Investigating Earth Systems Correlation to Indiana's State Academic Science Standards Grades 6, 7, 8

"X" = Coverage **Secondary concept of the activity or problem. Students gain a basic understanding or introduction of the concept.** **"XX" = In-depth Coverage** **Primary concept that is the focus of the activity or problem. Students gain thorough understanding of the concept.**	**Climate and Weather**	**Dynamic Planet**	**Energy Resources**	**Fossils**	**Materials and Minerals**	**Oceans**	**Rocks and Landforms**	**Soil**	**Water as a Resource**
GRADE 6									
The Nature of Science and Technology: Students design investigations. They use computers and other technology to collect and analyze data; they explain findings and can relate how they conduct investigations to how the scientific enterprise functions as a whole. Students understand that technology has allowed humans to do many things, yet it cannot always provide solutions to our needs.									
The Scientific View of the World									
6.1.1 Explain that some scientific knowledge, such as the length of the year, is very old and yet is still applicable today. Understand, however, that scientific knowledge is never exempt from review and criticism.	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**
Scientific Inquiry									
6.1.2 Give examples of different ways scientists investigate natural phenomena and identify processes all scientists use, such as collection of relevant evidence, the use of logical reasoning, and the application of imagination in devising hypotheses* and explanations, in order to make sense of the evidence.	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**
6.1.3 Recognize and explain that hypotheses are valuable, even if they turn out not to be true, if they lead to fruitful investigations.	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**
The Scientific Enterprise									
6.1.4 Give examples of employers who hire scientists, such as colleges and universities, businesses and industries, hospitals, and many government	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**
6.1.5 Identify places where scientists work, including offices, classrooms, laboratories, farms, factories, and natural field settings ranging from space to the ocean floor.	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**
6.1.6 Explain that computers have become invaluable in science because they speed up and extend people's ability to collect, store, compile, and analyze data; prepare research reports; and share data and ideas with investigators all over the world.	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**
Technology and Science									

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6.1.7 Explain that technology is essential to science for such purposes as access to outer space and other remote locations, sample collection and treatment, measurement, data collection and storage, computation, and communication of information.	XX	XX	XX	XX	XX	XX	XX	XX	XX
6.1.8 Describe instances showing that technology cannot always provide successful solutions for problems	XX	XX	XX	XX	XX	XX	XX	XX	XX
6.1.9 Explain how technologies can influence all living things.	XX	XX	XX	XX	XX	XX	XX	XX	XX
Scientific Thinking **Students use computers and other tools to collect information, calculate, and analyze data. They prepare tables and graphs, using these to summarize data and identify relationships.**									
Computation and Estimation									
6.2.1 Find the mean* and median* of a set of data.	XX	XX	XX	XX	XX	XX	XX	XX	XX
6.2.2 Use technology, such as calculators or computer spreadsheets, in analysis of data.	XX	XX	XX	XX	XX	XX	XX	XX	XX
Manipulation and Observation									
6.2.3 Select tools, such as cameras and tape recorders, for capturing									
6.2.4 Inspect, disassemble, and reassemble simple mechanical devices and describe what the various parts are for. Estimate what the effect of making a change in one part of a system is likely to have on the system as a whole.									
Communication Skills									
6.2.5 Organize information in simple tables and graphs and identify relationships they reveal. Use tables and graphs as examples of evidence for explanations when writing essays or writing about lab work, fieldwork,	XX	XX	XX	XX	XX	XX	XX	XX	XX
6.2.6 Read simple tables and graphs produced by others and describe in words what they show.	XX	XX	XX	XX	XX	XX	XX	XX	XX
6.2.7 Locate information in reference books, back issues of newspapers and magazines, compact disks, and computer databases.	XX	XX	XX	XX	XX	XX	XX	XX	XX
6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so.	XX	XX	XX	XX	XX	XX	XX	XX	XX

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Critical Response Skills									
6.2.9 Compare consumer products, such as generic and brand-name products, and consider reasonable personal trade-offs among them on the basis of features, performance, durability, and costs.									
The Physical Setting **Students collect and organize data to identify relationships between physical objects, events, and processes. They use logical reasoning to question their own ideas as new information challenges their conceptions of the natural world.**									
The Universe									
6.3.1 Compare and contrast the size, composition, and surface features of the planets that comprise the solar system, as well as the objects orbiting them. Explain that the planets, except Pluto, move around the sun in nearly circular orbits.									
6.3.2 Observe and describe that planets change their position relative to the background of stars.									
6.3.3 Explain that Earth is one of several planets that orbit the sun, and that the moon, as well as many artificial satellites and debris, orbit around Earth.									
The Earth and the Processes That Shape It									
6.3.4 Explain that we live on a planet which appears at present to be the only body in the solar system capable of supporting life.									
6.3.5 Use models or drawings to explain that Earth has different seasons and weather patterns because it turns daily on an axis that is tilted relative to the plane of Earth's yearly orbit around the sun. Know that because of this, sunlight falls more intensely on different parts of Earth during the year (the accompanying greater length of days also has an effect) and the difference in heating produces seasons and weather patterns.	**XX**								
6.3.6 Use models or drawings to explain that the phases of the moon are caused by the moon's orbit around Earth, once in about 28 days, changing what part of the moon is lighted by the sun and how much of that part can be seen from Earth, both during the day and night.									

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6.3.7 Understand and describe the scales involved in characterizing Earth and its atmosphere. Describe that Earth is mostly rock, that three-fourths of its surface is covered by a relatively thin layer of water, and that the entire planet is surrounded by a relatively thin blanket of air.	X								
6.3.8 Explain that fresh water, limited in supply and uneven in distribution, is essential for life and also for most industrial processes. Understand that this resource can be depleted or polluted, making it unavailable or unsuitable for life.									XX
6.3.9 Illustrate that the cycling of water in and out of the atmosphere plays an important role in determining climatic patterns.	XX								XX
6.3.10 Describe the motions of ocean waters, such as tides, and identify their causes.						XX			
6.3.11 Identify and explain the effects of oceans on climate.	X					XX			
6.3.12 Describe ways human beings protect themselves from adverse weather conditions.	X								
6.3.13 Identify, explain, and discuss some effects human activities, such as the creation of pollution, have on weather and the atmosphere.	X								
6.3.14 Give examples of some minerals that are very rare and some that exist in great quantities. Explain how recycling and the development of substitutes can reduce the rate of depletion of minerals.					X				
6.3.15 Explain that although weathered* rock is the basic component of soil, the composition and texture of soil and its fertility and resistance to erosion* are greatly influenced by plant roots and debris, bacteria, fungi, worms, insects, and other organisms.					X		X	XX	
6.3.16 Explain that human activities, such as reducing the amount of forest cover, increasing the amount and variety of chemicals released into the atmosphere, and farming intensively, have changed the capacity of the environment to support some life forms.								X	
Matter and Energy									

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6.3.17 Recognize and describe that energy is a property of many objects and is associated with heat, light, electricity, mechanical motion, and sound.		X	X						
6.3.18 Investigate and describe that when a new material, such as concrete, is made by combining two or more materials, it has properties that are different from the original materials.					XX				
6.3.19 Investigate that materials may be composed of parts that are too small to be seen without magnification.		X	X	X	X				
6.3.20 Investigate that equal volumes* of different substances usually have different masses as well as different densities*.			X		X				
The Living Environment **Students recognize that plants and animals obtain energy in different ways, and they can describe some of the internal structures of organisms related to this function. They examine the similarities and differences between humans and other species. They use microscopes to observe cells and recognize cells as the building blocks of all life.** **Interdependence of Life and Evolution**									
6.4.8 Explain that in all environments, such as freshwater, marine, forest, desert, grassland, mountain, and others, organisms with similar needs may compete with one another for resources, including food, space, water, air, and shelter. Note that in any environment, the growth and survival of organisms depend on the physical conditions.						X			
6.4.9 Recognize and explain that two types of organisms may interact in a competitive or cooperative relationship, such as producer*/consumer*, predator*/prey*, or parasite*/host*.						X			
6.4.10 Describe how life on Earth depends on energy from the sun.									
The Mathematical World **Students apply mathematics in scientific contexts. They use mathematical ideas, such as relations between operations, symbols, shapes in three dimensions, statistical relationships, and the use of logical reasoning in the representation and synthesis of data.** **Numbers**									
6.5.1 Demonstrate that the operations addition and subtraction are inverses and that multiplication and division are inverses of each other.									
6.5.2 Evaluate the precision and usefulness of data based on measurements taken.	XX	XX	XX	XX	XX	XX	XX	XX	XX

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Shapes and Symbolic Relationships									
6.5.3 Explain why shapes on a sphere* like Earth cannot be depicted on a flat surface without some distortion.						X			
6.5.4 Demonstrate how graphs may help to show patterns, such as trends, varying rates of change, gaps, or clusters, which can be used to make predictions.	X	XX	XX	X	X	X		X	X
Reasoning and Uncertainty									
6.5.5 Explain the strengths and weaknesses of using an analogy to help describe an event, object, etc.		X							
6.5.6 Predict the frequency of the occurrence of future events based on data.	X	X		X		X			
6.5.7 Demonstrate how probabilities and ratios can be expressed as fractions, percentages, or odds.									
Historical Perspectives **Students gain understanding of how the scientific enterprise operates through examples of historical events. Through the study of these events, they understand that new ideas are limited by the context in which they are conceived, are often rejected by the scientific establishment, sometimes spring from unexpected findings, and grow or transform slowly through the contributions of many different investigators.**									
6.6.1 Understand and explain that from the earliest times until now, people have believed that even though countless different kinds of materials seem to exist in the world, most things can be made up of combinations of just a few basic kinds of things. Note that there has not always been agreement, however, on what those basic kinds of things are, such as the theory of long ago that the basic substances were earth, water, air, and fire. Understand that this theory seemed to explain many observations about the world, but as we know now, it fails to explain many others.					X				
6.6.2 Understand and describe that scientists are still working out the details of what the basic kinds of matter are on the smallest scale, and of how they combine, or can be made to combine, to make other substances.					X			X	

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6.6.3 Understand and explain that the experimental and theoretical work done by French scientist Antoine Lavoisier in the decade between the American and French Revolutions contributed crucially to the modern science of chemistry.									
Common Themes: Students use mental and physical models to conceptualize processes. They recognize that many systems have feedback mechanisms that limit changes.									
Systems									
6.7.1 Describe that a system, such as the human body, is composed of subsystems.									
Models and Scale									
6.7.2 Use models to illustrate processes that happen too slowly, too quickly, or on too small a scale to observe directly, or are too vast to be changed deliberately, or are potentially dangerous.		**XX**	**X**						
Constancy and Change									
6.7.3 Identify examples of feedback mechanisms within systems that serve to keep changes within specified limits.									
GRADE 7									
The Nature of Science and Technology									
Students further their scientific understanding of the natural world through investigations, experiences, and readings. They design solutions to practical problems by using a variety of scientific methodologies.									
The Scientific View of the World									
7.1.1 Recognize and explain that when similar investigations give different results, the scientific challenge is to judge whether the differences are trivial or significant, which often takes further studies to decide.	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**
Scientific Inquiry									
7.1.2 Explain that what people expect to observe often affects what they actually do observe and provide an example of a solution to this problem.	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**
7.1.3 Explain why it is important in science to keep honest, clear, and accurate records.	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**

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7.1.4 Describe that different explanations can be given for the same evidence, and it is not always possible to tell which one is correct without further inquiry.	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**
The Scientific Enterprise									
7.1.5 Identify some important contributions to the advancement of science, mathematics, and technology that have been made by different kinds of people, in different cultures, at different times.	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**
7.1.6 Provide examples of people who overcame bias and/or limited opportunities in education and employment to excel in the fields of science.									
Technology and Science									
7.1.7 Explain how engineers, architects, and others who engage in design and technology use scientific knowledge to solve practical problems.	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
7.1.8 Explain that technologies often have drawbacks as well as benefits. Consider a technology, such as the use of pesticides, which help some organisms but may hurt others, either deliberately or inadvertently.	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
7.1.9 Explain how societies influence what types of technology are developed and used in fields such as agriculture, manufacturing, sanitation, medicine, warfare, transportation, information processing, and communication.	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
7.1.10 Identify ways that technology has strongly influenced the course of history and continues to do so.	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
7.1.11 Illustrate how numbers can be represented using sequences of only two symbols, such as 1 and 0 or on and off, and how that affects the storage of information in our society.	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Scientific Thinking **Students use instruments and tools to measure, calculate, and organize data. They frame arguments in quantitative terms when possible. They question claims and understand that findings may be interpreted in more than one acceptable way.**									
Computation and Estimation									
7.2.1 Find what percentage one number is of another and figure any percentage of any number.									

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7.2.2 Use formulas to calculate the circumferences and areas* of rectangles, triangles, and circles, and the volumes* of rectangular solids.					X				
7.2.3 Decide what degree of precision is adequate, based on the degree of precision of the original data, and round off the result of calculator operations to significant figures* that reasonably reflect those of the inputs.	X	X	X	X	X	X	X	X	X
7.2.4 Express numbers like 100, 1,000, and 1,000,000 as powers of 10.									
7.2.5 Estimate probabilities of outcomes in familiar situations, on the basis of history or the number of possible outcomes.									
Manipulation and Observation									
7.2.6 Read analog and digital meters on instruments used to make direct measurements of length, volume, weight, elapsed time, rates, or temperatures, and choose appropriate units.	X	X	X	X	X	X	X	X	X
Communication Skills									
7.2.7 Incorporate circle charts, bar and line graphs, diagrams, scatter plots*, and symbols into writing, such as lab or research reports, to serve as evidence for claims and/or conclusions.	XX	XX	XX	XX	XX	XX	XX	XX	XX
Critical Response Skills									
7.2.8 Question claims based on vague attributes, such as "Leading doctors say ...," or on statements made by celebrities or others outside the area of their particular expertise.									
The Physical Setting **Students collect and organize data to identify relationships between physical objects, events, and processes. They use logical reasoning to question their own ideas as new information challenges their conceptions of the natural world.**									
The Universe									
7.3.1 Recognize and describe that the sun is a medium-sized star located near the edge of a disk-shaped galaxy of stars and that the universe contains many billions of galaxies and each galaxy contains many billions of stars.									

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7.3.2 Recognize and describe that the sun is many thousands of times closer to Earth than any other star, allowing light from the sun to reach Earth in a few minutes. Note that this may be compared to time spans of longer than a year for all other stars.									
The Earth and the Processes That Shape It									
7.3.3 Describe how climates sometimes have changed abruptly in the past as a result of changes in Earth's crust, such as volcanic eruptions or impacts of huge rocks from space.									
7.3.4 Explain how heat flow and movement of material within Earth causes earthquakes and volcanic eruptions and creates mountains and ocean basins.						X			
7.3.5 Recognize and explain that heat energy carried by ocean currents has a strong influence on climate around the world.	X					XX			
7.3.6 Describe how gas and dust from large volcanoes can change the atmosphere.		X							
7.3.7 Give examples of some changes in Earth's surface that are abrupt, such as earthquakes and volcanic eruptions, and some changes that happen very slowly, such as uplift and wearing down of mountains and the action of glaciers.		XX					XX		
7.3.8 Describe how sediments of sand and smaller particles, sometimes containing the remains of organisms, are gradually buried and are cemented together by dissolved minerals to form solid rock again.				X	X		X	X	
7.3.9 Explain that sedimentary rock*, when buried deep enough, may be reformed by pressure and heat, perhaps melting and recrystallizing into different kinds of rock. Describe that these reformed rock layers may be forced up again to become land surface and even mountains, and subsequently erode.				X	X		X	X	
7.3.10 Explain how the thousands of layers of sedimentary rock can confirm the long history of the changing surface of Earth and the changing life forms whose remains are found in successive layers, although the youngest layers are not always found on top, because of folding, breaking, and uplifting of layers.				X	X		XX		

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Matter and Energy									
7.3.11 Explain that the sun loses energy by emitting light. Note that only a tiny fraction of that light reaches Earth. Understand that the sun's energy arrives as light with a wide range of wavelengths*, consisting of visible light, infrared*, and ultraviolet radiation*.			X						
7.3.12 Investigate how the temperature* and acidity* of a solution influences reaction rates, such as those resulting in food spoilage.									
7.3.13 Explain that many substances dissolve in water. Understand that the presence of these substances often affects the rates of reactions that are occurring in the water as compared to the same reactions occurring in the water in the absence of the substances.				X	X				X
7.3.14 Explain that energy in the form of heat is almost always one of the products of an energy trans-formation, such as in the examples of exploding stars, biological growth, the operation of machines, and the motion of people.	X	X	X						
7.3.15 Describe how electrical energy can be produced from a variety of energy sources and can be transformed into almost any other form of		X	X						
7.3.16 Recognize and explain that different ways of obtaining, transforming, and distributing energy have different environmental consequences.	X	X	X						
Forces of Nature									
7.3.17 Investigate that an unbalanced force, acting on an object, changes its speed* or path of motion or both, and know that if the force always acts toward the same center as the object moves, the object's path may curve into an orbit around the center.									
7.3.18 Describe that light waves, sound waves, and other waves move at different speeds in different materials.		X							
7.3.19 Explain that human eyes respond to a narrow range of wavelengths of the electromagnetic spectrum.									
7.3.20 Describe that something can be "seen" when light waves emitted or reflected by it enter the eye just as something can be "heard" when sound waves from it enter the ear									
The Living Environment									

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Students begin to trace the flow of matter and energy through ecosystems. They recognize the funda-mental difference between plants and animals and understand its basis at the cellular level. Students distinguish species, particularly through an examination of internal structures and functions. They use microscopes to observe cells and recognize that cells function in similar									
Diversity of Life									
7.4.1 Explain that similarities among organisms are found in external and internal anatomical features, including specific characteristics at the cellular level, such as the number of chromosomes*. Understand that these similarities are used to classify organisms since they may be used to infer the degree of relatedness among organisms.									
7.4.2 Describe that all organisms, including the human species*, are part of and depend on two main interconnected global food webs*, the ocean food web and the land food web.						**X**			
7.4.3 Explain how, in sexual reproduction, a single specialized cell from a female merges with a specialized cell from a male and this fertilized egg carries genetic information from each parent and multiplies to form the complete organism.									
7.4.4 Explain that cells continually divide to make more cells for growth and repair and that various organs and tissues function to serve the needs of cells for food, air, and waste removal.									
7.4.5 Explain that the basic functions of organisms, such as extracting energy from food and getting rid of wastes, are carried out within the cell and understand that the way in which cells function is similar in all organisms.									
Interdependence of Life and Evolution									
7.4.6 Explain how food provides the fuel and the building material for all organisms.									
7.4.7 Describe how plants use the energy from light to make sugars from carbon dioxide and water to produce food that can be used immediately or stored for later use.									
7.4.8 Describe how organisms that eat plants break down the plant structures to produce the materials and energy that they need to survive, and in turn, how they are consumed by other organisms.						**X**			

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7.4.9 Understand and explain that as any population of organisms grows, it is held in check by one or more environmental factors. These factors could result in depletion of food or nesting sites and/or increase loss to increased numbers of predators or parasites. Give examples of some consequences of this.						X			
Human Identity									
7.4.10 Describe how technologies having to do with food production, sanitation, and disease prevention have dramatically changed how people live and work and have resulted in changes in factors that affect the growth of human population.									
7.4.11 Explain that the amount of food energy (calories) a person requires varies with body weight, age, sex, activity level, and natural body efficiency. Understand that regular exercise is important to maintain a healthy heart/lung system, good muscle tone, and strong bone structure.									
7.4.12 Explain that viruses, bacteria, fungi, and parasites may infect the human body and interfere with normal body functions. Recognize that a person can catch a cold many times because there are many varieties of cold viruses that cause similar symptoms.									
7.4.13 Explain that white blood cells engulf invaders or produce antibodies that attack invaders or mark the invaders for killing by other white blood cells. Know that the antibodies produced will remain and can fight off subsequent invaders of the same kind.									
7.4.14 Explain that the environment may contain dangerous levels of substances that are harmful to human beings. Understand, therefore, that the good health of individuals requires monitoring the soil, air, and water as well as taking steps to keep them safe.									
The Mathematical World **Students apply mathematics in scientific contexts. They use mathematical ideas, such as relations between operations, symbols, statistical relationships, and the use of logical reasoning, in the representation and synthesis of data.** **Numbers**									

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7.5.1 Demonstrate how a number line can be extended on the other side of zero to represent negative numbers and give examples of instances where this is useful.	X	X	X	X	X	X	X	X	X
Shapes and Symbolic Relationships									
7.5.2 Illustrate how lines can be parallel, perpendicular, or oblique.									
7.5.3 Demonstrate how the scale chosen for a graph or drawing determines its interpretation.		X	X	X	X	X	X		
Reasoning and Uncertainty									
7.5.4 Describe that the larger the sample, the more accurately it represents the whole. Understand, however, that any sample can be poorly chosen and this will make it unrepresentative of the whole.								X	
Historical Perspectives **Students gain understanding of how the scientific enterprise operates through examples of historical events. Through the study of these events, they understand that new ideas are limited by the context in which they are conceived, are often rejected by the scientific establishment, sometimes spring from unexpected findings, and grow or transform slowly through the contributions of many different investigators.**									
7.6.1 Understand and explain that throughout history, people have created explanations for disease. Note that some held that disease had spiritual causes, but that the most persistent biological theory over the centuries was that illness resulted from an imbalance in the body fluids. Realize that the introduction of germ theory by Louis Pasteur and others in the 19 th century led to the modern understanding of how many diseases are caused by microorganisms, such as bacteria, viruses, yeasts, and parasites.									

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7.6.2 Understand and explain that Louis Pasteur wanted to find out what caused milk and wine to spoil. Note that he demonstrated that spoilage and fermentation* occur when microorganisms enter from the air, multiply rapidly, and produce waste products, with some desirable results, such as carbon dioxide in bread dough, and some undesirable, such as acetic acid in wine. Understand that after showing that spoilage could be avoided by keeping germs out or by destroying them with heat, Pasteur investigated animal diseases and showed that microorganisms were involved in many of them. Also note that other investigators later showed that specific kinds of germs caused specific diseases.									
7.6.3 Understand and explain that Louis Pasteur found that infection by disease organisms (germs) caused the body to build up an immunity against subsequent infection by the same organisms. Realize that Pasteur then demonstrated more widely what Edward Jenner had shown for smallpox without understanding the underlying mechanism: that it was possible to produce vaccines that would induce the body to build immunity to a disease without actually causing the disease itself.									
7.6.4 Understand and describe that changes in health practices have resulted from the acceptance of the germ theory of disease. Realize that before germ theory, illness was treated by appeals to supernatural powers or by attempts to adjust body fluids through induced vomiting or bleeding. Note that the modern approach emphasizes sanitation, the safe handling of food and water, the pasteurization of milk, quarantine, and aseptic surgical techniques to keep germs out of the body; vaccinations to strengthen the body's immune system against subsequent infection by the same kind of microorganisms; and antibiotics and other chemicals and processes to destroy microorganisms.									
Common Themes: Students analyze the relationships within systems. They investigate how different models can represent the same data, rates of change, cyclic changes, and changes that counterbalance one another. **Systems**									
7.7.1 Explain that the output from one part of a system, which can include material, energy, or information, can become the input to other parts and this feedback can serve to control what goes on in the system as a whole.		**X**				**X**			

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Models and Scale									
7.7.2 Use different models to represent the same thing, noting that the kind of model and its complexity should depend on its purpose.		X	X		X				
Constancy and Change									
7.7.3 Describe how physical and biological systems tend to change until they reach equilibrium and remain that way unless their surroundings change.						X			
7.7.4 Use symbolic equations to show how the quantity of something changes over time or in response to changes in other quantities.									
GRADE 8 **The Nature of Science and Technology** **Students design and carry out increasingly sophisticated investigations. They understand the reason for isolating and controlling variables in an investigation. They realize that scientific knowledge is subject to change as new evidence arises. They examine issues in the design and use of technology, including constraints, safeguards, and trade-offs.** **The Scientific View of the World**									
8.1.1 Recognize that and describe how scientific knowledge is subject to modification as new information challenges prevailing theories and as a new theory* leads to looking at old observations in a new way.									
8.1.2 Recognize and explain that some matters cannot be examined usefully in a scientific way.									
Scientific Inquiry									
8.1.3 Recognize and describe that if more than one variable changes at the same time in an experiment, the outcome of the experiment may not be attributable to any one of the variables.	XX	XX	XX	XX	XX	XX	XX	XX	XX
The Scientific Enterprise									
8.1.4 Explain why accurate record keeping, openness, and replication are essential for maintaining an investigator's credibility with other scientists and society.	XX	XX	XX	XX	XX	XX	XX	XX	XX
8.1.5 Explain why research involving human subjects requires that potential subjects be fully informed about the risks and benefits associated with the research and that they have the right to refuse to participate.									
Technology and Science									

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8.1.6 Identify the constraints that must be taken into account as a new design is developed, such as gravity and the properties of the materials to be used.									
8.1.7 Explain why technology issues are rarely simple and one-sided because contending groups may have different values and priorities.									
8.1.8 Explain that humans help shape the future by generating knowledge, developing new technologies, and communicating ideas to others.	XX	XX	XX	XX	XX	XX	XX	XX	XX
Scientific Thinking									
Students use computers to organize and compare information. They perform calculations and determine the appropriate units for the answers. They weigh the evidence for or against an argument, as well as the logic of the conclusions.									
Computation and Estimation									
8.2.1 Estimate distances and travel times from maps and the actual size of objects from scale drawings.		X	X			X			
8.2.2 Determine in what units, such as seconds, meters, grams, etc., an answer should be expressed based on the units of the inputs to the calculation.		X	X			X	X	X	
Manipulation and Observation									
8.2.3 Use proportional reasoning to solve problems.					X				
8.2.4 Use technological devices, such as calculators and computers, to perform calculations.		X	X		X	X	X	X	X
8.2.5 Use computers to store and retrieve information in topical, alphabetical, numerical, and keyword files and create simple files of students' own devising.		X	X		X	X	X	X	
Communication									
8.2.6 Write clear, step-by-step instructions (procedural summaries) for conducting investigations, operating something, or following a procedure.	XX	XX	XX	XX	XX	XX	XX	XX	XX
8.2.7 Participate in group discussions on scientific topics by restating or summarizing accurately what others have said, asking for clarification or elaboration, and expressing alternative positions.	XX	XX	XX	XX	XX	XX	XX	XX	XX
8.2.8 Use tables, charts, and graphs in making arguments and claims in, for example, oral and written presentations about lab or fieldwork.	XX	XX	XX	XX	XX	XX	XX	XX	XX

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Critical Response Skills									
8.2.9 Explain why arguments are invalid if based on very small samples of data, biased samples, or samples for which there was no control sample.									
8.2.10 Identify and criticize the reasoning in arguments in which fact and opinion are intermingled or the conclusions do not follow logically from the evidence given, an analogy is not apt, no mention is made of whether the control group is very much like the experimental group, or all members of a group are implied to have nearly identical characteristics that differ from those of other groups.	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**
The Physical Setting **Students collect and organize data to identify relationships between physical objects, events, and processes. They use logical reasoning to question their own ideas as new information challenges their conceptions of the natural world.**									
The Universe									
8.3.1 Explain that large numbers of chunks of rock orbit the sun and some of this rock interacts with Earth.									
The Earth and the Processes That Shape It									
8.3.2 Explain that the slow movement of material within Earth results from heat flowing out of the deep interior and the action of gravitational forces on regions of different density*.		**X**				**X**	**X**		
8.3.3 Explain that the solid crust of Earth, including both the continents and the ocean basins, consists of separate plates that ride on a denser, hot, gradually deformable layer of earth. Understand that the crust sections move very slowly, pressing against one another in some places, pulling apart in other places. Further understand that ocean-floor plates may slide under continental plates, sinking deep into Earth, and that the surface layers of these plates may fold, forming mountain ranges.		**XX**				**X**	**X**		

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8.3.4 Explain that earthquakes often occur along the boundaries between colliding plates, and molten rock from below creates pressure that is released by volcanic eruptions, helping to build up mountains. Understand that under the ocean basins, molten rock may well up between separating plates to create new ocean floor. Further understand that volcanic activity along the ocean floor may form undersea mountains, which can thrust above the ocean's surface to become islands.		XX				X	X		
8.3.5 Explain that everything on or anywhere near Earth is pulled toward Earth's center by a gravitational force.							X	X	
8.3.6 Understand and explain that the benefits of Earth's resources, such as fresh water, air, soil, and trees, are finite and can be reduced by using them wastefully or by deliberately or accidentally destroying them.	X		X		X			X	XX
8.3.7 Explain that the atmosphere and the oceans have a limited capacity to absorb wastes and recycle materials naturally.	X					X			
Matter and Energy									
8.3.8 Explain that all matter is made up of atoms which are far too small to see directly through an optical microscope. Understand that the atoms of any element are similar but are different from atoms of other elements. Further understand that atoms may stick together in well-defined molecules or may be packed together in large arrays. Also understand that different arrangements of atoms into groups comprise all substances.					X			X	X
8.3.9 Demonstrate, using drawings and models, the movement of atoms in a solid, liquid, and gaseous state. Explain that atoms and molecules are perpetually in motion.								X	XX
8.3.10 Explain that increased temperature means that atoms have a greater average energy of motion and that most gases expand when heated.									XX

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8.3.11 Describe how groups of elements can be classified based on similar properties, including highly reactive metals, less reactive metals, highly reactive nonmetals, less reactive nonmetals, and some almost completely nonreactive gases.									
8.3.12 Explain that no matter how substances within a closed system interact with one another, or how they combine or break apart, the total mass of the system remains the same. Understand that the atomic theory explains the conservation of matter: if the number of atoms stays the same no matter how they are rearranged, then their total mass stays the same.									
8.3.13 Explain that energy cannot be created or destroyed but only changed from one form into another.									
8.3.14 Describe how heat can be transferred through materials by the collision of atoms, or across space by radiation, or if the material is fluid, by convection currents that are set up in it that aid the transfer of heat.	X					X			X
8.3.15 Identify different forms of energy that exist in nature.			X			X			X
Forces of Nature									
8.3.16 Explain that every object exerts gravitational force on every other object and that the force depends on how much mass the objects have and how far apart they are.									
8.3.17 Explain that the sun's gravitational pull holds Earth and the other planets in their orbits, just as the planets' gravitational pull keeps their moons in orbit around them.									
8.3.18 Investigate and explain that electric currents and magnets can exert force on each other.									
8.3.19 Investigate and compare series and parallel circuits.									
8.3.20 Compare the differences in power consumption in different electrical devices.									
The Living Environment: **Students trace the flow of matter and energy through ecosystems*. They understand that the total amount of matter remains constant and that almost all food energy has its origin in sunlight.** **Interdependence of Life and Evolution**									

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8.4.4 Describe how matter is transferred from one organism to another repeatedly and between organisms and their physical environment.									
8.4.5 Explain that energy can be transferred from one form to another in living things.						X			
8.4.6 Describe how animals get their energy from oxidizing their food and releasing some of this energy as heat.									
8.4.7 Recognize and explain that small genetic differences between parents and offspring can accumulate in successive generations so that descendants are very different from their ancestors.									
8.4.8 Describe how environmental conditions affect the survival of individual organisms and how entire species may prosper in spite of the poor survivability or bad fortune of individuals.									
Human Identity									
8.4.9 Recognize and describe that fossil evidence is consistent with the idea that human beings evolved from earlier species*.				X					
The Mathematical World **Students apply mathematics in scientific contexts. Students use mathematical ideas, such as symbols, geometrical relationships, statistical relationships, and the use of key words and rules in logical reasoning, in the representation and synthesis of data.**									
Numbers									
8.5.1 Understand and explain that a number must be written with an appropriate number of significant figures (determined by the measurements from which the number is derived).									
Shapes and Symbolic Relationships									
8.5.2 Show that an equation containing a variable may be true for just one value of the variable.		X	X		X				
8.5.3 Demonstrate that mathematical statements can be used to describe how one quantity changes when another changes.		X	X		X				
8.5.4 Illustrate how graphs can show a variety of possible relationships between two variables.		X	X		X	X	X		X
8.5.5 Illustrate that it takes two numbers to locate a point on a map or any other two-dimensional surface.		X	X		X	X	X		X
Reasoning and Uncertainty									

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8.5.6 Explain that a single example can never prove that something is always true, but it could prove that something is not always true.		X	X	X		X			
8.5.7 Recognize and describe the danger of making over-generalizations when inventing a general rule based on a few observations.		X	X	X		X			
8.5.8 Explain how estimates can be based on data from similar conditions in the past or on the assumption that all the possibilities are known.		X	X	X		X			
8.5.9 Compare the mean*, median*, and mode* of a data set.									
8.5.10 Explain how the comparison of data from two groups involves comparing both their middles and the spreads.									
Historical Perspectives **Students gain understanding of how the scientific enterprise operates through examples of historical events. Through the study of these events, they understand that new ideas are limited by the context in which they are conceived, are often rejected by the scientific establishment, sometimes spring from unexpected findings, and grow or transform slowly through the contributions of many different investigators.**									
8.6.1 Understand and explain that Antoine Lavoisier's work was based on the idea that when materials react with each other, many changes can take place, but that in every case the total amount of matter afterward is the same as before. Note that Lavoisier successfully tested the concept of conservation of matter by conducting a series of experiments in which he carefully measured the masses of all the substances involved in various									
8.6.2 Understand and describe that the accidental discovery that minerals containing uranium darken photographic film, as light does, led to the discovery of radioactivity									

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8.6.3 Understand that and describe how in their laboratory in France, Marie Curie and her husband, Pierre Curie, isolated two new elements that were the source of most of the radioactivity of uranium ore. Note that they named one radium because it gave off powerful, invisible rays, and the other polonium in honor of Madame Curie's country of birth, Poland. Also note that Marie Curie was the first scientist ever to win the Nobel Prize in two different fields, in physics, shared with her husband, and later in chemistry.									
8.6.4 Describe how the discovery of radioactivity as a source of Earth's heat energy made it possible to understand how Earth can be several billion years old and still have a hot interior.		X					X		
Common Themes: Students analyze the parts and interactions of systems to understand internal and external relationships. They investigate rates of change, cyclic changes, and changes that counterbalance one another. They use mental and physical models to reflect upon and interpret the limitations of such models.									
Systems									
8.7.1 Explain that a system usually has some properties that are different from those of its parts but appear because of the interaction of those parts.									
8.7.2 Explain that even in some very simple systems, it may not always be possible to predict accurately the result of changing some part or connection.	X	X	X	X	X	X	X	X	X
Models and Scale									
8.7.3 Use technology to assist in graphing and with simulations that compute and display results of changing factors in models.		X	X	X	X		X		
8.7.4 Explain that as the complexity of any system increases, gaining an understanding of it depends on summaries, such as averages and ranges*, and on descriptions of typical examples of that system.								X	
Constancy and Change									
8.7.5 Observe and describe that a system may stay the same because nothing is happening or because things are happening that counteract one another.		X							

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8.7.6 Recognize that and describe how symmetry may determine properties of many objects, such as molecules, crystals, organisms, and designed structures.					**X**				
8.7.7 Illustrate how things, such as seasons or body temperature, occur in cycles.			**X**			**X**			