At Missouri School for the Blind we believe student success is our first and foremost responsibility. We further believe, that every student learns in an individual way and at an individual rate, therefore, Missouri School for the Blind differentiates instruction to meet the needs of each learner. For student's whose educational program centers on the Show-Me-Standards, as defined in the Grade-Level-Expectations (GLE), curriculum-based and on-going assessment, determine instructional methods, remediation, enrichment, and pacing through the curriculum. The GLE's are designed to meet a wide range of students needs; however, each course may be further differentiated through the IEP process to meet individual student needs. To identify the objectives associated with a specific course, please contact the assigned


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# Missouri School for the Blind

# Science

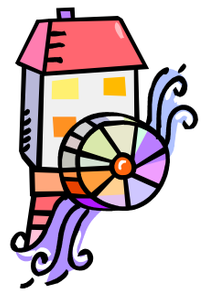
***Graded High School Curriculum***

MSB

## By the end of 9th-12th Grade Science Courses, students will be able to:

### Properties and Principles of Matter and Energy

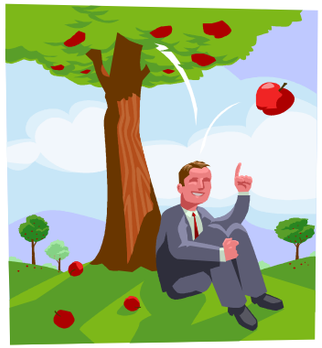
- Explain the structure of the periodic table in terms of the elements with common properties and repeating properties.
- Classify elements as metals, nonmetals, metalloids, and noble gases according to their location on the Periodic Table.
- Predict the chemical reactivity of elements, and the type of bonds that may result between them, using the Periodic Table.
- Distinguish between physical and chemical changes in matter.
- Describe how the valence electron configuration determines how atoms interact and may bond.
- Predict the reaction rates of different substances based on their properties.
- Compare and contrast the types of chemical bonds.
- Identify the consequences of different types of reactions to humans and human activity.
- Compare the mass of the reactants to the mass of the products in a chemical reaction or physical change as support for the Law of Conservation of Mass.
- Recognize whether the number of atoms of the reactants and products in a chemical equation are balanced.
- Differentiate between thermal energy, heat and temperature.
- Recognize chemical energy as the energy stored in the bonds between atoms in a compound.
- Describe the relationship among wavelength, energy, and frequency as illustrated by the electromagnetic spectrum.
- Differentiate between the properties and examples of conductors and insulators of different forms of energy.
- Describe sources and common uses of different forms of energy.
- Identify and evaluate advantages/disadvantages of using various sources of energy for human activity.
- Describe the effect of different frequencies of electromagnetic waves on the Earth and living organisms.
- Interpret examples of heat transfer as convection, conduction, or radiation.
- Relate kinetic energy to an object's mass & its velocity.
- Relate an object's gravitational potential energy to its weight and height relative to the surface of the Earth.
- Distinguish between examples of kinetic and potential energy within a system.
- Describe the effect of work on an object's kinetic and potential energy.
- Describe evidence of energy transfer and transformations that occur during exothermic and endothermic chemical reactions.
- Describe how changes in the nucleus of an atom during a nuclear reaction result in emission of radiation.
- Identify the role of nuclear energy as it serves as a source of energy for the Earth, stars, and human activity.
- Describe the transformations that occur as energy changes from kinetic to potential within a system.



- Compare the efficiency of simple machines.
- Classify the different forms of energy that can be observed as energy is transferred and transformed within a system when given a scenario.
- Explain how energy can be transferred or transformed between and within systems as the total amount of energy remains constant.

## Properties and Principles of Force and Motion

- Represent and analyze the motion of an object graphically.
- Analyze the speed of two objects in terms of distance and time.
- Calculate the speed of objects.
- Measure and analyze an object's motion in terms of speed, velocity, and acceleration.
- Calculate the acceleration of an object.
- Compare the momentum of two objects in terms of mass and velocity.
- Explain that the total momentum remains constant within a system
- Identify and describe the forces acting on an object.
- Describe gravity as an attractive force among all objects.
- Compare and describe the gravitational forces between two objects in terms of their masses and the distances between them.
- Describe weight in terms of the force of a planet's or moon's gravity acting on a given mass.
- Recognize all free-falling bodies accelerate at the same rate due to gravity regardless of their mass.



- Recognize changing magnetic fields can produce electrical current and electric currents can produce magnetic forces.
- Predict the effects of an electromagnetic force on the motion of objects.
- Recognize that inertia is a property of matter that can be described as an object's tendency to resist a change in motion, and is dependent upon the object's mass.
- Describe the effect of a change in mass of an object on the inertia of that object.
- Using information about the mass and acceleration of two objects, compare the forces required to move them.
- Identify forces acting on a falling object and the factors that affect the rate of fall.
- Determine the overall effect of forces acting on an object at the same time.
- Predict and explain the effect of a change in force and/or mass on the motion of an object.
- Analyze action/reaction forces acting between two objects and describe their magnitude and direction.
- Predict the change in motion of one object when it is acted upon by the equal and opposite force of another object.
- Describe the force(s) that keep an object traveling in a circular path.
- Describe the force(s) acting on a projectile on the Earth.
- Predict the path of an object when the forces directing it change.
- Describe the relationships between work, applied net force, and the distance an object moves.
- Explain how the efficiency of machines can be expressed as a ratio of work output to work input.
- Describe power in terms of work and time.
- Analyze and describe the relationship among work, power, and efficiency.

## Characteristics and Interactions of Living Organisms

- Recognize cells that both increase in number and differentiate, becoming specialized in structure and function, during and after embryonic development.
- Identify factors that may affect the differentiation of cells and the development of an organism.

## Scientific Inquiry

- Formulate testable questions and hypotheses.
- Analyzing an experiment, identify the components, explain their importance to the design of a valid experiment.
- Design and conduct a valid experiment.
- Recognize it is not always possible, for practical or ethical reasons, to control some conditions.
- Acknowledge some scientific explanations cannot be tested using the standard experimental "scientific method" due to the limits of the laboratory environment, resources, and/or technologies.
- Acknowledge there is no fixed procedure called "the scientific method", but that some investigations involve systematic observations, carefully collected and relevant evidence, logical reasoning, and some imagination in developing hypotheses and other explanations.
- Evaluate the design of an experiment and make suggestions for reasonable improvements.
- Make qualitative and quantitative observations using the appropriate senses, tools and equipment to gather data.
- Measure length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, force to the nearest Newton, temperature to the nearest degree Celsius, time to the nearest second.
- Determine the appropriate tools and techniques to collect, analyze, and interpret data.
- Judge whether measurements and computation of quantities are reasonable.
- Calculate the range, average/mean, percent, and ratios for sets of data.
- Recognize observation is biased by the experiences and knowledge of the observer.
- Use quantitative and qualitative data as support for reasonable explanations.
- Analyze experimental data to determine patterns, relationship, perspectives, and credibility of explanations.
- Identify the possible effects of errors in observations, measurements, and calculations, on the validity and reliability of data and resultant explanations.
- Analyze whether evidence and scientific principles support proposed explanations.
- Evaluate the reasonableness of an explanation.
- Communicate the procedures and results of investigations and explanations through: Oral presentation, drawings and maps, data tables, graphs, equations and writings.
- Communicate and defend a scientific argument.
- Explain the importance of the

## Impact of Science, Technology and Human Activity

- Recognize the relationships linking technology & science.
- Identify and evaluate the drawbacks & benefits of technological solutions to a given problem.
- Recognize contributions to science are made by a diverse group of scientists representing various ethnic and gender groups.
- Recognize gender and ethnicity of scientists often influence the questions asked and/or the methods used in scientific research and may limit or advance science knowledge and/or technology.
- Identify and describe how explanations of scientific phenomena have changed over time as a result of new evidence.
- Identify and analyze current theories that are being questioned, and compare them to new theories that have emerged to challenge older ones.
- Analyze the roles of science & society as they interact to determine the direction of scientific/technological progress.
- Identify and describe major scientific and technological challenges to society and their ramifications for public policy.
- Analyze and evaluate the social, political, economic, ethical, and environmental factors affecting progress toward meeting major scientific and technological challenges.
- Identify and evaluate the need for informed consent in experimentation.
- Identify the ethical issues involved in experimentation.
- Identify and evaluate the role of models as an ethical alternative to direct experimentation.
- Evaluate a given source for its scientific credibility.
- Explain why accurate record-keeping, openness, and replication are essential for maintaining an investigator's credibility with other scientists and society.

- Distinguish between renewable and nonrenewable energy resources.
- Recognize the finite availability of fresh water for use by living organisms.
- Identify human activities that adversely affect the composition of the atmosphere, hydrosphere, or geosphere.
- Predict the effect of change on the other sphere when given a scenario describing how the composition of the atmosphere, hydrosphere, or geosphere is altered.
- Recognize how the geomorphology of Missouri (i.e., different types of Missouri soil and rock materials such as limestone, granite, clay, loam; land formations such as karst (cave) formations, glaciated plains, river channels) affects the development of land use (i.e. agriculture, recreation, planning and zoning, waste management).
- Recognize the limited availability of major mineral deposits in the United States (i.e. lead, petroleum, coal, copper, zinc, iron, gravel, aluminum) and the factors that affect their availability.
- Recognize the economic, political, social, and ethical constraints associated with obtaining and using natural resources.

## Composition and Structure of the Universe and the Motion of the Objects Within It

- Describe and relate the positions and motions of the Sun-Earth solar system, the Milky-Way galaxy, and other galaxies within the universe (i.e. it is just one of several solar systems orbiting the center of a rotating spiral galaxy; that spiral galaxy is just one of many galaxies which orbit a common center of gravity; the expanding universe causes the distance between galaxies to increase).
- Explain how Earth's environmental characteristics and location in the universe (i.e. atmosphere, temperature, orbital path, magnetic field, mass-gravity, location in solar system) provide a life-supporting environment.
- Compare the environmental characteristics and location in the universe of Earth and other celestial bodies (i.e. planets, moons) to determine ability to support life.
- Identify information that the electromagnetic spectrum provides about the stars and the universe (i.e. chemical composition, temperature, age of stars, location of black holes, motion of celestial bodies).
- Evaluate the advantages/disadvantages of using different tools (i.e. spectroscope, different types of telescopes, probes) to gather information about the universe (i.e. background radiation, magnetic fields, discovery of previously unknown celestial bodies).
- Relate units of time (i.e. day, month, year) to the regular and predictable motion of the planets and moons and their positions in the Solar System.
- Explain seasonal phenomena (i.e. weather, length of day, temperature, intensity of sunlight) as a consequence of a planet's axial tilt as it rotates and a planet's orbital position as it revolves around the Sun.
- Provide evidence that can be observed from Earth that supports the fact Earth rotates on its axis and revolves around the Sun.
- Predict the moon rise/set times, phases of the moon, and/or eclipses when given the relative positions of the moon, planet, and Sun.
- Explain how the gravitational forces, due to the relative positions of a planet, moon, and Sun, determine the height and frequency of tides.
- Explain orbital motions of moons around planets, and planets around the Sun, as the result of gravitational forces between those objects.

- Recognize all organisms are composed of cells, the fundamental units of structure and function.
- Describe the structure of cell parts found in different types of cells and the functions they perform that are necessary to the survival of the cell and organism.
- Explain how similarities used to group taxa might reflect evolutionary relationships.
- Explain how & why the classification of any taxon might change as more is learned about the organisms assigned to that taxon.
- Compare & contrast the structure and function of mitochondria and chloroplasts.
- Compare & contrast the structure and function of cell wall and cell membranes.
- Explain physical & chemical interactions that occur between organelles as they carry out life processes.
- Compare and contrast photosynthesis and cellular respiration reactions.
- Explain the interrelationship between the processes of photosynthesis and cellular respiration.
- Determine what factors affect the processes of photosynthesis and cellular respiration.
- Summarize how energy transfer occurs during photosynthesis and cellular respiration.
- Distinguish among organic compounds in relation to their role in living systems.
- Recognize energy is absorbed or released in the breakdown and/or synthesis of organic compounds.
- Explain how protein enzymes affect chemical reactions.
- Interpret a data table showing the effects of an enzyme on a biochemical reaction.
- Explain how the DNA code determines the sequence of amino acids necessary for protein synthesis.
- Recognize the function of protein in cell structure and function.
- Explain the significance of semi-permeability to the transport of molecules across cellular membranes.
- Predict the movement of molecules needed for a cell to maintain homeostasis, given concentration gradients of different sizes of molecules.
- Relate the role of diffusion, osmosis, and active transport to the movement of molecules across semi-permeable membranes.
- Explain how water is important to cells.
- Distinguish between asexual and sexual reproduction.
- Describe the chemical and structural properties of DNA.
- Recognize that DNA codes for proteins, which are expressed as the heritable characteristics of an organism.
- Recognize that degree of relatedness can be determined by comparing DNA sequences.
- Explain how an error in the DNA molecule can be transferred during replication.
- Identify possible external causes.
- Recognize the chromosomes of daughter cells, formed through the processes of asexual reproduction and mitosis, the formation of somatic cells in multicellular organisms, are identical to the chromosomes of the parent cell.
- Recognize that during meiosis, the formation of sex cells, chromosomes are reduced to half the number present in the parent cell.
- Explain how fertilization restores the diploid number of chromosomes.
- Identify the implications of human sex chromosomes for sex determination.
- Describe the advantages/disadvantages of asexual/sexual reproduction with regard to variation within a population.
- Describe how genes can be altered and combined to create genetic variation within a species.
- Recognize that new heritable characteristics can only result from new combinations of existing genes or from mutations of genes in an organism's sex cells.
- Explain how genotypes contribute to phenotypic variation within a species.
- Predict the probability of the occurrence of specific traits, including sex-linked traits, in an offspring by using a monohybrid cross.
- Explain how sex-linked traits may or may not result in the expression of a genetic disorder depending on gender.

## Changes in Ecosystems and Interactions of Organisms with their Environments

- Explain the nature of interactions between organisms in different symbiotic relationships (i.e. mutualism, commensalism, parasitism).
- Explain how cooperative (i.e. symbiosis) and competitive (i.e. predator/prey) relationships help maintain balance within an ecosystem.
- Explain why no two species can occupy the same niche in a community.
- Identify and explain the limiting factors that may affect the carrying capacity of a population within an ecosystem.
- Predict how populations within an ecosystem change in number and/or structure in response to hypothesized changes in biotic and/or abiotic factors.
- Devise a multi-step plan to restore the stability and/or biodiversity of an ecosystem when given a scenario describing the possible adverse effects of human interactions with that ecosystem (i.e. destruction caused by direct harvesting, pollution, atmospheric changes).

- Predict and explain how natural or human caused changes (biological, chemical and/or physical) in one ecosystem may affect other ecosystems due to natural mechanisms (i.e. global wind patterns, water cycle, ocean currents) .
- Predict the impact (beneficial or harmful) a natural environmental event (i.e. forest fire, flood, volcanic eruption, avalanche) may have on the diversity of different species in an ecosystem.
- Describe possible causes of extinction of a population.
- Illustrate and describe the flow of energy within a food web.
- Explain why there are generally more producers than consumers in an energy pyramid
- Predict how energy distribution and energy use will be altered due to changes in a food web.
- Explain the processes involved in the recycling of nitrogen, oxygen, and carbon through an ecosystem.
- Explain the importance of the recycling of nitrogen, oxygen, and carbon within an ecosystem.
- Interpret fossil evidence to explain the relatedness of organisms using the principles of superposition and fossil correlation.
- Evaluate the evidence that supports the theory of biological evolution (i.e. fossil records, similarities between DNA and protein structures, similarities between developmental stages of organisms, homologous and vestigial structures).
- Define a species in terms of the ability to breed and produce fertile offspring.
- Explain the importance of reproduction to the survival of a species (i.e., the failure of a species to reproduce will lead to extinction of that species).
- Describe how variation in characteristics provides populations an advantage for survival.
- Identify examples of adaptations that may have resulted from variations favored by natural selection (i.e. long-necked giraffes, long-eared jack rabbits).
- Explain how genetic homogeneity may cause a population to be more susceptible to extinction (i.e. succumbing to a disease for which there is no natural resistance).
- Explain how environmental factors (i.e. habitat loss, climate change, pollution, introduction of non-native species) can be agents of natural selection.
- Given a scenario describing an environmental change, hypothesize why a given species was unable to survive.

## Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere, and Hydrosphere)

- Recognize the importance of water as a solvent in the environment as it relates to karst topography (cave formation), acid rain, and water pollution.
- Relate the composition of gases and temperature of the layers of the atmosphere (i.e., troposphere, stratosphere, ionosphere) to cloud formation and transmission of radiation.
- Describe the causes and consequences of observed and predicted changes in the ozone layer.
- Provide evidence (i.e. melting glaciers, fossils, desertification) that supports theories of climate change due to natural phenomena and/or human interactions.
- Explain how climate and weather patterns in a particular region are affected by factors, such as proximity to large bodies of water or ice/ocean currents, latitude, altitude, prevailing wind currents, and amount of solar radiation.
- Explain the external processes (i.e. weathering, erosion, deposition of sediment) that result in the formation and modification of landforms.
- Describe the factors that affect rates of weathering and erosion of landforms (i.e. soil/rock type, amount and force of run-off, slope).
- Describe the internal source of energy on Earth that results in uneven heating of the mantle (i.e. decay of radioactive isotopes).
- Illustrate and explain the convection currents that result from the uneven heating inside the mantle and cause movement of crustal plates.
- Describe how the energy of an earthquake travels as seismic waves and provides evidence for the layers of the geosphere.
- Relate the densities of the materials found in continental and oceanic plates to the processes that result in each type of plate boundary (i.e. diverging, converging, transform).
- Describe the effects of the movement of crustal plates at a given location on the planet.
- Articulate the processes involved in the Theory of Plate Tectonics (i.e. uneven heating of the mantle due to the decay of radioactive isotopes, movement of materials via convection currents, movement of continental and oceanic plates along diverging, converging, or transform plate boundaries) and describe evidence that supports that theory.
- Use evidence from relative and real dating techniques (i.e. correlation of trace fossils, landforms, and rock sequences; evidence of climate changes; presence of intrusions and faults; magnetic orientation; relative age of drill samples) to infer geologic history
- Predict the weather at a designated location using weather maps (including map legends) and/or weather data (i.e. temperature, barometric pressure, cloud cover and type, wind speed and direction, precipitation).
- Discover and evaluate patterns and relationships in the causes of weather phenomena and regional climates.
- Explain how global wind and ocean currents are produced on the Earth's surface.
- Describe the effects of natural phenomena on the properties of the atmosphere.
- Distinguish between renewable and nonrenewable energy resources.
- Recognize the finite availability of fresh water for use by living organisms .
- Identify human activities that adversely affect the composition of the atmosphere, hydrosphere, or geosphere.
- Predict the effect of change on the other sphere when given a scenario describing how the composition of the atmosphere, hydrosphere, or geosphere is altered.
- Recognize how the geomorphology of Missouri affects the development of land use.
- Recognize the limited availability of major mineral deposits in the United States (i.e. lead, petroleum, coal, copper, zinc, iron, gravel, aluminum) and the factors that affect their availability.
- Recognize the economic, political, social, and ethical constraints associated with obtaining and using natural resources.