external source, the sun, all of which create heat, and link these respectively to their major effect;

(2) Observe and describe convection currents formed by heating water in a container;

(3) Explain, using diagrams and citing firsthand observations, how uneven heating of the surface of the earth from the sun forms convection currents within the atmosphere and ocean, producing wind and ocean currents that are modified by the rotation of the earth;

(4) Investigate the unusual ability of water to dissolve a wide range of substances and explain, using diagrams and citing firsthand observations, how water dissolves minerals and gases as it passes through the water cycle and carries them to oceans and lakes;

(5) Describe, using diagrams or multimedia presentations, how global climate is determined primarily by the conversion of light and ultraviolet energy to infrared radiation at and near the surface of the earth;

(6) Describe how relatively small changes in solar output may have contributed to large changes in the climate of the earth in the past, for example, ice ages and interglacial periods;

(7) Explain how large-scale, long-term equilibrium can accommodate small-scale changes, for example:

(I) A relatively small disruption such as a fire, landslide or flood of a large ecosystem may disturb patterns such as food webs and cycles of matter found in that ecosystem, but over time new patterns may form or old patterns may reestablish; and

(II) A regional disruption of climate, for example, El Niño, may cause global changes in weather, but it may not have a significant impact on climate over long periods of time;

(8) Explain, using diagrams or animated multimedia presentations, the global system of the cycles of rocks, carbon and nitrogen, including living and nonliving components of these cycles as appropriate;

(9) Describe the model of the greenhouse effect, including a list of the various gases, which impede the transfer of long-wave radiation from the earth into space;

(10) Explain that the theory of global warming is based on observations subject to multiple interpretations and predictions and that the theory is less certain than the model of the greenhouse effect, which is one component of the theory of global warming, but which is based on reproducible laboratory data; and

(11) Model, using multimedia software or other methods, and explain how the energy that propels the lithosphere plates of the earth is predominantly a result of nuclear processes deep in the earth.

(e) Understand that the earth is part of a planetary system within the Milky Way Galaxy, which is part of the known universe, as demonstrated by the pupil's ability to:

(1) Investigate, using print, multimedia or Internet resources, and compare and contrast the earth's atmosphere, water, temperature and composition with those conditions on other planets;

(2) Explain, using print or multimedia software, how most objects in the solar system are in regular and predictable motion, and relate that motion to such phenomena as the day, the year, phases of the moon and eclipses;

(3) Explain that stars produce energy and elements heavier than hydrogen from nuclear reactions;

(4) Estimate the age of the universe as 10 billion years and cite supporting scientific evidence;

(5) Describe how increasingly sophisticated technology, such as mathematical models and computer simulations, is used to learn about the universe; and

(6) Explain that the physical laws, such as the laws of Newton, Kepler, thermodynamics, relativity and quantum physics, appear to apply to all bodies in the universe.

4. For the area of environmental sciences:

(a) Understand that ecosystems display patterns of organization, change and stability as a result of the interactions and interdependencies among the life forms and the physical components of the earth, as demonstrated by the pupil's ability to:

(1) Investigate and describe, using specific examples, how changes in an ecosystem may affect biodiversity and contribute to an ecosystem's stability or instability;

(2) Explain how an ecosystem may change or remain the same in response to different kinds of influences;

(3) Contrast the immediate and long-term effects of a disaster, such as a flood or fire, with those produced by a change in climate or introduction of a new species;

(4) Interpret a food web showing how materials and energy are cycled through ecosystems; and

(5) Compare and contrast the geologic, hydrologic, climatic and biological characteristics of the principal bioregions of the State of Nevada, for example, northern Nevada's cold desert and southern Nevada's warm desert.

(b) Understand that natural resources include renewable and nonrenewable materials and energy, that all organisms, including humans, use resources to maintain and improve their existence and that the use of resources can have positive and negative consequences, as demonstrated by the pupil's ability to:

(1) Investigate, using print, multimedia or the Internet, the positive and negative consequences of changing the way in which the nation as a whole and individuals use a natural resource, for example:

(I) Switching from the use of fossil fuels to the use of solar power may reduce air pollution, but would likely involve the extraction and use of materials from the earth to make solar apparatus; and

(II) Recycling aluminum cans reduces the energy involved in extracting aluminum ore, but requires changing personal habits and creating new systems for recycling;

(2) Investigate and describe the various processes involved in obtaining, using and recycling a specific class of materials such as wood products, minerals or plastics and explain the environmental implications;

(3) Investigate, using print, multimedia or Internet resources, and describe the career opportunities associated with the study, exploration, extraction, use, protection and restoration of natural resources;

(4) Analyze and describe the limitations of the ability of the earth to respond to several different kinds of stresses produced by human or natural activities, for example:

(I) Excessive rates of removal of ground water may destroy an aquifer's ability to recharge;

(II) Channelization of mature rivers can change capacity for bioremediation by reducing the amount of wetland or marsh area the water normally passes through; and

(III) Forest fires in marginally arable areas can, over the short or long term, reduce soil stability and increase erosion; and

(5) Analyze and evaluate, with specific examples, the effects that changes in human populations have caused, such as:

(I) The depletion of resources and environmental degradation when a population increases; and

(II) The positive and negative changes in ecosystems when populations migrate.

(c) Understand that humans have the unique ability to change personal and societal behavior based on ethical considerations regarding other organisms, the planet as a whole and future generations, as demonstrated by the pupil's ability to:

(1) Analyze the energy condition, conservation efforts and societal behavior patterns of the United States;

(2) Discuss how human actions may impact the equilibrium of global systems;

(3) Select a representative example and show how there can be scientific uncertainty regarding an environmental issue due to its complexity or the length of time required to ascertain effects; and

(4) Provide examples of global actions that may affect the environment or economy of the State of Nevada and the impact of related trade-offs.

5. For the area of the nature and history of science:

(a) Understand that humans have the unique ability to change personal and societal behavior based on ethical considerations regarding other organisms, the planet as a whole and future generations, as demonstrated by the pupil's ability to:

(1) Demonstrate that scientific knowledge uses a process of critique and consensus, for example, communicating methods and procedures used in scientific investigations to peers and teachers;

(2) Investigate and explain that public policy impacts the allocation of money available for research, for example, nuclear research, cancer research and acquired immune deficiency syndrome (AIDS) research;

(3) Research and explain how a scientific innovation that was originally challenged is now widely accepted, such as the sun-centered model of the solar system;

(4) Explain, with an appropriate example, that scientists work with others to resolve differences in interpretation of observations;

(5) Provide examples of technological problems that create a demand for new scientific knowledge and new technologies which make it possible for scientists to extend their research in new ways or to undertake entirely new lines;

(6) Provide examples of scientific knowledge that is built on previous information to explain that entire theories are rarely completely discarded in favor of new ones, for example, the Greek view of the atom versus the quantum mechanical view; and

(7) Provide examples of ethical scientific policies and the reasons for those policies.

(b) Understand that many decisions require reasoning and critical consideration of scientific evidence, as demonstrated by the pupil's ability to:

(1) Evaluate how the validity of the scientific techniques used, for example, sampling procedures, affect the credibility of the information obtained in a specific kind of scientific investigation such as a controlled experiment, field work or secondary research;

(2) Develop and present an analysis of costs, benefits and risks that includes all major factors in a decision-making situation, for example, creating a man-made lake to enhance a new subdivision;

(3) Identify and accurately describe examples of systems that are quantitatively different from the components which comprise them, such as:

(I) How populations differ from individuals;

(II) How a cardiac system differs from its individual cells;

(III) How the features of a carburetor are unique, yet the carburetor functions in an engine system; or

(IV) The role of a raindrop in the water cycle; and

(4) Compare and contrast a scientific law, theory, rule and hypothesis and explain the limits of generalizations, assumptions, analogies and models by relating and applying each term to a specific concept in science.

(c) Understand that a variety of models can be used to describe or predict things and events, as demonstrated by the pupil's ability to:

(1) Use mathematical symbols and formulas for expression, for example, the universal gas law or Newton's Laws of Motion;

(2) Use models to identify and predict relationships of cause and effect, for example, the effect of temperature on the volume of a gas or the effect of the level of carbon dioxide on the greenhouse effect;

(3) Identify and describe how systems are often different from their components, using an example such as an aquarium or automobiles;

(4) Compare groups of data, taking into account both percentages and actual numbers;

(5) Identify types of hazards, such as transportation of chemicals on highways or railways, earthquakes or drought, and choose one example to estimate impacts such as fire or explosion or to estimate consequences of exposure to a hazard such as illness, death, economic loss of property, or loss of livelihood; and

(6) Provide examples of ways to reduce or eliminate risks, such as laws, planning and zoning, or safety precautions.

(d) Understand that science is an active process of systematically examining the natural world, as demonstrated by the pupil's ability to:

(1) Clearly demonstrate, through written or oral work, curiosity, honesty and skepticism by asking questions, not changing data, reasonably accounting for discrepant data and critically evaluating false or controversial findings;

(2) Repeat experiments for statistical analysis to produce conclusions that are well supported; and

(3) Given a common phenomenon, generate multiple explanations and describe which explanation is the most logical.

(e) Understand that a variety of methods of communication may be used to share scientific information, as demonstrated by the pupil's ability to:

(1) Analyze experimental procedures and suggest appropriate revisions for improvement;

(2) Incorporate the use of tables, charts and graphs to effectively make arguments and claims in oral and written presentations; and

(3) Discuss scientific topics by restating or summarizing accurately what others have said, asking for clarification or elaboration, expressing alternative positions and making use of available print, Internet and multimedia resources.

6. For the area of scientific inquiry, processes and skills:

(a) Understand that scientific inquiry is enhanced by and often communicated through the use of mathematics, as demonstrated by the pupil's ability to:

(1) Determine the relationship between variables in an investigation, for example, direct, inverse or square;

(2) Use a preselected algebraic relationship to calculate the answer to a problem, for example, given density = mass ÷ volume, calculate one of the three variables given the values of the other two;

~~(3) Identify what the correct order of magnitude would be for an answer to a specific problem;~~

~~(4) Use derived quantities, ratios, proportions and constants to solve appropriate problems;~~

~~(5) Provide an explanation or analysis of why a calculation does not agree with the expected result, such as the calculation of percent accuracy and class precision; and~~

~~(6) Select samples by a random system to avoid bias.~~

~~(b) Appropriately and safely apply the tools and techniques of scientific inquiry, as demonstrated by the pupil's ability to:~~

~~(1) Consistently demonstrate personal responsibility for using safety equipment and observing all safety standards;~~

~~(2) Consistently follow the instructions given by the teacher on the proper handling, storage and disposal of chemicals;~~

~~(3) Inspect, manipulate and describe the functions of various parts of technical and scientific equipment;~~

~~(4) Maintain a satisfactory record of procedures, data analyses, decisions and conclusions drawn from scientific investigations;~~

~~(5) Write procedures for the investigation of delegated or original scientific problems that are comprehensible; and~~

~~(6) Design, carry out and report on a scientific investigation.]~~

Instruction in the ninth through twelfth grades in science must be designed so that pupils meet the following standards by the completion of the twelfth grade:

1. ***In the area of Science Inquiry: Students understand that a variety of communication methods can be used to share scientific information.***
   (a) Students know tables, charts, illustrations and graphs can be used in making arguments and claims in oral and written presentations, and
   (b) Students know scientists maintain a permanent record of procedures, data, analyses, decisions, and understandings of scientific investigations, and
   (c) Students know repeated experimentation allows for statistical analysis and unbiased conclusions, and
   (d) Students know how to safely conduct an original scientific investigation using the appropriate tools and technology, and
   (e) Students know models and modeling can be used to identify and predict cause-effect relationships.
2. ***In the area of Science, Technology, and Society: Students understand the impacts of science and technology in terms of costs and benefits to society.***
   (a) Students know science, technology, and society influenced one another in both positive and negative ways, and
   (b) Students know consumption patterns, conservation efforts, and cultural or social practices in countries have varying environmental impacts, and
   (c) Students know the influence of ethics on scientific enterprise, and
   (d) Students know scientific knowledge builds on previous information.
3. ***In the area of Matter: Students understand that atomic structure explains the properties and behavior of matter.***
   (a) Students know different molecular arrangements and motions account for the different physical properties of solids, liquids, and gases, and
   (b) Students know elements in the periodic table are arranged into groups and periods by repeating patterns and relationships, and
   (c) Students know identifiable properties can be used to separate mixtures, and

(d) Students know atoms bond with one another by transferring or sharing electrons, and
(e) Students know chemical reactions can take place at different rates, depending on a variety of factors (i.e. temperature, concentration, surface area, and agitation), and
(f) Students know chemical reactions either release or absorb energy, and
(g) Students know that, in chemical reactions, elements combine in predictable ratios, and the numbers of atoms of each element do not change, and
(h) Students know most elements have two or more isotopes, some of which have practical applications, and
(i) Students know the number of electrons in an atom determines whether the atom is electrically neutral or an ion.

4. *In the area of Force and Motion: Students understand the interactions between force and motion.*
   (a) Students know laws of motion can be used to determine the effects of forces on the motion of objects, and
   (b) Students know magnetic forces and electric forces can be thought of as different aspects of electromagnetic force, and
   (c) Students know the strength of the electric force between two objects increases with charge and decreases with distance, and
   (d) Students know the strength of the gravitational force between two objects increases with mass and decreases rapidly with distance.
5. *In the area of Energy: Students understand that there are interactions between matter and energy.*
   (a) Students know waves (I.e. sound, seismic, electromagnetic) have energy that can be transferred when the waves interact with matter, and
   (b) Students know energy forms can be converted, and
   (c) Students know nuclear reactions convert a relatively small amount of material into a large amount of energy, and
   (d) Students know characteristics, applications and impacts of radioactivity, and
   (e) Students know the relationship between heat and temperature, and
   (f) Students know electricity is transferred from generating sources for consumption and practical uses.
6. *In the area of Heredity: Students understand how genetic information is passed from one generation to another.*
   (a) Students know genetic information passed from parents to offspring is coded in the DNA molecule, and
   (b) Students know DNA molecules provide instructions for assembling protein molecules, and
   (c) Students know all body cells in an organism develop from a single cell and contain essentially identical genetic instructions, and
   (d) Students know several causes and effects of somatic versus sex cell mutations, and
   (e) Students know how to predict patterns of inheritance.
7. *In the area of Structure of Life: Students understand that all life forms, at all levels of organization, use specialized structure and similar processes to meet life's needs*
   (a) Students know cell structures and their functions, and
   (b) Students know the human body has a specialized anatomy and physiology composed of an hierarchical arrangement of differentiated cells, and
   (c) Students know disease disrupts the equilibrium that exists in a healthy organism.

8. *In the area of Organisms and their Environment: Students understand that ecosystems display patterns of organization, change, and stability as a result of the interactions and interdependencies among the living and non-living components of the Earth.*
   (a) Students know relationships of organisms and their physical environment, and
   (b) Students know how changes in an ecosystem can affect biodiversity and biodiversity's contribution to an ecosystem's stability, and
   (c) 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, and
   (d) Students know the unique geologic, hydrologic, climatic, and biological characteristics of Nevada's bioregions.
9. *In the area of Diversity of Life: Students understand biological evolution and diversity of life.*
   (a) Students know organisms can be classified based on evolutionary relationships, and
   (b) Students know similarity of DNA sequences gives evidence of relationships between organisms, and
   (c) Students know the fossil record gives evidence for natural selection and its evolutionary consequences, and
   (d) Students know the extinction of species can be a natural process, and
   (e) Students know biological evolution explains diversity of life, and
   (f) Students know the concepts of natural and artificial selection.
10. *In the area of Atmospheric Processes and the Water Cycle: Students understand heat and energy transfer in and out of the atmosphere and influence weather and climate.*
   (a) Students know the Sun is the major source of Earth's energy, and provides the energy driving Earth's weather and climate, and
   (b) Students know the composition of Earth's atmosphere has changed in the past and is changing today, and
   (c) Students understand the role of the atmosphere in Earth's greenhouse effect, and
   (d) Students know convection and radiation play important roles in moving heat energy in the Earth system, and
   (e) Students know convection and radiation play important roles in moving heat energy in the Earth system, and
   (f) Students know Earth's rotation affects winds and ocean currents.
11. *In the area of Solar System and Universe: Students know scientific theories of origins and evolution of the universe.*
   (a) Students know common characteristics of stars, and
   (b) Students know stars are powered by nuclear fusion of lighter elements into heavier elements, which results in the release of large amounts of energy, and
   (c) Students know ways in which technology has increased understanding of the universe, and
   (d) Students know the on-going processes involved in star formation and destruction, and
   (e) Students know scientific evidence suggest that the universe is expanding.
12. *In the area of Earth's Structure and Composition: Students understand evidence for processes that take place on a geologic time scale.*
   (a) 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, and
   (b) Students understand the concept of plate tectonics including the evidence that supports it (structural, geophysical and paleontological evidence), and

(c) Students know elements exist in fixed amounts and move through solid earth, oceans, atmosphere and living things as part of biogeochemical cycles, and
(d) Student know processes of obtaining, using, and recycling of renewable and non-renewable resources, and
(e) Students know soil, derived from weathered rocks and decomposed organic material, is found in layers. E/S