GRADE 6 SCIENCE
CURRICULUM GUIDE

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Elkhart Community Schools
September 2002

COURSE DESCRIPTION
ELEMENTARY SCIENCE

(Grades 4-6)
0460-04, 0460-05, 0460-06

Elementary Science in the intermediate grades provides learning experiences through which students further develop science habits of mind and refine their understanding of simple concepts and principles about the nature of science and technology, the physical setting, the living environment, the human organism, the designed world, and the common themes of science.

These experiences are designed to allow students to:

- indicate a desire to investigate new and alternative ideas;
- accept the results of investigations even when these results require changing previously held positions and opinions;
- be enthusiastic and curious about the ways and ideas of science;
- value the integrity of what is observed by looking at data collected through scientifically valid procedures;
- identify, access, and use information from various reliable and relevant print and non-print sources;
- use basic science concepts to help understand various kinds of scientific information;
- follow and understand scientific and technical instructions;
- begin to evaluate certain "scientific" claims through guided classroom activities and discussion;
- use the appropriate sense(s) to observe objects and events;
- become familiar with devices which can enhance and refine observations;
- separate objects, ideas, and events into appropriate groups according to their characteristics;
- combine both past experiences and present evidence to arrive at logical explanations;
- predict what will happen in a given situation by referring to a series of related observations;
- select appropriate units and measuring devices for the situation;
- designate the results of the measurement accurately in numbers and use common words to express how terms and concepts are understood;
- revise definitions of terms, objects, and events as more experiences with them are acquired;
- formulate specific, appropriate questions and logical guesses concerning related observations;
- select or invent appropriate devices and equipment to accomplish a given scientific task;
- experience the data gathering portion of the experimental process;
- design a model (physical representation, drawing, or mental image) to explain objects and events;
- work cooperatively in groups, with each member accepting a specific role, to solve a problem or reach a goal;
- demonstrate an appreciation of how significant new scientific and technological ideas, discoveries, and inventions have affected our understanding of the world;
- demonstrate, through responsible actions, why care of and concern about the earth's resources are essential;
- consider ethical values, based on the applications of scientific information, when assessing the effects of human actions on the total environment; and
- identify a problem, propose solutions, devise ways to gather information to test the proposed solution and determine the most appropriate solution(s).

Elkhart Community Schools
September 2002

THE NATURE OF SCIENCE AND TECHNOLOGY

Standard 1: 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.			
Indicator	**Example**	**Instruction/Assessment Reference**	**Resource**
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.	Length of one year is 12 months, 52 weeks, etc.	To determine the length of one minute, have students stand up and when they think one minute is up, they sit down.	Measuring Time Magnets and Motors Technology of Paper
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. *hypothesis: an informed guess or tentative explanation for which there is not yet much evidence	Tornado Watchers	Construct and graph table showing results from an activity.	Measuring Time Magnets and Motors Experiments With Plants Technology of Paper

THE NATURE OF SCIENCE AND TECHNOLOGY

Standard 1: 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. (continued)			
Indicator	**Example**	**Instruction/Assessment Reference**	**Resource**
Scientific Inquiry (continued)			
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.	Have students make hypotheses before conducting experiments.	What would happen if the students did an experiment in which they put a cactus in a pond, or a water lily in the desert?	Experiments With Plants Magnets and Motors Measuring Time Technology of Paper
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 agencies.	None	None	No kit used as a resource in Grade 6.
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.	None	None	No kit used as a resource in Grade 6.
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.	None	None	No kit used as a resource in Grade 6.

THE NATURE OF SCIENCE AND TECHNOLOGY

Standard 1: 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. (continued)			
Indicator	**Example**	**Instruction/Assessment Reference**	**Resource**
Technology and Science			
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.	None	None	No kit used as a resource in Grade 6.
6.1.8 Describe instances showing that technology cannot always provide successful solutions for problems or fulfill every human need.	None	None	No kit used as a resource in Grade 6.
6.1.9 Explain how technologies can influence all living things.	Picture of farming showing pre 1920's and farming today.	Students research different cultural calendars through technology.	Measuring Time

SCIENTIFIC THINKING

Standard 2: 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.			
Indicator	**Example**	**Instruction/Assessment Reference**	**Resource**
Computation and Estimation			
6.2.1 Find the mean* and median* of a set of data. * mean: the average obtained by adding the values and dividing by the number of values * median: the value that divides a set of data, written in order of size, into two equal parts	Mean = 14 13, 14, 14, 17, 21 Median = 25.8 13, 14, 14, 17, 21	Students find the mean and median of their results of their sinking water clock experiment.	Experiments With Plants Measuring Time Technology of Paper
6.2.2 Use technology, such as calculators or computer spreadsheets, in analysis of data.	None	None	No kit used as a resource in Grade 6.
Manipulation and Observation			
6.2.3 Select tools such as cameras and tape recorders for capturing information.	None	None	No kit used as a resource in Grade 6.
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.	Tinker toy clock	Teacher's Edition, p. 128, Final Activity #1	Magnets and Motors Measuring Time

SCIENTIFIC THINKING

Standard 2: 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. (continued)			
Indicator	**Example**	**Instruction/Assessment Reference**	**Resource**
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, etc.	Demonstrate different types of graphs and tables that the students could use.	Construct table and graph showing results from flashlight activity.	Experimenting With Plants Measuring Time Motors and Magnets Technology of Paper
6.2.6 Read simple tables and graphs produced by others and describe in words what they show.	Table of moon phrases	Teacher shows table of moon phrases. Students will write about what the table means.	Experiments with Plants Measuring Time Motors and Magnets Technology of Paper
6.2.7 Locate information in reference books, back issues of newspapers and magazines, compact disks, and computer databases.	Have students use information to include in a report.	Have students write up and present information with the class.	No kit used as a resource in Grade 6. Social Studies, Science – any topic you choose.
6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so.	Demonstrate different ways to do an experiment that the results come out the same.	Sinking Water Clock experiment	Experiments With Plants Measuring Time Technology of Paper

SCIENTIFIC THINKING

Standard 2: 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. (continued)			
Indicator	**Example**	**Instruction/Assessment Reference**	**Resource**
Critical Response Skills (continued)			
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.	Look at different ads for the same product.	Compare different types of toilet tissues by experimenting.	Technology of Paper

THE PHYSICAL SETTING

Standard 3: 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.			
Indicator	**Example**	**Instruction/Assessment Reference**	**Resource**
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.	None	None	No kit used as a resource in Grade 6.
6.3.2 Observe and describe that planets change their position relative to the background of stars.	None	None	No kit used as a resource in Grade 6.
6.3.3 Explain that the Earth is one of several planets that orbit the sun, and that the moon, as well as many artificial satellites and debris, orbit around the Earth.	None	None	No kit used as a resource in Grade 6.
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.	None	None	No kit used as a resource in Grade 6.

THE PHYSICAL SETTING

Standard 3: 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. (continued)			
Indicator	**Example**	**Instruction/Assessment Reference**	**Resource**
The Earth and the Processes That Shape It (continued)			
6.3.5 Use models or drawings to explain that the Earth has different seasons and weather patterns because it turns daily on an axis that is tilted relative to the plane of the Earth's yearly orbit around the sun. Know that because of this, sunlight falls more intensely on different parts of the Earth during the year (the accompanying greater length of days also has an effect) and the difference in heating produces seasons and weather patterns.	None	None	No kit used as a resource in Grade 6.
6.3.6 Use models or drawings to explain that the phases of the moon are caused by the moon's orbit around the 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 the Earth, both during the day and night.	Mini lesson – Demonstrating phases of the moon.	Student puts moon phase cards in order.	Measuring Time
6.3.7 Understand and describe the scales involved in characterizing the Earth and its atmosphere. Describe that the 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.	None	None	No kit used as a resource in Grade 6.

THE PHYSICAL SETTING

Standard 3: 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. (continued)			
Indicator	**Example**	**Instruction/Assessment Reference**	**Resource**
The Earth and the Processes That Shape It (continued)			
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.	None	None	No kit used as a resource in Grade 6.
6.3.9 Illustrate that the cycling of water in and out of the atmosphere plays an important role in determining climatic patterns.	None	None	No kit used as a resource in Grade 6.
6.3.10 Describe the motions of ocean waters, such as tides, and identify their causes.	None	None	No kit used as a resource in Grade 6.
6.3.11 Identify and explain the effects of oceans on climate.	None	None	No kit used as a resource in Grade 6.
6.3.12 Describe ways human beings protect themselves from adverse weather conditions.	None	None	No kit used as a resource in Grade 6.
6.3.13 Identify, explain, and discuss some effects human activities, such as the creation of pollution, have on weather and the atmosphere.	None	None	No kit used as a resource in Grade 6.

THE PHYSICAL SETTING

Standard 3: 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. (continued)			
Indicator	**Example**	**Instruction/Assessment Reference**	**Resource**
The Earth and the Processes That Shape It (continued)			
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.	As lesson 12 is discussed with the class, talk about "minerals" that are rare and abundant. Have students do a report on a mineral.	Lesson 12, p. 161 – Extensions could tie in "minerals" and do mini-lesson.	Technology of Paper Internet Library
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. * weathering: breaking down, by such things as rain or wind, of rocks and other materials on the earth's surface * erosion: the process by which the products of weathering are moved from one place to another	None	None	No kit used as a resource in Grade 6.

THE PHYSICAL SETTING

Standard 3: 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. (continued)			
Indicator	**Example**	**Instruction/Assessment Reference**	**Resource**
The Earth and the Processes That Shape It (continued)			
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 intensive farming, have changed the capacity of the environment to support some life forms.	None	None	No kit used as a resource in Grade 6.
Matter* and Energy*			
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.	Talk about how energy is a property of many objects. Have students discuss how energy is a part of electricity.	Teacher's Edition, Lesson 12, p. 77 Teacher's Edition, Lesson 16, p. 99	Magnets and Motors
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.	None	None	No kit used as a resource in Grade 6.
6.3.19 Investigate that materials may be composed of parts that are too small to be seen without magnification.	None	None	No kit used as a resource in Grade 6.

*matter: anything that takes up space and has mass
energy: what is needed to do work
work: force acting over a distance to move an object
force: a push or a pull that can cause a change in the motion of an object
*motion: a change in position of an object in a certain amount of time

THE PHYSICAL SETTING

Standard 3: 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. (continued)			
Indicator	**Example**	**Instruction/Assessment Reference**	**Resource**
Matter* and Energy* (continued)			
6.3.20 Investigate that equal volumes* of different substances usually have different masses* as well as different densities*. * volume: a measure of the size of a three-dimensional object * mass: a measure of the amount of matter in an object * density: the density of a sample is the sample's mass divided by its volume	None	None	No kit used as a resource in Grade 6.

THE PHYSICAL SETTING

Standard 3: 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. (continued)			
Indicator	**Example**	**Instruction/Assessment Reference**	**Resource**
Forces of Nature			
6.3.21 Investigate, using a prism for example, that light is made up of a mixture of many different colors of light, even though the light is perceived as almost white.	Use a flashlight with activity, shine light, then shine on prism.	Record what is seen with light, and then what is seen with light and prism.	Measuring Time – Lesson 3
6.3.22 Demonstrate that vibrations in materials set up wavelike disturbances that spread away from the source such as sound and earthquake waves*. * waves: traveling disturbances that carry energy from one place to another	Using water clock in kit, come up with experiment to measure the water wave. Use different objects to see if it varies the wave.	Draw a picture of a wave. (water) (Move away from source.) Construct a graph the length of the wave – use different objects, graph differences.	Measuring Time – Kit, Lessons 7, 8, and 9 Music Teacher
6.3.23 Explain that electrical circuits* provide a means of transferring electrical energy from sources such as generators to devices in which heat, light, sound, and chemical changes are produced. * circuit: the complete path of an electric current	When students have constructed a circuit the switch becomes "hot". Time how long this takes. Many activities throughout the kit use this indicator.	Teacher's Edition, pp. 45, 50-51, 62-63, 69, 84-85, 92-93.	Magnet and Motor kit

THE LIVING ENVIRONMENT

Standard 4: 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.			
Indicator	**Example**	**Instruction/Assessment Reference**	**Resource**
Diversity of Life			
6.4.1 Explain that one of the most general distinctions among organisms is between green plants, which use sunlight to make their own food, and animals, which consume energy-rich foods.	Show interconnectedness between plants and animals. Field trip to Cooper Lab.	Students make a food chain.	Experimenting With Plants Cooper Science Lab – Dave Emery.
6.4.2 Give examples of organisms that cannot be neatly classified as either plants or animals, such as fungi and bacteria.	None	None	No kit used as a resource in Grade 6.
6.4.3 Describe some of the great variety of body plans and internal structures animals and plants have that contribute to their being able to make or find food and reproduce.	None	None	No kit used as a resource in Grade 6.

*species: a category of biological classification that is comprised of organisms sufficiently and closely related as to be potentially able to mate with one another

THE LIVING ENVIRONMENT

Standard 4: 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. (continued)			
Indicator	**Example**	**Instruction/Assessment Reference**	**Resource**
Diversity of Life (continued)			
6.4.4 Recognize and describe that a species comprises all organisms that can mate with one another to produce fertile offspring.	Fish – mommies and babies.	Discuss plant and animal cells.	Experimenting With Plants Internet
6.4.5 Investigate and explain that all living things are composed of cells whose details are usually visible only through a microscope.	None	None	No kit used as a resource in Grade 6.
6.4.6 Distinguish the main differences between plant and animal cells, such as the presence of chlorophyll* and cell walls in plant cells and their absence in animal cells. * chlorophyll: a substance found in green plants that is needed for photosynthesis* * photosynthesis: a process by which green plants use energy from sunlight to make their own food	None	None	No kit used as a resource in Grade 6.
6.4.7 Explain that about two thirds of the mass of a cell is accounted for by water. Water gives cells many of their properties.	None	None	No kit used as a resource in Grade 6.

THE LIVING ENVIRONMENT

Standard 4: 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. (continued)			
Indicator	**Example**	**Instruction/Assessment Reference**	**Resource**
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. In any environment, the growth and survival of organisms depend on the physical conditions.	When experiment with amount of seeds, overcrowding causes plants to die.	Record observations with plants. Draw healthy plant, plant that has competed.	Experiments With Plants kit Internet
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*. *producer: an organism that can make its own food *consumer: an organism that feeds directly or indirectly on producers *predator: an organism that kills and eats other organisms *prey: an organism that is killed and eaten by a predator *parasite: an organism that feeds on other living organisms *host: an organism in which or on which another organism lives	have students work together predator/prey parasite/host. Find ways interact in competitive and or cooperative relationship.	Report to class their findings. Make chart or poster. Write from certain view-point how relationship affects them.	Internet Silver Burdett Grade 6 Science Text (discarded)

THE LIVING ENVIRONMENT

Standard 4: 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. (continued)			
Indicator	**Example**	**Instruction/Assessment Reference**	**Resource**
Interdependence of Life and Evolution (continued)			
6.4.10 Describe how life on Earth depends on energy from the sun.	None	None	No kit used as a resource in Grade 6.
Human Identity			
6.4.11 Describe that human beings have body systems for obtaining and providing energy, defense, reproduction, and the coordination of body functions.	None	None	Health Text Grade 6 No kit used as a resource in Grade 6.
6.4.12 Explain that human beings have many similarities and differences and that the similarities make it possible for human beings to reproduce and to donate blood and organs to one another.	None	None	Health Text Grade 6 No kit used as a resource in Grade 6.
6.4.13 Give examples of how human beings use technology to match or exceed many of the abilities of other species.	None	None	No kit used as a resource in Grade 6.

THE MATHEMATICAL WORLD

Standard 5: 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, to represent and synthesize data.

Indicator	Example	Instruction/Assessment Reference	Resource
Numbers			
6.5.1 Demonstrate that the operations addition and subtraction are inverses and that multiplication and division are inverses of each other.	Do examples with students: 9 + 11 = 20 20 – 9 = 11 20 – 11 = 9 36 ÷ 4 = 9 36 ÷ 9 = 4 9 x 4 = 36 4 x 9 = 36	Have students come up with examples of addition and subtraction and multiplication and division being inverse operations.	Math Text No kit used as a resource in Grade 6.
6.5.2 Evaluate the precision and usefulness of data based on measurements taken.	Brainstorm a list of ideas of things that need to be measured precisely and the ramifications if the measurements are off.	Have students test the strength of a variety of different paper bags. Students then design an ad campaign for one of the brands.	Experiments With Plants Technology of Paper
Shapes and Symbolic Relationships			
6.5.3 Explain why shapes on a sphere* like the Earth cannot be depicted on a flat surface without some distortion. *sphere: a shape best described as that of a round ball, such as a baseball, that looks the same when seen from all directions	None	None	No kit used as a resource in Grade 6.

THE MATHEMATICAL WORLD

Standard 5: 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, to represent and synthesize data. (continued)			
Indicator	**Example**	**Instruction/Assessment Reference**	**Resource**
Shapes and Symbolic Relationships (continued)			
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.	Show examples of graphs and have students make predictions.	Any of the experiments in the kits could be used for instruction.	Experiments With Plants Magnets and Motors Measuring Time Thinking About Paper
Reasoning and Uncertainty			
6.5.5 Explain the strengths and weaknesses of using an analogy to help describe an event, object, etc.	None	None	No kit used as a resource in Grade 6.
6.5.6 Predict the frequency of the occurrence of future events based on data.	Have students graph data. Next, predict the frequency of the occurrence in the future.	Any lesson where there is graphed data.	Experiments With Plants Magnets and Motors Measuring Time Thinking About Paper
6.5.7 Demonstrate how probabilities and ratios can be expressed as fractions, percentages, or odds.	None	None	Grade 6 Math text No kit used as a resource in Grade 6.

HISTORICAL PERSPECTIVES

Standard 6: 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, that the ideas are often rejected by the scientific establishment, that the ideas sometimes spring from unexpected findings, and that the ideas grow or transform slowly through the contributions of many different investigators.

Indicator	Example	Instruction/Assessment Reference	Resource
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.	None	None	No kit used as a resource in Grade 6.
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.	None	None	No kit used as a resource in Grade 6.
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.	None	None	No kit used as a resource in Grade 6.

COMMON THEMES

Standard 7: Students use mental and physical models to conceptualize processes. They recognize that many systems have feedback mechanisms that limit changes.			
Indicator	**Example**	**Instruction/Assessment Reference**	**Resource**
Systems			
6.7.1 Describe that a system, such as the human body, is composed of subsystems.	Cells→Tissues→ Organs→System Discuss how each is a part of the next group.	Have the student explain how the body "works" with each subsystem.	No kit used as a resource in Grade 6. Grade 6 Health text
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.	None	None	No kit used as a resource in Grade 6.
Constancy and Change			
6.7.3 Identify examples of feedback mechanisms within systems that serve to keep changes within specified limits.	None	None	No kit used as a resource in Grade 6.

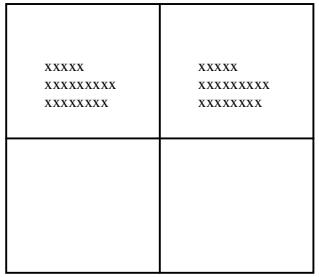
Unit: Experiments With Plants
Lesson 1: What Do You Know About Experiments?

Objective	Indicator	Instruction/Assessment Reference	Resources
TLW share what they already know about the characteristics of a "fair" experiment. TLW share what they know about plant growth. TLW develop an interest in investigating plant growth. TLW read about the requirements for growth and development of Wisconsin Fast Plants.	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. 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.	What would happen if they did an experiment in which they put a cactus in a pond, or a water lily in the desert? See Teacher's Edition, p. 13 Extension #1,	Exploring with Wisconsin Fast Plants by Paul H. Williams, Coe M. Williams and Richard P. Green How to Think Like a Scientist: Answering Questions by the Scientific Method by Stephen P. Kramer How Fast Do Your Oysters Grow? by Norman Smith Science For Kids: 39 Easy Plant Biology Experiments by R. Wood Cesar Chavez by Ruth Franchere Pocketful of Goobers by Barbara Mitchell The Story of George Washington Carver by Eva Moore New Unesco Source Books for Science Teaching by Unesco

Unit: Experiments With Plants
Lesson 2: Identifying Variables and Planning a Fair Test

Objective	Indicator	Instruction/Assessment Reference	Resources
TLW learn more about the variables that affect plant growth. TLW begin to learn how to conduct experiments using these variables. TLW understand what constitutes a fair test. TLW use planning boards to design their experiments	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. 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.	1. Introduce basic activity where they can only change one thing at a time. 2. Explain "fair test" with example of a race. If people start at different beginnings, would that be fair?	How to Think Like a Scientist: Answering Questions by the Scientific Method by Stephen P. Kramer How Fast Do Your Oysters Grow? by Norman Smith Science For Kids: 39 Easy Plant Biology Experiments by R. Wood The Book of Think (Or How to Solve a Problem Twice Your Size) written by Marilyn Burns, illustrated by Martha Weston Bean and Plant by Christine Back and Barrie Watts Your First Garden Book by Marc Brown Plant by David Burnie Grow Lab: A Complete Guide to Gardening in the Classroom by E. Ranis and J. Hale 200 Illustrated Science Experiments for Children by Robert Brown

Unit: Experiments With Plants
Lesson 3: Outlining the Experimental Plan

Objective	Indicator	Instruction/Assessment Reference	Resources
In teams, TLW decide on a specific topic for their experiments Each team designs an experimental plan. TLW begin a record keeping journal.	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. 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. 6.5.2 Evaluate the precision and usefulness of data based on measurements taken.	Draw 4 sections (quads) on paper large enough that student can list in each one what they will be planting. 1 2  3 4 This enables teacher to walk around and see the "plan" to make sure it follows what is to be tested.	How to Think Like a Scientist: Answering Questions by the Scientific Method by Stephen P. Kramer How Fast Do Your Oysters Grow? by Norman Smith Science For Kids: 39 Easy Plant Biology Experiments by R. Wood The Book of Think (Or How to Solve a Problem Twice Your Size) written by Marilyn Burns, illustrated by Martha Weston Looking at Plants by David Suzuki An Apple Tree Through the Year by Claudia Schnieper Grow Lab: A Complete Guide to Gardening in the Classroom by E. Pranis and J. Hale In My Garden by Helen and Kelly Oechsli

GRADE 6 SCIENCE CURRICULUM GUIDE
UNIT REFERENCE

Unit: Experiments With Plants
Lesson 4: Planting the Seeds

Objective	Indicator	Instruction/Assessment Reference	Resources
TLW learn to plant. TL, experimenting with fertilizer and with overcrowding will begin manipulating their variables.	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.	Have at least one hour to get finished. Follow chart (plan). Step them through process.	From Flower to Flower by Patricia Lauber Corn Is Maize: The Gift of the Indians by Aliki Bean and Plant by Christine Back and Barrie Watts Plant by David Burnie Mysteries and Marvels of Plant Life by Barbara Cork Science Fun with Peanuts and Popcorn by Rose Wyler

Unit: Experiments With Plants
Lesson 5: Thinning and Transplanting

Objective	Indicator	Instruction/Assessment Reference	Resources
TLW learn why thinning and transplanting are sometimes necessary for the health of a plant. TLW gain practical experience and these with these two gardening techniques. TL experimenting with overcrowding will continue their manipulation of their variable by allowing their plants to remain overcrowded.	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. 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so.	Teacher's Edition, p. 54 Extension Activity	In My Garden by Helen Oechsli and Kelly Oechsli The Reason for a Flower by Ruth Heller Grow Lab: A Complete Guide to Gardening in the Classroom by E. Pranis and J. Hale Looking at Plants by David Suzuki How to Think Like a Scientist: Answering Questions by the Scientific Method by Stephen P. Kramer Science Fun with Peanuts and Popcorn by Rose Wyler How Fast Do Your Oysters Grow? by Norman Smith Science For Kids: 39 Easy Plant Biology Experiments by R. Wood

Unit: Experiments With Plants
Lesson 6: Getting a Handle on Your Bee

Objective	Indicator	Instruction/Assessment Reference	Resources
TLW learn about the anatomy of the honeybee and the Brassica flower through close observation with a magnifier and through reading. TL who will be pollinating will follow instructions to make a bee stick. TL who will not be pollinating, will gain exposure to pollination through reading; they also devise and construct pollination prevention barriers. TLW continue to keep daily records of their plants.	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*. *producer: an organism that can make its own food *consumer: an organism that feeds directly or indirectly on producers *predator: an organism that kills and eats other organisms *prey: an organism that is killed and eaten by a predator *parasite: an organism that feeds on other living organisms *host: an organism in which or on which another organism lives	Draw a picture of a bee. Then let them see their bee with magnifying lens. Compare drawing to a real bee. Teacher's Edition, p. 62 Extension #1	"How My Class Caught the "Bug" by Maria Palopoli and Philip Matsikas from Science and Children 5/95 How Fast Do Your Oysters Grow? by Norman Smith Science For Kids: 39 Easy Plant Biology Experiments by R. Wood Plants and Flowers by Brian Holley The Honeybee and the Robber by Eric Carle Life of the Honeybee by Andreas and Heiderose Fischer-Nagel From Flower to Flower by Patricia Lauber Bugs by Nancy Winslow Parker and Joan Richards Wright Joyful Noise: Poems for Two Voices by Paul Fleischman

Unit: Experiments With Plants
Lesson 7: Pollination and Interdependence

Objective	Indicator	Instruction/Assessment Reference	Resources
TLW learn more about pollination by using their bee sticks to carry it out. TLW experiment with pollination variable devises, and put into place barriers to prevent pollination TLW lean more about the interdependent relationship between bees and flowering plants.	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. 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*. *producer: an organism that can make its own food *consumer: an organism that feeds directly or indirectly on producers *predator: an organism that kills and eats other organisms *prey: an organism that is killed and eaten by a predator *parasite: an organism that feeds on other living organisms *host: an organism in which or on which another organism lives	Teacher's Edition, p.69 Extensions, #1 second box.	The Honeybee and the Robber: A Moving Picture Book Bean and Plant by Chrtistine Back and Barrie Watts The Forest by David Bellamy The Roadside by David Bellamy Mysteries and Marvels of Plant Life by Barbara Cork How the Forest Grew by William Jaspersohn Looking at Plants by David Suzuki Mysteries and Marvels of Plant Life by Barbara Cork

Unit: Experiments With Plants
Lesson 8: Harvesting and Threshing the Seeds

Objective	Indicator	Instruction/Assessment Reference	Resources
TLW observe that their plants have completed their life cycle, from seed to seed. TLW observe their plants in the last stage of their lives. TLW harvest and thresh their "crop" and collect their final data.	6.2.1 Find the mean* and median* of a set of data. 6.2.6 Read simple tables and graphs produced by others and describe in words what they show. 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so. *mean: the average obtained by adding the values and dividing by the number of values *median: the value that divides a set of data, written in order of size, into two equal parts	Teacher's Edition, p. 78, Extensions	An Apple Tree Through the Year by Claudia Schnieper Bean and Plant by Chrtistine Back and Barrie Watts The Forest by David Bellamy The Roadside by David Bellamy Mysteries and Marvels of Plant Life by Barbara Cork How the Forest Grew by William Jaspersohn Looking at Plants by David Suzuki Mysteries and Marvels of Plant Life by Barbara Cork

Unit: Experiments With Plants
Lesson 9: Organizing and Analyzing the Data From the Experiment: Part 1

Objective	Indicator	Instruction/Assessment Reference	Resources
TLW review their team's experiment as a whole. TLW begin to organize and analyze all of the data collected in their team's experiment. The team decides the best way to organize and communicate its findings.	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. 6.2.6 Read simple tables and graphs produced by others and describe in words what they show. 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so.	Teacher's Edition, p. 78 Extensions	How to Think Like A Scientist : Answering Questions by the Scientific Method by Stephen Kramer Science Fairs and Projects by National Science Teachers Association Science For Kids: 39 Easy Plant Biology Experiments by R. Wood Bean and Plant by Chrtistine Back and Barrie Watts The Forest by David Bellamy The Roadside by David Bellamy Mysteries and Marvels of Plant Life by Barbara Cork How the Forest Grew by William Jaspersohn Looking at Plants by David Suzuki

Unit: Experiments With Plants
Lesson 10: Organizing and Analyzing the Data From the Experiment Part: 2

Objective	Indicator	Instruction/Assessment Reference	Resources
TLW organize and analyze their team's data. TLW represent their team's data graphically. TLW draw conclusions from their data.	6.2.1 Find the mean* and median* of a set of data. 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, etc 6.2.6 Read simple tables and graphs produced by others and describe in words what they show. 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so. *mean: the average obtained by adding the values and dividing by the number of values *median: the value that divides a set of data, written in order of size, into two equal parts	Organizing data	How to Think Like a Scientist: Answering Questions by the Scientific Method by Stephen Kramer Science Fairs and Projects by National Science Teachers Association Science For Kids: 39 Easy Plant Biology Experiments by R. Wood Make It Graphic! Drawing Graphs for Science and Social Studies Projects by Eve and Albert Stwertka The Forest by David Bellamy The Roadside by David Bellamy Looking at Plants by David Suzuki Mysteries and Marvels of Plant Life by Barbara Cork

Unit: Experiments With Plants
Lesson 11: The Scientific Conference: Communication, The Experiment and its Results

Objective	Indicator	Instruction/Assessment Reference	Resources
TLW plan an event to communicate the results of their experiments. The class has fun and shares all they have experienced and learned together so far. The teacher evaluates student's accomplishments	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. 6.1.9 Explain how technologies can influence all living things. 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so.	Teacher's Edition, p. 89, Extensions Teacher's Edition, p. 89, Evaluation	How to Think Like A Scientist : Answering Questions by the Scientific Method by Stephen Kramer Science Fairs and Projects by National Science Teachers Association Science For Kids: 39 Easy Plant Biology Experiments by R. Wood Bean and Plant by Chrtistine Back and Barrie Watts "Copter Gun Explorations Toying With Inquiry" by John Park from Science Scope 4/92 "The Pasta Paradigm" by Jim Sconyers from Science Scope 1/97 "Put Science in a Bag" by Quincy Spurlin from Science and Children 1/95

Unit: Experiments With Plants
Lesson 12: Planning and Setting Up Germination Experiments

Objective	Indicator	Instruction/Assessment Reference	Resources
TLW review techniques and reinforce skills learned in planning experiments. TLW use these skills to set up a controlled experiment in seed germination. The teacher evaluates how well the students can plan and set up a controlled experiment.	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. 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so.	Teacher's Edition, p. 95 Extension and Evaluation	How Fast Do Your Oysters Grow? by Norman Smith Make It Graphic! Drawing Graphs for Science and Social Studies Projects by Eve Stwertka and Albert Stwertka Science For Kids: 39 Easy Plant Biology Experiments by R. Wood Looking at Plants by David Suzuki Mysteries and Marvels of Plant Life by Barbara Cork Plant by David Burnie The Reason for a Flower by Ruth Heller

Unit: Experiments With Plants
Lesson 13: What Did We Find Out About Tropisms In Wisconsin Fast Plants?

Objective	Indicator	Instruction/Assessment Reference	Resources
TLW gain further experience analyzing data and drawing conclusions from it. TLW learn more about germination.	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, etc 6.5.2 Evaluate the precision and usefulness of data based on measurements taken.	Teacher's Edition. p. 103 Final Activities and Evaluation	How Fast Do Your Oysters Grow? by Norman Smith Make It Graphic! Drawing Graphs for Science and Social Studies Projects by Eve Stwertka and Albert Stwertka Science For Kids: 39 Easy Plant Biology Experiments by R. Wood Looking at Plants by David Suzuki Mysteries and Marvels of Plant Life by Barbara Cork Plant by David Burnie The Reason for a Flower by Ruth Heller "How to Bend a Plant Out of Shape" by Garry Hardy and Marvin Tolman Science and Children 4/93

Unit: Experiments With Plants
Lesson 14: Two Tropism Experiments

Objective	Indicator	Instruction/Assessment Reference	Resources
TLW learn about tropisms in plants. TLW set up experiments involving geotropism and phototropism. TLW gain more experience in planning controlled experiments, taking measurements, and recording data. TLW use a protractor in a real situation.	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. 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.	Teacher's Edition, p. 109, Final Activities and Evaluations	Science For Kids: 39 Easy Plant Biology Experiments by R. Wood Grow Lab: A Complete Guide to Gardening in the Classroom by E. Pranis and J. Hale Plant by David Burnie Mysteries and Marvels of Plant Life by Barbara Cork Looking at Plants by David Suzuki "How to Bend a Plant Out of Shape" by Garry Hardy and Marvin Tolman Science and Children 4/93 "Garbage Grows Great Plants" by Alenander Brittain Science and Children 4/96

Unit: Experiments With Plants
Lesson 15: What Did We Find Out About Tropisms In Wisconsin Fast Plants?

Objective	Indicator	Instruction/Assessment Reference	Resources
TLW gain more experience analyzing data. TLW practice drawing conclusions based on data. TLW criticize the experimental plans and suggest improvements. The teacher evaluates the student's understandings of tropisms.	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. 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. 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, etc. 6.2.6 Read simple tables and graphs produced by others and describe in words what they show.	Teacher's Edition, p. 117, Final Activities, Extensions, and Evaluations	Science For Kids: 39 Easy Plant Biology Experiments by R. Wood Grow Lab: A Complete Guide to Gardening in the Classroom by E. Pranis and J. Hale Plant by David Burnie Mysteries and Marvels of Plant Life by Barbara Cork Looking at Plants by David Suzuki "How to Bend a Plant Out of Shape" by Garry Hardy and Marvin Tolman Science and Children 4/93 "Garbage Grows Great Plants" by Alenander Brittain Science and Children 4/96

Unit: Experiments With Plants
Lesson 15: What Did We Find Out About Tropisms In Wisconsin Fast Plants? (continued)

Objective	Indicator	Instruction/Assessment Reference	Resources
	6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so. 6.5.2 Evaluate the precision and usefulness of data based on measurements taken. 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.		

Unit: Magnets and Motors
Lesson 2: What Can Magnets Do?

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW learn several properties of and uses for magnets. TLW relay their ideas about magnets to the teacher.	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. *hypothesis: an informed guess or tentative explanation for which there is not yet much evidence	Teacher's Edition, pp. 12 - 14	Physics for Kids: 49 Easy Experiments With Electricity and Magnetism R. Wood My First Batteries & Magnets Book J. Challoner Magnetism R. Wood Bill Nye, the Science Guy: Time VHS #3077, 26 minutes

Unit: Magnets and Motors
Lesson 3: How Can You Find Out What Magnets Can Do?

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW learn to make and test their own hypotheses. TLW become proficient at classifying objects and organizing information. TLW observe the characteristics that distinguish a magnet from other magnetic materials.	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. 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. *hypothesis: an informed guess or tentative explanation for which there is not yet much evidence	Teacher's Edition, p. 18 -19	My First Batteries and Magnets Book J. Challoner Electricity and Magnetism R. Gardner

Unit: Magnets and Motors
Lesson 4: Measuring Magnets

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW begin to understand the concept of a controlled experiment, or a "fair test." TLW develop skill in manipulating materials. TLW become skillful in conducting an experiment in a systematic way. TLW learn one way of varying magnetic strength. TLW use graphs to communicate their results.	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. 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. 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, etc. *hypothesis: an informed guess or tentative explanation for which there is not yet much evidence	Teacher's Edition, p. 24	Magnetism A. Ward "The Magnetic Pendulum" A. Janulaw Science Scope November/December 1993 Physical Science Activities for Grades 2-8 M. Tolman and J. Morton 200 Illustrated Science Experiments for Children R. Brown

Unit: Magnets and Motors
Lesson 5: Building a Compass

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW learn about the historical significance of the magnetic compass and its present uses. TLW discover the characteristics of a magnetic compass. TLW develop proficiency in manipulating materials, following plans, and troubleshooting.	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.	Teacher's Edition, p. 30 - 31	The Compass P. Hogan Steven Carney's Invention Book S. Carney Energy A. Ward

Unit: Magnets and Motors
Lesson 6: Using a Compass: Which Way is Which?

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW learn more about the geographic usefulness of a compass. TLW investigate magnetic poles. TLW begin thinking about the ways in which magnets can be used to cause motion, as in a motor.		Teacher's Edition, p. 38 - 39	All About Animal Migrations J. Sanders Physics for Kids: 49 Easy Experiments with Electricity and Magnetism R. Wood Electricity and Magnetism R. Gardner

Unit: Magnets and Motors
Lesson 7: Creating Magnetism Through Electricity

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW express the ideas they have about electricity. TLW observe several characteristics of an electric current by experimenting with an electric circuit. TLW learn by experimentation that an electric current causes magnetism.	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. 6.3.23 Explain that electrical circuits* provide a means of transferring electrical energy from sources such as generators to devices in which heat, light, sound, and chemical changes are produced. *hypothesis: an informed guess or tentative explanation for which there is not yet much evidence *circuit: the complete path of an electric current	Teacher's Edition, p. 45	"Making Electricity With Fruit" M. Dispezio Science Scope September 1992 Electricity S. Parker Physical Science Activities for Grades 2-8 M. Tolman and J. Morton Janice VanCleave's Physics For Every Kid J. VanCleave Janice VanCleave's Magnets J. VanCleave Magnetism A. Ward Taking Charge - An Introduction to Electricity L. E. Schafer "Sparking Interest in Electricity" J. Hajda and L. Hajda Science Scope November/December 1994

Unit: Magnets and Motors
Lesson 8: Making Magnets with Electricity

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW learn that a coil of wire with electricity flowing through it has magnetic poles. TLW build an electromagnet and begin to formulate their own questions about how it works.	6.3.23 Explain that electrical circuits* provide a means of transferring electrical energy from sources such as generators to devices in which heat, light, sound, and chemical changes are produced. *circuit: the complete path of an electric current	Teacher's Edition, p. 50 - 51	Electricity and Magnetism R. Gardner "All Aboard! For a Lesson on Magnetic Levitated Trains" V. Moore and W. Kaszas Science and Children February 1995 Experimenting With Batteries, Bulbs and Wires A. Ward

Unit: Magnets and Motors
Lesson 9: Planning an Experiment to Test the Strength of an Electromagnet

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW develop an awareness of at least one historical figure in the field of electromagnetism – Joseph Henry. TLW identify several variables that they believe may have an effect on electromagnetic strength. TLW cooperatively design an experiment to test the effect that changing one variable has on electromagnetic strength.	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. 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. 6.3.23 Explain that electrical circuits* provide a means of transferring electrical energy from sources such as generators to devices in which heat, light, sound, and chemical changes are produced. *hypothesis: an informed guess or tentative explanation for which there is not yet much evidence *circuit: the complete path of an electric current	Teacher's Edition, p. 62 - 63	Triumph of Discovery: Women Scientists Who Won the Nobel Prize J. Dash Extraordinary Stories Behind the Invention of Ordinary Things D. Wulffson Be An Inventor B. Taylor Picture History of Great Inventors G. Clements Thomas Edison and Electricity S. Parker

Unit: Magnets and Motors
Lesson 10: Testing an Electromagnet

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW learn how to carry out the experiment that they planned in Lesson 9 TLW learn as part of a team.	6.3.23 Explain that electrical circuits* provide a means of transferring electrical energy from sources such as generators to devices in which heat, light, sound, and chemical changes are produced. *circuit: the complete path of an electric current	Teacher's Edition, p. 69	"Electromagnetic Attraction" J. Milson Science and Children September 1990 101 Physics Tricks T. Cash How to Think Like A Scientist S. Parker The Book of Think (Or How to Solve a Problem Twice Your Size) M. Burns and M. Weston

Unit: Magnets and Motors
Lesson 11: Showing Others What You Have Learned

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW graph the data they collected in Lesson 10. TLW discuss their experimental results. TLW learn how their experiment relates to the work of others.	6.2.6 Read simple tables and graphs produced by others and describe in words what they show.	Teacher's Edition, p. 74 - 75	Magnetism A. Ward Physics for Kids: 49 Easy Experiments with Electricity and Magnetism R. Wood How to Think Like A Scientist S. Parker

Unit: Magnets and Motors
Lesson 12: Making a Motor

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW learn how to use electromagnetism to make a compass rotate. TLW begin to understand how a motor functions. TLW express their ideas about how motors work.	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. 6.3.23 Explain that electrical circuits* provide a means of transferring electrical energy from sources such as generators to devices in which heat, light, sound, and chemical changes are produced. *circuit: the complete path of an electric current	Teacher's Edition, p. 79	Janice VanCleave's Machines J. VanCleave Weird Wheels A. Chinnian Humanpower: Cars, Planes R. Yepsen Boats With Muscles for Motors R. Yepsen Macmillian Book of How Things Work M. & M. Tolsom

Unit: Magnets and Motors
Lesson 13: Building a Spinning Coil Motor

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW build a working electric motor and investigate further how a motor works. TLW express their ideas about motors and their uses.	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. 6.3.23 Explain that electrical circuits* provide a means of transferring electrical energy from sources such as generators to devices in which heat, light, sound, and chemical changes are produced. *circuit: the complete path of an electric current	Teacher's Edition, p. 84 -85	101 Physics Tricks T. Cash Almost the Real Thing, Your High-Tech World G. Skurzynski Windmills, Bridges and Old Machines D. Weitzman

Unit: Magnets and Motors
Lesson 14: What is Inside an Electric Motor?

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW build a working electric motor and investigate further how a motor works. TLW express their ideas about motors and their uses.	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. 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. 6.3.23 Explain that electrical circuits* provide a means of transferring electrical energy from sources such as generators to devices in which heat, light, sound, and chemical changes are produced. *circuit: the complete path of an electric current	Teacher's Edition, p. 92 - 93	Boats, Ships, Submarines and Other Floating Machines I. Graham Machines J. VanCleave Moving Heavy Things J. Adkins Weird Wheels A. Chirinian

Unit: Magnets and Motors
Lesson 15: How Does a Motor Work?

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW explore different ways of changing how a motor functions. TLW learn how a motor works. TLW successfully reassemble the motor they took apart in Lesson 14.	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. 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. 6.3.23 Explain that electrical circuits* provide a means of transferring electrical energy from sources such as generators to devices in which heat, light, sound, and chemical changes are produced. *circuit: the complete path of an electric current	Teacher's Edition, p. 98	"Gizmos: Electronic Devices for Problem Solving" C. Engel and R. Smith Science Scope February 1995 101 Physics Tricks T. Cash Machines in the Home R. Weaver and R. Dale Physics for Every Kid J. VanCleave The Book of Think (Or How to Solve a Problem Twice Your Size) M. Burns and M. Weston

Unit: Magnets and Motors
Lesson 16: Generating Electricity

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW learn about the source of household electricity. TLW explore different ways to turn a generator. TLW learn about another connection between electricity and magnetism.	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.	Teacher's Edition, p. 102	Force and Motion P. Lafferty Cars, Bikes, Trains, and Other Land Machines I. Graham Cranes, Dump Trucks, Bulldozers and Other Building Machines T. Jennings Planes, Gliders, Helicopters and Other Flying Machines T. Jennings "Rube Goldberg Contraptions" J. Cox Science Scope January 1994

Unit: Measuring Time
Lesson 1: Before Clocks

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW brainstorm their ideas and questions about time. TLW investigate their sense of time by estimating the duration of one minute. TLW develop and interest and enthusiasm toward exploring and investigating time.	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. 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. 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. *hypothesis: an informed guess or tentative explanation for which there is not yet much evidence	To determine the length of one minute, have students stand up, and when they think one minute is up, they sit down. Discuss observations List an activity for them to do (jumping jacks, sit-ups) and have them count how many they can do in a minute. To bring it into the classroom element, have students get out their current spelling list. Have them write their spelling words three times each. See how many they can get done in _____ time. (Show not to close up shop early.)	Earthmaker's Tales: North American Indian Stories About Earth Happenings by Gretchen Will Mayo. In the Beginning: Creation Stories from Around the World by Virginia Hamilton Science in Ancient China and Science in Ancient Greece by George Beshore Thirteen Moons on Turtle's Back by J. Bruchac and J. London "Legends and Myths of the Sky" by Thea Canizo Science Scope, March 1994

Unit: Measuring Time
Lesson 2: Making a Record of a Shadow

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW observe that shadows cast by the sun can be used to measure and predict the passage of time during a day. TLW record the changes they observe by marking the position of shadows at various times throughout the day.	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. 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. *hypothesis: an informed guess or tentative explanation for which there is not yet much evidence	Demonstrate how to draw shadow changes on the sundial. Have students draw their own sundials.	The Timetables of Science by Alexander Hellemans and Bryan How to Think Like a Scientist by Stephen P. Kramer The Book of Think (How to Solve a Problem Twice Your Size) Written by Marilyn Burns, Illustrated by Martha Weston "Who's Eratosthenes and What's He Doing in My Science Class?" by Karl A. Matz from Science and Children, January 1996

Unit: Measuring Time
Lesson 3: Does the Sun Move

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW analyze their observations and use them to construct a graph. TLW simulate sun shadows. TLW record and discuss observations and questions about sun clocks.	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. 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, etc. 6.2.6 Read simple tables and graphs produced by others and describe in words what they show. *hypothesis: an informed guess or tentative explanation for which there is not yet much evidence	Student does demonstration with flashlight activity. Construct table and graph showing results from activity. Ask the students to investigate the gods in Greek and Roman mythology, particularly the sun god, Apollo.	Sundials: Their Theory and Construction by Albert Waugh The Great Sundial Cutout Book by Robert Adzeman and Mablen Jones Anno's Sundial by Mitsumasa Anno "Earth, Moon, and Stars" by Cary I. Sneider LHS GEMS "Sun Dance" from Through the Eyes of the Explorers AIMS "Eratosthenes, The Earth Measurer" from Historical Connections in Mathematics III AIMS

Unit: Measuring Time
Lesson 3: Does the Sun Move (continued)

Objective	Indicator	Instruction/Assessment Reference	Resource
	6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so. 6.5.2 Evaluate the precision and usefulness of data based on measurements taken. 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.		

Unit: Measuring Time
Lesson 4: Counting Days-Devising a Calendar

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW read about calendars used by other cultures. TLW design and construct their own calendars. TLW discuss different methods they have to measure time.	6.1.9 Explain how technologies can influence all living things.	Students research through technology different cultural calendars. Have students construct their own calendar (either a month–birthday with activities they like to do each day, or 15-year calendar to predict future).	Empires of Time: Calendars, Clocks, and Cultures by Anthony Aveni "America's Ancient Skywatchers" by John B. Carlson. National Geographic Magazine, March 1990. 76-107 Sun Journey: A Story of Zuni Pueblo by Ann Nolan Clark Science of the Early American Indians by B & H Tannenbaum First Civilizations: History of Everyday Things by G. Caselli

Unit: Measuring Time
Lesson 5: Predicting the Phases of the Moon

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW compile lists in their notebooks of things they know about the moon and questions they have about the moon. TLW record predictions about the sequence of the moon's phases on moon-phase cards. TLW observe the moon's phases.	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. 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. 6.3.6 Use models or drawings to explain that the phases of the moon are caused by the moon's orbit around the 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 the Earth, both during the day and night. *hypothesis: an informed guess or tentative explanation for which there is not yet much evidence	Ask students to create and illustrate their own myths to explain the waxing and waning of the moon. Teacher demonstrates phases of the moon. (mini-lesson). Student uses this information to put moon phase cards in order.	Earth Science for Every Kid by Janice VanCleave The Book of Think by Marilyn Burns and Martha Weston "The Moon in Daytime," Idea #145, from the Idea Bank Collation Volume 1 "Look to the Moon" by Gerald Wm. Foster from Science and Children November/December 1996 "Mooning in the Middle School" by C. Matthews, T. Campbell and J. Craig from Science Scope September 1995

Unit: Measuring Time
Lesson 6: Observing the Phases of the Moon

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW examine the moon-phase predictions they made in Lesson 5. TLW manipulate a three-dimensional model to simulate the phases of the moon. TLW discuss and refine their ideas about the cause of the moon's phases.	6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so. 6.3.6 Use models or drawings to explain that the phases of the moon are caused by the moon's orbit around the 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 the Earth, both during the day and night.	Field trip to the Planetarium Encourage students to do flipbook to show moon phases. (Teacher's Edition, p. 63)	"Ceiling to Floor Astronomy" by Linda Bull from Science Scope November/December 1995 Earth, Moon, and Stars by LHS GEMS "The Moon in Daytime," Idea #145 from the Idea Bank Collation Volume 1 "Mooning in the Middle School" by C. Matthews, T. Campbell and J. Craig from Science Scope September 1995 Countdown to the Moon by S. Englehart

Unit: Measuring Time
Lesson 7: Using Water to Measure Time

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW construct sinking water clocks. TLW identify the variables that have an effect on the time it takes their water clocks to sink. TLW read about water clocks used by early cultures.	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. 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. 6.2.1 Find the mean* and median* of a set of data. *hypothesis: an informed guess or tentative explanation for which there is not yet much evidence *mean: the average obtained by adding the values and dividing by the number of values *median: the value that divides a set of data, written in order of size, into two equal parts	Encourage students to design and/or build their own water clocks. Have students create advertisements to sell their clocks. Have them include three good reasons why they should buy them.	Clocks by Bernie Zubrowski Earth Science for Every Kid by Janice VanCleave Messing Around With Water Pumps and Siphons by Bernie Zubrowski "Archimedes, The Greek Streaker" Historical Connections in Mathematics Volume 1 AIMS Water Energy by G. Rickard

Unit: Measuring Time
Lesson 8: Planning an Experiment With Sinking Water Clocks

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW identify experimental variables affecting sinking water clocks. TLW plan an experiment controlling variables. TLW devise a data table to record their test data.	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. 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, etc. 6.2.6 Read simple tables and graphs produced by others and describe in words what they show.	Have students do analogies. A striking clock is to time as _____ is to _____. Ask students to determine the average in terms of median average.	Clocks: Building and Experimenting with Timepieces by Bernie Zubrowski Keeping Time: From the Beginning and Into the 21st Century by F. Branley Water Energy by G. Rickard Wonders of Energy by D. Adler Physics for Every Kid by Janice VanCleave Physics for Kids: 49 Easy Experiments with Mechanics by R. Wood

Unit: Measuring Time
Lesson 9: Experimenting with Sinking Water Clocks

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW conduct the experiments they planned in Lesson 8. TLW construct a graph to summarize their findings. TLW interpret and discuss their experimental results.	6.2.1 Find the mean* and median* of a set of data. 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, etc. 6.2.6 Read simple tables and graphs produced by others and describe in words what they show. 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so. 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. *mean: the average obtained by adding the values and dividing by the number of values *median: the value that divides a set of data, written in order of size, into two equal parts	Ask the students to write a letter describing the group's experiment. (Teacher's Edition, p. 90) Have students design their own clocks for specific amount of time (lunchtime, recess, specific amount of time – 3 minute timer.	The Inventive Process by Deanna Klein Mistakes that Worked by C. F. Jones Random House Book of How Things Were Built by D. Brown First Civilizations: History of Everyday Things by Giovani Caselli Extraordinary Stories Behind the Invention of Ordinary Things by D. Wuffson

Unit: Measuring Time
Lesson 10: Investigating Pendulums

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW identify characteristics of pendulums. TLW plan an experiment to investigate how changing one variable affects the frequency of a pendulum.	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. 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. *hypothesis: an informed guess or tentative explanation for which there is not yet much evidence	Teacher's Edition, p. 101, Activity #1 Teacher's Edition, p. 101, Activity #2 Teacher's Edition, p. 101 Activity #3 (box and whisker – coordinate with math)	"The Magnetic Pendulum - Drawing Students to the Science of Swing" by Al Janulaw from Science Scope, November/December 1993 The Inventive Process by Deanna Klein "Galileo - Father of the Scientific Method" from Historical Connections in Mathematics Vol. II AIMS

Unit: Measuring Time
Lesson 10: Investigating Pendulums (continued)

Objective	Indicator	Instruction/Assessment Reference	Resource
	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.		

Unit: Measuring Time
Lesson 11: Experimenting With Pendulums

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW conduct the experiment they planned in Lesson 10. TLW record their findings and construct individual graphs. TLW explain their investigations to other students.	6.2.1 Find the mean* and median* of a set of data. 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, etc. 6.2.6 Read simple tables and graphs produced by others and describe in words what they show. 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so. 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. *mean: the average obtained by adding the values and dividing by the number of values *median: the value that divides a set of data, written in order of size, into two equal parts	Teacher's Edition, p. 112, Activity #1	"Foucault's Pendulum Demonstration," Idea #222, from Idea Bank Collation, A Handbook for Science Teachers, Volume 1

Unit: Measuring Time
Lesson 12: Comparing Results

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW investigate the effect of a second variable on the frequency of a pendulum. TLW discover that frequency of a pendulum is not affected significantly by changes in mass or starting angle but is affected by changes in length. TLW investigate the effect of a second variable on the frequency of a pendulum. TLW discover that frequency of a pendulum is not affected significantly by changes in mass or starting angle but is affected by changes in length.	6.2.1 Find the mean* and median* of a set of data. 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, etc. 6.2.6 Read simple tables and graphs produced by others and describe in words what they show. 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so. 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. *mean: the average obtained by adding the values and dividing by the number of values *median: the value that divides a set of data, written in order of size, into two equal parts	Teacher's Edition, p. 112, Final Activity #1 Teacher's Edition, p. 117, Final Activity #3	The Inventive Process by Deanna Klein Strange and Amazing Worlds by Celeste Ediciones Discovery and Inventions by Geoff Endacott ISBN 84-75553-28-1 Making Things Move by Neil Ardley

Unit: Measuring Time
Lesson 13: Constructing a Clock Escapement

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW build a working model of an escapement. TLW become familiar with how an escapement works. TLW build a working model of an escapement. TLW become familiar with how an escapement works.	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.	Teacher's Edition, p. 128, Final Activities #1, and #2	The Book of Think (Or How to Solve a Problem Twice Your Size) by Marilyn Burns, illustrated by Martha Weston Timekeeping by R. Dale Random House Book of How Things Work by S. Parker

Unit: Measuring Time
Lesson 14: Adjusting the Clock Escapement

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW brainstorm how to improve the operation of a clock escapement. TLW apply practical problem-solving skills to figure out how to make the clock escapement work. TLW discuss the results of their troubleshooting strategies.	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.	Teacher's Edition, p. 128, Activities #1 and #2	Clocks by Bernie Zumbrowski "Benjamin Banneker - Self-Taught Genius" Historical Connections Vol. 2 AIMS "A Clockmaker's Challenge" Historical Connections Vol. 2 AIMS Story of the Wheel by T. Healey

Unit: Measuring Time
Lesson 15: Calibrating the Clock

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW identify variables that affect the length of time that the clock escapement will operate. TLW engage in a practical challenge to invent ways to maximize the running time of the clock escapement.	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.	Teacher's Edition, p. 128, Activities #1 and #2	Clocks by Bernie Zumbrowski Wheels at Work by Bernie Zumbrowski Spiderwebs to Skyscrapers by D. Darling How to Travel Through Time by J. Deem Owl Service by A. Garner (time travel) Disappearing Bike Shop by E. Woodruff (time travel)

Unit: Measuring Time
Lesson 16: Building a One-Minute Timer

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW use the records in their notebooks to help them plan a one-minute timer. TLW construct a device to measure a one-minute interval of time.	6.5.2 Evaluate the precision and usefulness of data based on measurements taken.	Teacher's Edition, p. 148, Extension #1, #2, and/or #3	Clocks by Bernie Zumbrowski Machines by Janice Van Cleave Keeping Time: From the Beginning and Into the 21st Century by F. Branley

Unit: Technology of Paper
Lesson 1: Thinking About Paper

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW prepare their science notebooks. TLW record individually and discuss as a group what they already know about paper. TLW collect a variety of paper samples and observe and describe their properties.	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. 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. *hypothesis: an informed guess or tentative explanation for which there is not yet much evidence	Have students write an essay describing what they think their life would be like without paper. Field trip Recycling Sorting station Teacher's Edition, p. 24, Extensions #2 and #4	Making Paper by Sarah Allen How is Paper Made? by Issac Asimov Paper Projects for Creative Kids of All Ages by Jim Bottomly The Secret Life of School Supplies by Vicki Cobb Wood and Paper by Jacqueline Dineen Paper, Paper, Everywhere by Gail Gibbons Paper by Andrew Langley Papermaking by Susie O'Reilly The History of Printmaking by Clare Romano and John Ross Paper by Elizabeth Simpson Smith Bookworks: Making Books by Hand by Gwyneth Swain

Unit: Technology of Paper
Lesson 2: Taking A Close Look At Paper

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW discuss what is meant by product quality, why they think measuring quality may be important, how the quality of products is compared, and what they think they could discover from comparing the quality of the six papers they are investigating. TLW identify the variable being tested and the variables that need to be controlled in the tear-resistance test. TLW conduct the tear-resistance test on the six paper samples. TLW share and discuss their test results and create a set of class results based on an average of the test trails. TLW predict how tear-resistant a sample of paper from a grocery bag would be compared with the six papers tested, test a grocery-bag sample, and discuss the results.	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. 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. 6.2.1 Find the mean* and median* of a set of data. 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more that one good way to do so. 6.5.2 Evaluate the precision and usefulness of data based on measurements taken.	Teacher's Edition, p. 35, Extensions #2 and #3	Making Paper by Sarah Allen How is Paper Made? by Issac Asimov The Amazing Paper Book by Paulette Bougeois The Secret Life of School Supplies by Vicki Cobb Paper Through the Ages by S. Cosner About Paper by Anabel Dean Wood and Paper by Jacqueline Dineen The Papermakers by Leonard Everett Fisher Paper, Paper, Everywhere by Gail Gibbons Paper by Andrew Langley From Wood to Paper by Ali Mitgutsch

Unit: Technology of Paper
Lesson 2: Taking A Close Look At Paper (continued)

Objective	Indicator	Instruction/Assessment Reference	Resource
	*hypothesis: an informed guess or tentative explanation for which there is not yet much evidence *mean: the average obtained by adding the values and dividing by the number of values *median: the value that divides a set of data, written in order of size, into two equal parts		Papermaking by Susie O'Reilly The History of Printmaking by Clare Romano and John Ross Paper by Elizabeth Simpson Smith Bookworks: Making Books by Hand by Gwyneth Swain

Unit: Technology of Paper
Lesson 3: Investigating The Properties of Paper: Part One

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW discuss what is meant by product quality, why they think measuring quality may be important, how the quality of products is compared, and what they think they could discover from comparing the quality of the six papers they are investigating. TLW identify the variable being tested and the variables that need to be controlled in the tear-resistance test. TLW conduct the tear-resistance test on the six paper samples. TLW share and discuss their test results and create a set of class results based on an average of the test trails. TLW predict how tear-resistant a sample of paper from a grocery bag would be compared with the six papers tested, test a grocery-bag sample, and discuss the results.	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. 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. 6.2.1 Find the mean* and median* of a set of data. 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more that one good way to do so. 6.5.2 Evaluate the precision and usefulness of data based on measurements taken. *hypothesis: an informed guess or tentative explanation for which there is not yet much evidence *mean: the average obtained by adding the values and dividing by the number of values *median: the value that divides a set of data, written in order of size, into two equal parts	Teacher's Edition, p. 54, Extensions #1 through #6	Making Paper by Sarah Allen How is Paper Made? by Issac Asimov The Amazing Paper Book by Paulette Bougeois The Secret Life of School Supplies by Vicki Cobb Paper Through the Ages by S. Cosner About Paper by Anabel Dean Wood and Paper by Jacqueline Dineen The Papermakers by Leonard Everett Fisher Paper,Paper, Everywhere by Gail Gibbons Paper by Andrew Langley From Wood to Paper by Ali Mitgutsch **Papermaking by Susie O'Reilly**

Unit: Technology of Paper
Lesson 4: Investigating The Properties Of Paper: Part Two

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW design a process to test the smoothness of paper, identify the test's variables, conduct the test, and rate the six paper samples from least to most smooth. TLW compare the processes of the class smoothness test and the tear-resistance test . TLW record their observations and results on a test-results table and predict how they think each paper sample will perform in a specific test. TLW, working in pairs, conduct tests to assess opacity, water absorbency, and ink absorbency.	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. 6.2.5 Organize information in simple tables and graphs and identify relationships they reveal. Use tables and graphs a examples of evidence for explanations when writing essays or writing about lab work, fieldwork, etc. 6.2.6 Read simple tables and graphs produced by others and describe in words what they show. 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so. 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.	Teacher's Edition, p. 66, Extension #3, Curling of Paper Teacher's Edition, p. 66, Extension #4, Making a Mobius Strip	The World Record Paper Airplane Book by Ken Blackburn and Jeff Lammers How is Paper Made? by Issac Asimov The Amazing Paper Book by Paulette Bougeois Book by Karen Brookfield The Secret Life of School Supplies by Vicki Cobb Paper Through the Ages by S. Cosner About Paper by Anabel Dean Wood and Paper by Jacqueline Dineen The Papermakers by Leonard Everett Fisher Paper, Paper, Everywhere by Gail Gibbons Paper by Andrew Langley

Unit: Technology of Paper
Lesson 4: Investigating The Properties Of Paper: Part Two (continued)

Objective	Indicator	Instruction/Assessment Reference	Resource
	6.5.2 Evaluate the precision and usefulness of data based on measurements taken. 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. *hypothesis: an informed guess or tentative explanation for which there is not yet much evidence		Paper by Kids by Arnold E. Grummer From Wood to Paper by Ali Mitgutsch Papermaking by Susie O'Reilly

Unit: Technology of Paper
Lesson 5: Reviewing The Test Results

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW share and discuss their test results from Lesson 4. TLW create a class set of test results that consolidates the results of all the groups. TLW write a performance summary for one of the six papers, focusing on whether or not all the test results are consistent with the paper's intended use. TLW read about the variety of writing surfaces used through history, the invention of paper, and how the use of paper spread throughout 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. 6.2.1 Find the mean* and median* of a set of data. 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so. 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. 6.5.2 Evaluate the precision and usefulness of data based on measurements taken.	Teacher's Edition, p. 80, Draw Timeline (horizontal) Research different people and report to class. Teacher's Edition, p. 81, #4	How is Paper Made? by Issac Asimov The Amazing Paper Book by Paulette Bougeois Book by Karen Brookfield Paper Through the Ages by S. Cosner About Paper by Anabel Dean Wood and Paper by Jacqueline Dineen The Papermakers by Leonard Everett Fisher Paper, Paper, Everywhere by Gail Gibbons Paper by Andrew Langley Paper Mills and a Nation's Capital by Linda Hetzer The Paper Book and Paper Maker by Shar Levine

Unit: Technology of Paper
Lesson 5: Reviewing The Test Results (continued)

Objective	Indicator	Instruction/Assessment Reference	Resource
	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. *mean: the average obtained by adding the values and dividing by the number of values *median: the value that divides a set of data, written in order of size, into two equal parts		From Wood to Paper by Ali Mitgutsch Papermaking by Susie O'Reilly Paper by Elizabeth Simpson Smith

Unit: Technology of Paper
Lesson 6: Recycling Paper By Hand

Objective	Indicator	Instruction/Assessment Reference	Resource
On the basis of the Class Paper-Property Tests - Results Table and the students' paper-performance summaries, TLW discuss which of the six paper types might break up most easily in water. TLW make pulp with toilet tissue and water, compare their pulp with their classmates', and identify the variables that affect the characteristics of pulp. TLW recycle toilet tissue by hand and discuss the variables involved in the recycling process that might affect the recycled paper. TLW write about their experience of making paper by hand.	6.2.1 Find the mean* and median* of a set of data. 6.2.5 Organize information in simple tables and graphs and identify relationships they reveal. Use tables and graphs a examples of evidence for explanations when writing essays or writing about lab work, fieldwork, etc. 6.2.6 Read simple tables and graphs produced by others and describe in words what they show. 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so. 6.3.19Investigate that materials may be composed of parts that are too small to be seen without magnification. *mean: the average obtained by adding the values and dividing by the number of values *median: the value that divides a set of data, written in order of size, into two equal parts	Video, How Paper is Made, VHS #3277, 20 minutes, before making paper. Teacher's Edition, p. 100, Extension #4. Challenge to find out about toilet paper (past – present)	Where Does Our Garbage Go? by Joan Bowden About Paper by Anabel Dean Wood and Paper by Jacqueline Dineen 50 Simple Things Kids Can Do to Recycle by Earthworks Group Going Green by John Ellington and Julia Hailes, Douglas Hill and Joel Makover How on Earth Do We Recycle Paper? by Helen Jill Fletcher and Seli Groves Paper by Andrew Langley The Paper Book and Paper Maker by Shar Levine Likeable Recyclables by Linda Schmartz Zillions, Consumer Reports for Kids by Consumer Reports Garbage into Gold by The Video Project

Unit: Technology of Paper
Lesson 7: Examining Our First Piece Of Recycled Paper

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW brainstorm and record the variables involved in the recycling process. TLW observe their recycled sheets of paper. Working as a class, TLW link the variables of the recycling process to their possible effects on the paper that is produced. TLW test the properties of their recycled tissue and compare them with those of the original tissue. TLW record the ways the recycled and original tissue are alike and different.	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. 6.2.5 Organize information in simple tables and graphs and identify relationships they reveal. Use tables and graphs a examples of evidence for explanations when writing essays or writing about lab work, fieldwork, etc. 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so. 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.	Devise a rubric for student self-assessment.	Where Does Our Garbage Go? by Joan Bowden About Paper by Anabel Dean Wood and Paper by Jacqueline Dineen 50 Simple Things Kids Can Do to Recycle by Earthworks Group Going Green by John Ellington and Julia Hailes, Douglas Hill and Joel Makover How on Earth Do We Recycle Paper? by Helen Jill Fletcher and Seli Groves Paper by Andrew Langley The Paper Book and Paper Maker by Shar Levine Likeable Recyclables by Linda Schmartz Zillions, Consumer Reports for Kids by Consumer Reports Garbage into Gold by The Video Project

Unit: Technology of Paper
Lesson 7: Examining Our First Piece Of Recycled Paper (continued)

Objective	Indicator	Instruction/Assessment Reference	Resource
	6.5.2 Evaluate the precision and usefulness of data based on measurements taken. 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. *hypothesis: an informed guess or tentative explanation for which there is not yet much evidence		

Unit: Technology of Paper
Lesson 8: Investigating Variables In Our Recycling Process

Objective	Indicator	Instruction/Assessment Reference	Resource
Working as a class, TLW decide how to standardize three variables: How much toilet tissue to recycle, how long to shake the pulp, and how vigorously to shake it. Working in pairs, TLW choose a variable to test and predict its effect on their recycled paper. TLW observe their recycled paper and compare their predictions with the final product. Working in groups, TLW discuss how varying the amount of toilet tissue or pulp shaking time affected the final product. TLW reflect on what they have learned through a self-assessment and a review of brainstorm lists from Lesson 1.	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. 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. 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so. 6.5.2 Evaluate the precision and usefulness of data based on measurements taken. *hypothesis: an informed guess or tentative explanation for which there is not yet much evidence	Teacher's Edition, p. 122, Extension #3 Student researches, builds, and tests their own mold and deckle. Extension #5 Write poem, etc. on recycled paper.	Making Paper by Sarah Allen About Paper by Anabel Dean Wood and Paper by Jacqueline Dineen 50 Simple Things Kids Can Do to Recycle by Earthworks Group Going Green by John Ellington and Julia Hailes, Douglas Hill and Joel Makover How on Earth Do We Recycle Paper? by Helen Jill Fletcher and Seli Groves Paper by Andrew Langley The Paper Book and Paper Maker by Shar Levine Likeable Recyclables by Linda Schmartz Zillions, Consumer Reports for Kids by Consumer Reports Garbage into Gold by The Video Project

Unit: Technology of Paper
Lesson 9: Recycling Different Kinds of Paper

Objective	Indicator	Instruction/Assessment Reference	Resource
Working as a class, TLW compare their recycling process with that used in modern industrial papermaking. TLW discuss the properties that may affect the pulping of newsprint, copy paper, notebook paper, magazine paper, and paper towel. TLW brainstorm ways to pulp the papers that do not break up as easily in water as the toilet tissue. Working in pairs, TLW finish their pulp preparation and recycle. TLW, in groups, discuss the methods they used to pulp the paper type they recycled.	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. 6.5.2 Evaluate the precision and usefulness of data based on measurements taken.	Do similar activities from previous lessons.	Making Paper by Sarah Allen About Paper by Anabel Dean Wood and Paper by Jacqueline Dineen 50 Simple Things Kids Can Do to Recycle by Earthworks Group Going Green by John Ellington and Julia Hailes, Douglas Hill and Joel Makover How on Earth Do We Recycle Paper? by Helen Jill Fletcher and Seli Groves Paper by Andrew Langley The Paper Book and Paper Maker by Shar Levine Likeable Recyclables by Linda Schmartz Zillions, Consumer Reports for Kids by Consumer Reports Garbage into Gold by The Video Project

Unit: Technology of Paper
Lesson 10: Experimenting With Our Paper-Recycling Process

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW observe their piece of recycled paper from Lesson 8 and compare it with the original paper and the recycled toilet tissue. TLW explore variations of the class recycling process by selecting variables to change, predicting their effects and deciding which papers they will use as their fiber source. TLW read about newspaper recycling. TLW volunteer to devise a procedure for using a cleaning agent to clean and deink recycled paper in the classroom.	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, etc.	Teacher's Edition, p. 141, #6 Use iron to flatten and dry sample. Use blender to process paper. Draw own sequence of recycling paper after reading selection.	Making Paper by Sarah Allen About Paper by Anabel Dean Wood and Paper by Jacqueline Dineen 50 Simple Things Kids Can Do to Recycle by Earthworks Group Going Green by John Ellington and Julia Hailes, Douglas Hill and Joel Makover How on Earth Do We Recycle Paper? by Helen Jill Fletcher and Seli Groves Paper by Andrew Langley The Paper Book and Paper Maker by Shar Levine Likeable Recyclables by Linda Schmartz Zillions, Consumer Reports for Kids by Consumer Reports Garbage into Gold by The Video Project

Unit: Technology of Paper
Lesson 11: Exploring Additives

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW discuss how they think paper is made into different products. TLW brainstorm the variables that need to be controlled in order to investigate how additives affect the properties of recycled paper. TLW recycle tissue using talc, food coloring, or gelatin as an additive. TLW observe and compare the papers with additives (the test, or experimental, papers) with those that do not contain additives (the control papers) and apply paper-property tests when appropriate. TLW discuss how additives affected their recycled paper.	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. 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so. 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. *hypothesis: an informed guess or tentative explanation for which there is not yet much evidence	Start a recycling program at school. Teacher's Edition, p. 154, Extension Activities, #5	How is Paper Made? by Issac Asimov The World Record Paper Airplane Book by Ken Blackburn and Jeff Lammers Book by Karen Brookfield Paper Science Toys by Richard E. Churchill This is a Newspaper by Lawrence H. Feigenbaum Paperworks: Colorful Crafts from Picture Eggs to Fish Kites by Virginie Fowler Paper by Kids by Arnold E. Grummer Paper Crafts by Linda Hetzer Pop-Up Paper Engineering : Cross Curricular Activities in Design Engineering Technology by Paul Johnson Unraveling Fibers by Patricia Keeler

Unit: Technology of Paper
Lesson 12: Recycling Different Papers With Additives

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW share results from Lesson 11 and discuss how each additive affected the recycled papers. Working in pairs, TLW develop a recycling plan to test the use of additives with magazine paper, newspaper, copy paper, notebook paper, or paper towel. TLW share their recycling plans, their predicted results, and the reasoning behind their predictions.	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. 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so. 6.5.2 Evaluate the precision and usefulness of data based on measurements taken. *hypothesis: an informed guess or tentative explanation for which there is not yet much evidence	Teacher's Edition , p. 161, Extensions Go to Simplicity Pattern Company in Niles.	Where Does Our Garbage Go? by Joan Bowden Paper Through the Ages by S. Cosner Book by Karen Brookfield Paper Through the Ages by S. Cosner 50 Simple Things Kids Can Do to Recycle by Earthworks Group Going Green by John Ellington, Julia Hailes, Douglas Hill and Joel Makover How on Earth Do We Recycle Paper? by Jill Helen Fletcher and Seli Groves Likable Recyclable by Linda Schmartz Unraveling Fibers by Patricia Keeler

Unit: Technology of Paper
Lesson 13: Implementing Our Design Plan

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW implement and evaluate the recycling plan they designed in Lesson 12. TLW observe their recycled papers and compare them with the control sheets, applying paper-property tests when applicable. TLW record their thoughts about the ways the additives affected the properties of their recycled paper. TLW discuss the possible uses of the paper they created and what they know now about additives and recycling that they did not know before.	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. 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, etc. 6.2.6 Read simple tables and graphs produced by others and describe in words what they show. 6.5.2 Evaluate the precision and usefulness of data based on measurements taken. *hypothesis: an informed guess or tentative explanation for which there is not yet much evidence	Teacher's Edition, p. 167, Extension Activities #2	Where Does Our Garbage Go? by Joan Bowden Paper Through the Ages by S. Cosner Book by Karen Brookfield Paper Through the Ages by S. Cosner 50 Simple Things Kids Can Do to Recycle by Earthworks Group Going Green by John Ellington, Julia Hailes, Douglas Hill and Joel Makover How on Earth Do We Recycle Paper? by Jill Helen Fletcher and Seli Groves Likable Recyclable by Linda Schmartz Unraveling Fibers by Patricia Keeler

Unit: Technology of Paper
Lesson 14: Paper Variations: Embedding And Embossing

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW show how to vary the paper they make through the processes of embedding and embossing. Working in pairs, TLW make two recycled sheets of paper using the techniques of embedding and embossing. TLW discuss the variables in the hand-papermaking process that affect whether or not objects can be embedded in the paper. TLW discuss the variables in the hand-papermaking process that affect whether or not the paper can be embossed. TLW evaluate the results of embossing paper and embedding objects in it.	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. 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, etc. 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so. 6.5.2 Evaluate the precision and usefulness of data based on measurements taken. *hypothesis: an informed guess or tentative explanation for which there is not yet much evidence	Teacher's Edition, p. 175, Extension Activities (stenciling, pulp painting, laminating, and three dimensional casting)	Paper Mills and a Nation's Capital by Robert E. Harrigan The Story of Money by Carolyn Kain The History of Printmaking by Clare Romano and John Ross

Unit: Technology of Paper
Lesson 15: Researching and Planning Our Design

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW evaluate greeting cards, postcards, and stationery to determine what properties make them successful. TLW brainstorm constraints that affect the design of their product (greeting cards, postcards, or stationery). TLW develop requirements for their recycled-paper products. TLW generate ideas for a design proposal and discuss whether they meet their product requirements. TLW write a design proposal, organize their materials, and plan the step-by-step process they will use to produce their recycled-paper product.	6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so. 6.5.2 Evaluate the precision and usefulness of data based on measurements taken.	Teacher's Edition, p. 191, Final Activities and Extensions (design greeting cards, post cards, and stationery)	Paper Mills and a Nation's Capital by Robert E. Harrigan The Story of Money by Carolyn Kain The History of Printmaking by Clare Romano and John Ross

Unit: Technology of Paper
Lesson 16: Implementing Our Design Plan

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW make their recycled-paper product using the plan they developed in Lesson 15. TLW evaluate their design plan as they implement it. On the basis of the requirements outlined on **Record Sheet 15-A,** TLW discuss suitable ways to measure the quality of their product. TLW reflect on their experiences by writing a journal entry in their science notebooks.	6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so. 6.5.2 Evaluate the precision and usefulness of data based on measurements taken.	Teacher's Edition, p. 200, Final Activities Teacher's Edition, p. 201, Extensions	Paper Projects for Creative Kids of All Ages by Jim Bottomly Paper by Kids by Arnold E. Grummer Paper Crafts by Linda Hetzer Pop-Up Paper Engineering: Cross Curricular Activities in Design Engineering Technology by Paul Johnson Paper Sculpture by John Lancaster Paper Magic: Creating Fantasies and Performing Tricks with Paper by Ormond McGill Usborne Big Book of Papercraft by A. Smith Bookworks: Making Books by Hand by Gwyneth Swain Classic Origami by P. D. Tuyen Great Newspaper Crafts by Virginia F. Walter

Unit: Technology of Paper
Lesson 17: Evaluating Our Product And Presenting Our Results

Objective	Indicator	Instruction/Assessment Reference	Resource
TLW share their ideas about how to test and evaluate their products. TLW test their products in at least two ways. TLW write a final evaluation of their paper product and share it with the class.	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. 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so. 6.5.2 Evaluate the precision and usefulness of data based on measurements taken. 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.	Teacher's Edition, p. 210, Final Activities Teacher's Edition, p. 211, Extensions	Paper Projects for Creative Kids of All Ages by Jim Bottomly Paper by Kids by Arnold E. Grummer Paper Crafts by Linda Hetzer Pop-Up Paper Engineering: Cross Curricular Activities in Design Engineering Technology by Paul Johnson Paper Sculpture by John Lancaster Paper Magic: Creating Fantasies and Performing Tricks with Paper by Ormond McGill Usborne Big Book of Papercraft by A. Smith Bookworks: Making Books by Hand by Gwyneth Swain Classic Origami by P. D. Tuyea Great Newspaper Crafts by Virginia F. Walter

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