# California State
## AIMS Activities supporting Sixth Grade Science Standards of Learning

### FOCUS ON EARTH SCIENCE

### PLATE TECTONICS AND EARTH'S STRUCTURE

**1. Plate tectonics explains important features of the Earth's surface and major geologic events. As the basis for understanding this concept, students know:**

**a. the fit of the continents, location of earthquakes, volcanoes, and mid-ocean ridges, and the distribution of fossils, rock types, and ancient climatic zones provide evidence for plate tectonics.**

"Drifting Apart," Finding Your Bearings
*Students will use a jigsaw puzzle format to determine how the continents once fit together.*
"Fossil Fill," *AIMS*: XIII.9
*Students will learn how paleontologists use the Principle of Superposition to determine the relative age of fossils.*
Resource: "Continental Drift Theory," Finding Your Bearings

**b. the solid Earth is layered with cold, brittle lithosphere; hot, convecting mantle; and dense, metallic core.**

"Layers of the Earth," *AIMS*: XIII.1
*Students will construct, draw, and label the layers of the earth.*
Resource: refer to 1.a

**c. lithospheric plates that are the size of continents and oceans move at rates of centimeters per year in response to movements in the mantle.**

Resource: refer to 1.a

**d. earthquakes are sudden motions along breaks in the crust called faults, and volcanoes/fissures are locations where magma reaches the surface.**

"Peanut Butter and Jelly Geology," Overhead and Underfoot
*Students will learn how natural forces shape the rock layers of the earth's crust.*
Resource: refer to 1.a

**e. major geologic events, such as earthquakes, volcanic eruptions, and mountain building result from plate motions.**

"Topping Off Mt. St. Helen's," Through The Eyes of The Explorers
*Students will use contour maps to construct models of Mt. St. Helen's before and after the 1980 eruption.*
Resource: refer to 1.a

**f. how to explain major features of California geology in terms of plate tectonics (including mountains, faults, volcanoes).**
**g. how to determine the epicenter of an earthquake and that the effects of an earthquake vary with its size, distance from the epicenter, local geology, and the type of construction involved.**

### SHAPING THE EARTH'S SURFACE

**2. Topography is reshaped by weathering of rock and soil and by the transportation and deposition of sediment. As the basis for understanding this concept, students know:**

**a. water running downhill is the dominant process in shaping the landscape, including California's landscape.**

"Quick Sand," Down to Earth
*Students will be able to state the relationship between a stream's slope and rate of flow and the rate of erosion.*

**b. rivers and streams are dynamic systems that erode and transport sediment, change course, and flood their banks in natural and recurring patterns.**

"Shoot The Rapids," Down To Earth
*Students will be able to determine the velocity of a stream and describe the relationship between slope and velocity.*
"Flood Stage," Down To Earth
*Students will be able to describe the relationship of the volume of water in a stream and its velocity, and determine the rate of flow in a stream.*

**c. beaches are dynamic systems in which sand is supplied by rivers and moved along the coast by wave action.**

**d. earthquakes, volcanic eruptions, landslides, and floods change human and wildlife habitats.**

## PHYSICAL SCIENCE

## HEAT (THERMAL ENERGY)

**3. Heat moves in a predictable flow from warmer objects to cooler objects until all objects are at the same temperature. As a basis for understanding this concept, students know:**

**a. energy can be carried from one place to another by heat flow, or by waves including water waves, light and sound, or by moving objects.**

"Heat Energy Moves," Primarily Physics
*Students will learn that metals are a good conductor of heat and plastic and wood are not.*
"Cold Tin and Hot Hands," Primarily Physics
*Students will be able to see that air when heated will expand.*

**b. when fuel is consumed, most of the energy released becomes heat energy.**

"The Burning Walnut," Off the Wall Science
*Students will observe what produces more heat energy, a burning walnut shell or a burning walnut meat.*
"Butter and Margarine Candles," Off the Wall Science
*Students will observe that there are oils in butter and margarine.*
"A Nutty Experience," Pieces and Patterns
*Students will compare the heat energy released in burning several kinds of nuts.*

**c. heat flows in solids by conduction (which involves no flow of matter) and in fluids by conduction and also by convection (which involves flow of matter).**

"Heat Energy Travels," Primarily Physics
*Students will learn that metal can be a good conductor of heat energy.*
"When Hot and Cold Meet," Primarily Physics
*Students will observe hot water moving by convection.*
Resource: "Mind Boggler: All Fired Up," *AIMS*: IX.9

**d. heat energy is also transferred between objects by radiation; radiation can travel through space.**

"Tints and Temps," Popping With Power
*Students will discover that dark cars radiate more heat than light cars and that the temperature inside a closed car can rise to unsafe levels on hot days.*
"Green Sleeves," *AIMS*: XII.2
*Students will gather data from thermometers positioned at different angles to the sun. They will compare the effect of direct rays and indirect rays on temperature and relate the results to the seasons.*

## ENERGY IN THE EARTH SYSTEM

**4. Many phenomena on the Earth's surface are affected by the transfer of energy through radiation and convection currents. As a basis for understanding this concept, students know:**

**a. the sun is the major source of energy for phenomena on the Earth's surface, powering winds, ocean currents, and the water cycle.**

Resources:
"Science Information: Heat Energy; Heat Energy and Temperature" Primarily Physics
"Side Talk: Weather In The Web Of Science" *AIMS*: IX.9
"Side Talk: Weather In The Web Of Science" *AIMS*: X.1
"Side Talk: Weather In The Web Of Science" *AIMS*: X.2
"Energy, Part 1" *AIMS*: VII.9
"Energy, Part 2" *AIMS*: VII.10

**b. solar energy reaches Earth through radiation, mostly in the form of visible light.**

Resources: refer to 4.a

**c. heat from Earth's interior reaches the surface primarily through convection.**

Resources: refer to 4.a

**d. convection currents distribute heat in the atmosphere and oceans.**

"When Hot and Cold Meet," Primarily Physics
*Students will observe hot water moving by convection.*
"Curly Cue," Popping With Power
*Students will discover that heat energy causes the air to move upward.*
"Hot Water and Cold Water," Off The Wall Science
*Students will observe the mixing of hot water and cold water.*

Resources: refer to 4.a

**e. differences in pressure, heat, air movement, and humidity result in changes of weather.**

"Weather Watch," *AIMS*: X.2
*Students will gather hourly weather information from a radio, television, or computer and observe weather patterns in a particular location.*
Resources: refer to 4.a

## LIFE SCIENCE

## ECOLOGY

**5. Organisms in ecosystems exchange energy and nutrients among themselves and with the environment. As a basis for understanding this concept, students know:**

**a. energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis, and then from organism to organism in food webs.**

"Photosynthesis," Budding Botanist
*The students will observe the production of oxygen through photosynthesis.*
"Pizza Parts and Web Wheels," Field Detectives
*The students will trace the food they eat through the levels of a food web.*
"Catch Me If You Can," Critters
*A food chain in a game of tag.*
"Food Chains and Webs," *AIMS*: IX.9
*The students will explore the variety of ways transfer of food energy can occur from a source in plants through a series of animals.*
"Nocturnal Hunter," *AIMS*: IV.5
*The students will dissect an owl pellet to determine what food the owl had consumed.*

**b. over time, matter is transferred from one organism to others in the food web, and between organisms and the physical environment.**

"Worm Home," Critters
*The students will observe earthworms in their home environments.*
"Pickle Jar Aquarium," Magnificent Microworld Adventures
*The students will observe fresh water protozoa and plants in their own aquarium.*
"Who's Who in the Habitat," Field Detectives
*The students will create, maintain, and observe various habitats.*
"Teddy Bears Fight Pollution," *AIMS*: II.3
*The students will model the affect of pollution on a food web.*

**c. populations of organisms can be categorized by the functions they serve in an ecosystem.**

"Catch Me If You Can," Critters
*A food chain in a game of tag.*
"Life in the Food Chain," Field Detectives
*The students will learn that all living things on the playground are part of various food chains which are links to overall food webs.*
"Producing a Producer," Field Detectives
*The students will learn that green plants are producers.*

"Buffet Lunch," Field Detectives
*The students will learn that some plant eating animals may eat only certain foods, while others will eat nearly anything that is available.*
"From Leaf to Soil," Field Detectives
*The students will learn that leaves are broken down by decomposing organisms and returned to the soil.*
"Pyramid Pile-Up," Field Detectives
*The students will construct a food pyramid structure to demonstrate the relationships within various food pyramids.*

**d. different kinds of organisms may play similar ecological roles in similar biomes.**

Exploring Environments
*The students will investigate different environments as though they were taking an expedition through each.*
"Who's Home in the Biome?" Critters
*The students will review which plants and animals are found in each biome.*

**e. the number and types of organisms an ecosystem can support depends on the resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition.**

Exploring Environments
*The students will investigate different environments as though they were taking an expedition through each.*
"Design Your Own Shelter," Field Detectives
*The students will learn that most animals need a place where they can rest, raise their young, stay warm and dry, and be safe from predators.*

"Comfort Clues," Field Detectives
*The students will discover that temperature is one of the physical conditions influencing which plants and animals live in a particular location.*
"What Do Plants Need to Grow?" Primarily Plants
*The students will understand that in order to grow healthy plants, soil, water, light and air must be provided.*

## RESOURCES

**6. Sources of energy and materials differ in amounts, distribution, usefulness, and the time required for their formation. As a basis for understanding this concept, students know:**

**a. the utility of energy sources is determined by factors that are involved in converting these sources to useful forms and the consequences of the conversion process.**

Resources:
"Zapped," *AIMS*: XIII.1
"Conceptual Overview," Machine Shop

**b. different natural energy and material resources, including air, soil, rocks, minerals, petroleum, fresh water, wildlife, and forests, and classify them as renewable or nonrenewable.**

**c. natural origin of the materials used to make common objects.**

## INVESTIGATION AND EXPERIMENTATION

**7. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept, and to address the content the other three strands, students should develop their own questions and perform investigations. Students will:**

**a. develop a hypothesis.**

**b. select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.**

**c. construct appropriate graphs from data and develop qualitative statements about the relationships between variables.**

**d. communicate the steps and results from an investigation in written reports and verbal presentations.**

**e. recognize whether evidence is consistent with a proposed explanation.**

**f. read a topographic map and a geologic map for evidence provided on the maps, and construct and interpret a simple scale map.**

**g. interpret events by sequence and time from natural phenomena (e.g., relative ages of rocks and intrusions).**

**h. identify changes in natural phenomena over time without manipulating the phenomena (e.g., a tree limb, a grove of trees, a stream, a hillslope).**

# California State
## AIMS Activities supporting Seventh Grade Science Standards of Learning

## LIFE SCIENCE

## CELL BIOLOGY

**1. All living organisms are composed of cells, from just one to many trillions, whose details usually are visible only through a microscope. As a basis for understanding this concept,**

**a. cells function similarly in all living organisms.**

"Model of a Cell," The Budding Botanist
*The students will build a cell model and learn its parts.*
"The Cell as a Factory," Magnificent Microworld Adventures
*The students will build a model of a cell to learn its structures and their function.*
Resources:
"Background Information for the Teacher: Cells: The Basis of Life," Magnificent Microworld Adventures
"Cell Facts," The Budding Botanist
Biographies (Leeuwenhoek, Hooke, Schwann and Schleiden), Magnificent Microworld Adventures

**b. the characteristics that distinguish plant cells from animal cells, including chloroplasts and cell walls.**

"Onion Rings," Magnificent Microworld Adventures
*The students will observe an onion cell's nucleus, cytoplasm, cell wall and cell membrane.*
"Cheek to Cheek," Magnificent Microworld Adventures
*The students will prepare a wet mount slide of cheek cells and observe that animal cells are different from plant cells.*
"The Cell as a Factory," Magnificent Microworld Adventures
*The students will build a model of a cell to learn its structures and their function.*
"Focus on Cells," The Budding Botanist
*The students will look at an onion cell and understand that the shape of a cell is related to its job.*

**c. the nucleus is the repository for genetic information in plant and animal cells.**

**d. mitochondria liberate energy for the work that cells do, and chloroplasts capture sunlight energy for photosynthesis.**

"Photosynthesis," The Budding Botanist
*The students will observe the production of oxygen through photosynthesis.*

**e. cells divide to increase their numbers through a process of mitosis, which results in two daughter cells with identical sets of chromosomes**

**f. as multicellular organisms develop, their cells differentiate.**

## GENETICS

**2. A typical cell of any organism contains genetic instructions that specify its traits. Those traits may be modified by environmental influences. As a basis for understanding this concept, students know:**

**a. the differences between the life cycles and reproduction of sexual and asexual organisms.**

**b. sexual reproduction produces offspring that inherit half their genes from each parent.**

"Picturing a Dichotomy," *AIMS*: IX.8
*The students will compare and contrast with others the data they record about certain inherited traits.*

**c. an inherited trait can be determined by one or more genes.**

"Picturing a Dichotomy," *AIMS*: IX.8
*The students will compare and contrast with others the data they record about certain inherited traits.*

**d. plant and animal cells contain many thousands of different genes, and typically have two copies of every gene. The two copies (or alleles) of the gene may or may not be identical, and one may be dominant in determining the phenotype while the other is recessive.**

"Teddy Bears Come In Pairs," *AIMS*: II.5
*The students will conduct an investigation which accurately simulates the experiments of Gregor Mendel with pea plants through which he discovered the Mendelian laws of heredity.*
"Picturing a Dichotomy," *AIMS*: IX.8
*The students will compare and contrast with others the data they record about certain inherited traits.*
Resources:
"Gregor Mendel," *AIMS*: II.5
"The Mendelian Laws of Heredity," *AIMS*: II.5

**e. DNA is the genetic material of living organisms, and is located in the chromosomes of each cell.**

**EVOLUTION**

**3. Biological evolution accounts for the diversity of species developed through gradual processes over many generations. As a basis for understanding this concept, students know:**

**a. both genetic variation and environmental factors are causes of evolution and diversity of organisms.**
**b. the reasoning used by Darwin in making his conclusion that natural selection is the mechanism of evolution.**

**c. how independent lines of evidence from geology, fossils, and comparative anatomy provide a basis for the theory of evolution.**

**d. how to construct a simple branching diagram to classify living groups of organisms by shared derived characteristics, and expand the diagram to include fossil organisms.**

**e. extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient for its survival.**

"Teddy Bears Fight Pollution," *AIMS*: II.3
*The students will model the affect of pollution on a food web.*
"Missing Moths," Critters
*The students will observe an environment with a variety of moths to see the effects of camouflage on animal visibility and its ability to survive.*
"Hide and Seek," Critters
*The students will make a critter and see the effects of camouflage on animal visibility and its ability to survive.*
"Gone Fishing," Critters
*The students will use paper fish cutouts to see the effect of camouflage on prey populations.*

## EARTH AND LIFE HISTORY (EARTH SCIENCE)

**4. Evidence from rocks allows us to understand the evolution of life on Earth. As the basis for understanding this concept, students know:**

**a. Earth processes today are similar to those that occurred in the past and slow geologic processes have large cumulative effects over long periods of time.**

"Drifting Apart," Finding Your Bearing
*Students will use a jigsaw puzzle format to determine how the continents once fit together.*
"Peanut Butter and Jelly Geology," Overhead and Underfoot
*Students will learn how natural forces shape the rock layers of the earth's crust.*
"Topping Off Mt. St. Helen's," Through The Eyes of The Explorers
*Students will use contour maps to construct models of Mt. St. Helen's before and after the 1980 eruption.*
Resource: "Continental Drift Theory," Finding Your Bearings

**b. the history of life on Earth has been disrupted by major catastrophic events, such as major volcanic eruptions or the impact of an asteroid.**

"Topping Off Mt. St. Helen's," Through The Eyes of The Explorers
*Students will use contour maps to construct models of Mt. St. Helen's before and after the 1980 eruption.*
"When Polar Ice Caps Melt," Down To Earth
*Students will learn what effect the melting of polar ice caps would have on the coasts of countries.*

**c. the rock cycle includes the formation of new sediment and rocks. Rocks are often found in layers with the oldest generally on the bottom.**

"Sands of Time," Down To Earth
*Students will be able to classify sand particles.*
"Peanut Butter and Jelly Geology," Overhead and Underfoot
*Students will learn how natural forces shape the rock layers of the earth's crust.*
Resource: "Cycle of Rock," Down To Earth

**d. evidence from geologic layers and radioactive dating indicate the Earth is approximately 4.6 billion years old, and that life has existed for more than 3 billion years.**

"The Rate of Decay," *AIMS*: VIII.7
*Students will become familiar with the concept of half-life through a probability investigation using coins and tapered corks.*

"Fossil Fill," *AIMS*: XIII.9
*Students will learn how paleontologists use the Principle of Superposition to determine the relative age of fossils.*

**e. fossils provide evidence of how life and environmental conditions have changed.**

"Fossil Fill," *AIMS*: XIII.9
*Students will learn how paleontologists use the Principle of Superposition to determine the relative age of fossils.*

**f. how movements of the Earth's continental and oceanic plates through time, with associated changes in climate and geographical connections, have affected the past and present distribution of organisms.**

"Drifting Apart," Finding Your Bearings
*Students will use a jigsaw puzzle format to determine how the continents once fit together.*
Resource: "Continental Drift Theory," Finding Your Bearings

**g. how to explain significant developments and extinctions of plant and animal life on the geologic time scale.**

## STRUCTURE AND FUNCTION IN LIVING SYSTEMS

**5. The anatomy and physiology of plants and animals illustrate the complementary nature of structure and function. As a basis for understanding this concept, students know:**

**a. plants and animals have levels of organization for structure and function, including cells, tissues, organs, organ systems, and the whole organism.**

"A Complete Package," Magnificent Microworld Adventures
*The students will observe how cells work together to perform specific functions.*

**b. organ systems function because of the contributions of individual organs, tissues, and cells. The failure of any part can affect the entire system.**

**c. how bones and muscles work together to provide a structural framework for movement.**

**d. how the reproductive organs of the human female and male generate eggs and sperm, and how sexual activity may lead to fertilization and pregnancy.**

**e. the function of the umbilicus and placenta during pregnancy.**

**f. the structures and processes by which flowering plants generate pollen and ovules, seeds, and fruit.**

"A Flower Study," The Budding Botanist
*The students will learn how flowers, seeds, and fruit develop in a plant.*
"Seeds from Fruits," The Budding Botanist
*The students will compare seeds that are produced in the mature ovary of several representative angiosperms (flowering plants).*
"Dissect a Seed," The Budding Botanist

*The students will dissect and compare a dicotyledon and a monocotyledon seed and identify the seed coat, the embryo, and the food for the plant.*

"Seed Scavenger Hunt," The Budding Botanist

*The students will examine the structure of seeds that are dispersed by different methods.*

Resources:
"Seed Plants," The Budding Botanist
"Seed Facts," The Budding Botanist

**g. how to relate the structures of the eye and ear to their functions.**

"No Goal in Sight," *AIMS*: VIII.7

*The students will discover their blind spot.*

Resources:
"The Eyes," Primarily Physics
"Big Ears," Primarily Physics
"Sound Energy," Primarily Physics
"Isn't It Interesting…Eye to Eye," *AIMS*: XII.10

## PHYSICAL PRINCIPLES IN LIVING SYSTEMS (PHYSICAL SCIENCE)

**6. Physical principles underlie biological structures and functions. As a basis for understanding this concept, students know:**

**a. visible light is a small band within a very broad electromagnetic spectrum.**

**b. for an object to be seen, light emitted by or scattered from it must enter the eye.**

"I See The Light," *AIMS*: VI.8

*Students will explore how increasing the amount of light increases a viewer's ability to discriminate objects and detail.*

Resources:
"Sunsets and Rainbows," *AIMS*: IV.5
"Seeing The Light," *AIMS*: IV.1

**c. light travels in straight lines except when the medium it travels through changes.**

"Bent On It," *AIMS*: XIII.5

*Students will explore how the densities of different media affect the path along which light passes.*

"Mind Boggler: Glow With The Flow," *AIMS*: X.1
Resource: "Isn't It Interesting…Speed Limits," *AIMS*: XIII.5

**d. how simple lenses are used in a magnifying glass, the eye, camera, telescope, and microscope.**

"Clownin' Around," *AIMS*: XII.1

*Students will learn how the shape of a container (lens) will effect the image of an object.*

"Magnificent Views," *AIMS*: XII.10

**e. white light is a mixture of many wavelengths (colors), and that retinal cells react differently with different wavelengths.**

Resources:
"Isn't It Interesting…Eye To Eye," *AIMS*: XII.10
"Sunsets and Rainbows," *AIMS*: IV.5
"Color and Light," *AIMS*: IV.4

**f. light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection).**

"Bent On It," *AIMS*: XIII.5
*Students will explore how the densities of different media affect the path along which light passes.*
"Through The Looking Glass," *AIMS*: IV.3
*Students will discover the position and orientation of an image in a reflected mirror.*
"Cornering Reflections," *AIMS*: IV.3
*Students will examine multiple reflections.*
"Slides of Refraction," *AIMS*: XIII.3
*Students will examine the refraction of light as it passes through different mediums and several layers of the same medium.*
"Mind Boggler: Glow With The Flow," *AIMS*: X.1

Resources:
"Isn't It Interesting…Speed Limits," *AIMS*: XIII.5
"Light Incidents," *AIMS*: IV.3

**g. the angle of reflection of a light beam is equal to the angle of incidence.**

"From Rays To Reason," *AIMS*: VIII.5
*Students will discover that the path light ray follows as they look in a mirror form the angle of incidence and reflection.*
"Revealing Reflections," *AIMS*: VII.5
*Students will learn the Law of Reflection and the relationship between mirror reflections and similar triangles.*
Resources:
"Reflection and Symmetry," *AIMS*: IV.1
"Reflection and Symmetry," *AIMS*: IV.2
"Reflection and Symmetry," *AIMS*: IV.3
"Reflection and Symmetry," *AIMS*: IV.4
"Reflection and Symmetry," *AIMS*: IV.5

**h. how to compare joints in the body (wrist, shoulder, thigh) with structures used in machines and simple devices (hinge, ball-and-socket, and sliding joints).**

**i. how levers confer mechanical advantage and how the application of this principle applies to the musculoskeletal system.**

"M.V.P.," Brick Layers
*The students will explore the workings of a lever.*
Resource: "Levers," Brick Layers

**j. contractions of the heart generate blood pressure, and heart valves prevent backflow of blood in the circulatory system.**

"The Pressure's On," From Head To Toe

*Students will analyze information gathered to determine if physical activity will affect blood pressure.*

Resource: "'Ya Gotta' Have Heart!" From Head To Toe

## INVESTIGATION AND EXPERIMENTATION

**7. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept, and to address the content the other three strands, students should develop their own questions and perform investigations. Students will:**

**a. select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.**

**b. utilize a variety of print and electronic resources (including the World Wide Web) to collect information as evidence as part of a research project.**

**c. communicate the logical connection among hypothesis, science concepts, tests conducted, data collected, and conclusions drawn from the scientific evidence.**

**d. construct scale models, maps and appropriately labeled diagrams to communicate scientific knowledge (e.g., motion of Earth's plates and cell structure).**

**e. communicate the steps and results from an investigation in written reports and verbal presentations.**

# California State
## AIMS Activities supporting Eighth Grade Science Standards of Learning

## FOCUS ON PHYSICAL SCIENCE

## MOTION

**1. The velocity of an object is the rate of change of its position. As a basis for understanding this concept, students know:**

**a. position is defined relative to some choice of standard reference point and a set of reference directions.**

"The Race," Gravity Rules!
*Students will collect, record, and graph, in three different ways, the distance-time data of a race between a tortoise and a hare.*
"Time Trials," *AIMS*: XI.2
*Students will measure the speed of a battery-powered vehicle to develop an understanding of speed.*

**b. average speed is the total distance traveled divided by the total time elapsed. The speed of an object along the path traveled can vary.**

"The Race," Gravity Rules!
*Students will collect, record, and graph, in three different ways, the distance-time data of a race between a tortoise and a hare.*
"How Fast Can You Walk?" Gravity Rules!
*Students will measure the time interval it takes them to walk, at their fastest rate, through a known distance.*
"How Fast Can You Run?" Gravity Rules!
*Students will measure the time interval it takes them to run, at their fastest rate, through a known distance.*
"Time Trials," *AIMS*: XI. 2
*Students will measure the speed of a battery-powered vehicle to develop an understanding of speed.*

**c. how to solve problems involving distance, time, and average speed.**

"The Race," Gravity Rules!
*Students will collect, record, and graph, in three different ways, the distance-time data of a race between a tortoise and a hare.*
"How Fast Can You Walk?" Gravity Rules!
*Students will measure the time interval it takes them to walk, at their fastest rate, through a known distance.*
"How Fast Can You Run?" Gravity Rules!
*Students will measure the time interval it takes them to run, at their fastest rate, through a known distance.*
"Time Trials," *AIMS*: XI. 2
*Students will measure the speed of a battery-powered vehicle to develop an understanding of speed.*

**d. to describe the velocity of an object one must specify both direction and speed.**

"How Fast Can You Walk?" Gravity Rules!
*Students will measure the time interval it takes them to walk, at their fastest rate, through a known distance.*

"How Fast Can You Run?" Gravity Rules!
*Students will measure the time interval it takes them to run, at their fastest rate, through a known distance.*

**e. changes in velocity can be changes in speed, direction, or both.**

"Fall-Timeters," Gravity Rules!
*Students will collect and record time and altitude data (directly from a video) and compute average velocities, including terminal velocities.*
"Terminal Velocity," Gravity Rules!
*Students will use a graphing calculator, data collector, and motion detector to measure the terminal velocity of a paper sky diver.*
Resource: AIMS Gravity Rules! Video

**f. how to interpret graphs of position versus time and speed versus time for motion in a single direction.**

"Terminal Velocity," Gravity Rules!
*Students will use a graphing calculator, data collector, and motion detector to measure the terminal velocity of a paper sky diver.*
"Fall-Timeters," Gravity Rules!
*Students will collect and record time and altitude data (directly from a video) and compute average velocities, including terminal velocities.*
"Time Trials," *AIMS*: XI. 2
*Students will measure the speed of a battery-powered vehicle to develop an understanding of speed.*

## FORCES

**2. Unbalanced forces cause changes in velocity. As a basis for understanding this concept, students know:**

**a. a force has both direction and magnitude.**

"Tinkering, Toys and Teaching: Beads in a Box," *AIMS*: XIII.3
*Students will construct a device that allows them to observe and better understand Newton's First Law of Motion.*
"Tug Teams," *AIMS*: XI.7
*Students will observe how balanced and unbalanced forces affect the motion of an object.*
Resources:
"Newton's First Law," *AIMS*: VI.2
"Newton's Second Law," *AIMS*: VI.3
"Newton's Third Law," *AIMS*: VI.7

**b. when an object is subject to two or more forces at once, the effect is the cumulative effect of all the forces.**
"Tinkering, Toys and Teaching: Beads in a Box," *AIMS*: XIII.3
*Students will construct a device that allows them to observe and better understand Newton's First Law of Motion.*
"Tug Teams," *AIMS*: XI.7
*Students will observe how balanced and unbalanced forces affect the motion of an object.*
Resources: see 2.a

**c. when the forces on an object are balanced, the motion of the object does not change.**

"Tinkering, Toys and Teaching: Beads in a Box," *AIMS*: XIII.3
*Students will construct a device that allows them to observe and better understand Newton's First Law of Motion.*
"Tug Teams," *AIMS*: XI.7
*Students will observe how balanced and unbalanced forces affect the motion of an object.*
"Beams Over Board," Brick Layers
*Students will discover the law of lever by determining where to place different masses on a lever to balance it.*
Resources: see 2.a

**d. how to identify separately two or more forces acting on a single static object, including gravity, elastic forces due to tension or compression in matter, and friction.**

"Tinkering, Toys and Teaching: Beads in a Box," *AIMS*: XIII.3
*Students will construct a device that allows them to observe and better understand Newton's First Law of Motion.*
"Skydiving In A Bottle," Gravity Rules
*Students will construct a device that allows them to observe Newton's First Law.*
"Slip, Sliding Away," *AIMS*: XIII.3
*Students will compare the friction-reducing capabilities of several lubricants.*
Resources: see 2.a

**e. when the forces on an object are unbalanced the object will change its motion (that is, it will speed up, slow down, or change direction).**

"Skydiving In A Bottle," Gravity Rules
*Students will construct a device that allows them to observe Newton's First Law.*
"The Marbleous Rolls," *AIMS*: VIII.1
*Students will study the effect of uniform acceleration of marbles rolled down an inclined plane on the distance they roll on a carpet.*
"Tug Teams," *AIMS*: XI.7
*Students will observe how balanced and unbalanced forces affect the motion of an object.*
"A Shift In Lift," Brick Layers
*Students will construct a winch and determine how the wheel size affects the force generated by the wheel.*
Resources: see 2.a

**f. the greater the mass of an object the more force is needed to achieve the same change in motion.**

Resources: see 2.a

**g. the role of gravity in forming and maintaining planets, stars and the solar system.**

Resource: "Skydiving: A Gravity Powered Sport," Gravity Rules

## STRUCTURE OF MATTER

**3. Elements have distinct properties and atomic structure. All matter is comprised of one or more of over 100 elements. As a basis for understanding this concept, students know:**

**a. the structure of the atom and how it is composed of protons, neutrons and electrons.**

"Atoms," Electrical Connections
*The students will make simple models of atoms.*
Resource: "Water Wonder," *AIMS*: III.7

**b. compounds are formed by combining two or more different elements. Compounds have properties that are different from the constituent elements.**

"The Water Molecule," Water Precious Water
*The students will construct a model of a water molecule.*
Resources:
"Water Wonder," *AIMS*: III.7
"Water Wonder, Part 2," *AIMS*: III.8

**c. atoms and molecules form solids by building up repeating patterns such as the crystal structure of NaCl or long chain polymers.**

**d. the states (solid, liquid, gas) of matter depend on molecular motion.**

Resource: "Water Wonder, Part 4," *AIMS*: III.10

**e. in solids the atoms are closely locked in position and can only vibrate, in liquids the atoms and molecules are more loosely connected and can collide with and move past one another, while in gases the atoms or molecules are free to move independently, colliding frequently.**

"A Crazy Colloid," *AIMS*: VI.1
*The students will experience a substance that displays the properties of both a liquid and a solid.*

**f. how to use the Periodic Table to identify elements in simple compounds**

## EARTH IN THE SOLAR SYSTEM (EARTH SCIENCE)

**4. The structure and composition of the universe can be learned from the study of stars and galaxies, and their evolution. As a basis for understanding this concept, students know:**

**a. galaxies are clusters of billions of stars, and may have different shapes.**

"Stars In The Milky Way Galaxy," Out of This World
*The students will discover the method by which scientists estimate the number of stars in the Milky Way Galaxy.*

**b. the sun is one of many stars in our own Milky Way galaxy. Stars may differ in size, temperature, and color.**

**c. how to use astronomical units and light years as measures of distance between the sun, stars, and Earth.**

"Spacing Out the System," Out of This World
*The students will determine the relative distance of the planets in order to construct a model solar system.*
"It All Depends on Your Point of View," Out of This World
*The students will construct a 3-dimensional model of a constellation.*

**d. stars are the source of light for all bright objects in outer space. The moon and planets shine by reflected sunlight, not by their own light.**

"Facing Up to the Moon," *AIMS*: X.8
*Students will learn about the changing moon phases.*

**e. the appearance, general composition, relative position and size, and motion of objects in the solar system, including planets, planetary satellites, comets, and asteroids.**

"Spacing Out the System," Out of This World
*Students will determine the relative distance of the planets in order to construct a model solar system.*
"Size It Up," Out of This World
*Students will determine the relative sizes of the planets in order to construct a model solar system.*
"Can You Planet," Out of This World
*Students will learn about various aspects of the planets and their relationships with one another.*
"Apparent Sizes," *AIMS*: XI.4
*The student will set a situation in which different sized objects distances apart, appear to be a smaller dimension.*

## REACTIONS

**5. Chemical reactions are processes in which atoms are rearranged into different combinations of molecules. As a basis for understanding this concept, students know:**

**a. reactant atoms and molecules interact to form products with different chemical properties.**

"Curds and Weigh," *AIMS*: IX.3
*The students will observe that matter is conserved even when it goes through a chemical reaction.*
"Feel the Heat," *AIMS*: X.10
*The students will observe the transformation of chemical energy into heat energy.*
"Change Matters," *AIMS*: XI.8
*The students will determine whether various changes in matter are physical or chemical.*
"Super Sleuth," Math + Science, a Solution
*The students will discover the varying characteristics of several substances with somewhat similar appearances.*
"A Strange Change," *AIMS*: XI.10
*The students will observe the changes that occur when steel wool is placed in water.*
"Homemade Fire Extinguisher," Off the Wall Science

*The students will observe the chemical reaction that occurs when baking soda and vinegar are combined. They will observe that the carbon dioxide gas that is produced does not support combustion.*

**b. the idea of atoms explains the conservation of matter: in chemical reactions the number of atoms stays the same no matter how they are arranged, so their total mass stays the same.**

"Curds and Weigh," *AIMS*: IX.3
*The students will observe that matter is conserved even when it goes through a chemical reaction.*

**c. chemical reactions usually liberate heat or absorb heat.**

"Feel the Heat," *AIMS*: X.10
*The students will observe the transformation of chemical energy into heat energy.*
"Another Look at 'A Strange Change'," *AIMS*: XII.3
*The students will watch the temperature change in a closed jar containing rusting steel wool.*

**d. physical processes include freezing and boiling, in which a material changes form with no chemical reaction.**

"Room For Change," *AIMS*: XIII.9
*The students will discover than when a known quantity of water in the liquid state is frozen, its volume changes but its mass remains constant.*

**e. how to determine whether a solution is acidic, basic or neutral.**

"Give Me An Indication," *AIMS*: VIII.2
*The students will mix different indicators with a base and an acid and note the differing pH levels.*
"Basic Indications," *AIMS*: XI.5
*The students will make an indicator that can be used to test for acid or base.*
"The Red C," Fun with Foods
*The students will use red cabbage juice as an acid-base indicator to test a variety of liquids.*

## CHEMISTRY OF LIVING SYSTEMS (LIFE SCIENCE)

**6. Principles of chemistry underlie the functioning of biological systems. As a basis for understanding this concept, students know:**

**a. carbon, because of its ability to combine in many ways with itself and other elements, has a central role in the chemistry of living organisms.**

**b. living organisms are made of molecules largely consisting of carbon, hydrogen, nitrogen, oxygen, phosphorus and sulfur.**

**c. living organisms have many different kinds of molecules including small ones such as water and salt, and very large ones such as carbohydrates, fats, proteins and DNA.**

## PERIODIC TABLE

**7. The organization of the Periodic Table is based on the properties of the elements and reflects the structure of atoms. As a basis for understanding this concept, students know:**

**a. how to identify regions corresponding to metals, nonmetals and inert gases.**

**b. elements are defined by the number of protons in the nucleus, which is called the atomic number. Different isotopes of an element have a different number of neutrons in the nucleus.**

**c. substances can be classified by their properties, including melting temperature, density, hardness, heat, and electrical conductivity.**

## DENSITY AND BUOYANCY

**8. All objects experience a buoyant force when immersed in a fluid. As a basis for understanding this concept, students know:**

**a. density is mass per unit volume.**

"Volumes of Fun," *AIMS*: VI.5
*The students will compare the mass of equal volumes of a variety of small objects.*

Resources:
"Density Demystified," Floaters and Sinkers
"Floating and Sinking," Floaters and Sinkers

**b. how to calculate the density of substances (regular and irregular solids, and liquids) from measurements of mass and volume.**

"Floating Wood," Floaters and Sinkers
*The students will compare the density of wood to the density of water.*
"See Level," Floaters and Sinkers
*The students will calculate the density of various liquids.*
"How Much Cargo Will It Hold?" Floaters and Sinkers
*The students will compare mass, volume, and density measures to determine which should be used for making fair chargers for hauling cargo.*
"What's in a BB?" Floaters and Sinkers
*The students will find the density of BB's.*

**c. the buoyant force on an object in a fluid is an upward force equal to the weight of the fluid it has displaced.**

"Aluminum Foil Boats," Off the Wall Science
*The students will discover that if the mass of the object is less than the amount of water it displaces, it will float.*
"Weighing Objects in Water," Off the Wall Science
*The students will observe the buoyant force (upward force) exerted on objects placed in water.*
Resources:
"Predicting Float Lines," Historical Connections Volume 1
"Water Wonder, Part 3," *AIMS*: III.9

**d. how to predict whether an object will float or sink.**

"Densor Sensor," Floaters and Sinkers

*The students will find out how solids and liquids of different densities arrange themselves when combined.*

"It Floats, It Sinks, Floaters and Sinkers

*The students will determine if objects will float or sink by comparing the mass to volume ratio.*

## INVESTIGATION AND EXPERIMENTATION

**9. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept, and to address the content the other three strands, students should develop their own questions and perform investigations. Students will:**

**a. plan and conduct a scientific investigation to test a hypothesis.**

**b. evaluate the accuracy and reproducibility of data.**

**c. distinguish between variable and controlled parameters in a test.**

**d. recognize the slope of the linear graph as the constant in the relationship y = kx and apply this to interpret graphs constructed from data.**

**e. construct appropriate graphs from data and develop quantitative statements about the relationships between variables.**

**f. apply simple mathematical relationships to determine one quantity given the other two (including speed = distance/time, density = mass/volume, force = pressure x area, volume = area x height).**

**g. distinguish between linear and non-linear relationships on a graph of data.**