CALVERT™ PUBLICATIONS

5th grade

SCIENCE

SCIENCE 501
CELLS

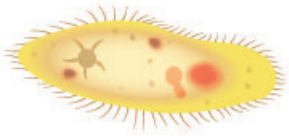
Viewing Cells

The only way to view most cells is to use a microscope. There are different types of microscopes. An *optical microscope* is the one you will normally see and use. It can magnify a cell up to about 2,000 times so that we can easily see the basic parts of the cell. However, some cells are too small to be seen by an optical microscope. For these, an *electron microscope* is needed. An electron microscope can magnify a cell by one million times! These electron microscopes not only allow us to see the smallest of cells, they also allow us to view the tiny subparts of cells. (We will cover some of these subparts of cells in Section 2.)

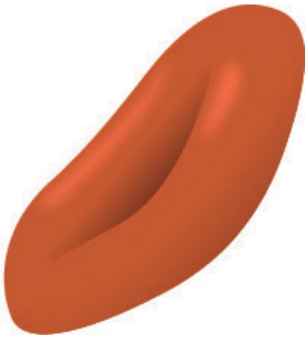
It is also helpful to use dyes to view cells. The dyes stain certain parts of the cell—such as the cell membrane and the nucleus—so that they stand out more clearly when we view the cells under a microscope. (You will use iodine as a dye in some of the experiments.)

| Optical microscope

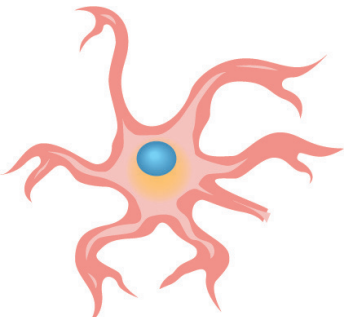
| Muscle cells



| Paramecium

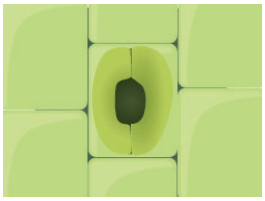


| Red blood cell



| Nerve cell

| Diatom

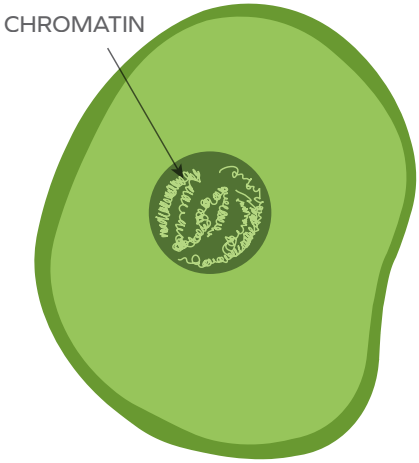


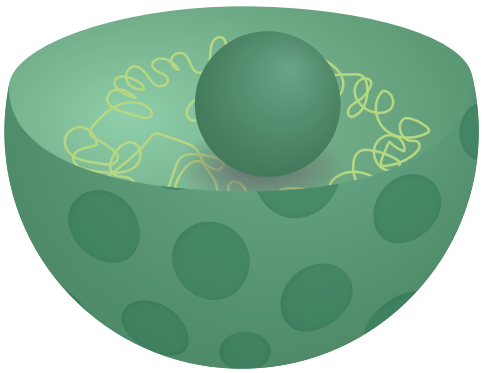
| Leaf pore guard cell

The *chromatin* (the material of the chromosomes) within the nucleus is made up of **DnA** (***Deoxyribonucleic Acid***), **RnA** (***Ribonucleic Acid***), and other proteins. You have probably heard of DNA. DNAs are very large, complex molecules that look like a "twisted ladder" (called a "*double helix*" shape). DNA contains **genes**. The genes are like "recipes" for making specific types of proteins in the cells. The DNA and genes contain the molecular information to make the cells and the groups of cells within a living thing what it is to be. For example, the DNA in your body determines the color of your hair and eyes. Your DNA is specific to you. The DNA is what makes the offspring of a living thing resemble the parent. DNA is what makes a dog produce another dog rather than a fish.

DNA in living things is designed to produce other living things similar to them.

The third part of a nucleus is the *nucleolus*. The nucleolus looks almost like a little "nucleus" within the nucleus! It is very condensed chromatin that contains mainly *RNA* (*Ribonucleic Acid*) and other proteins. RNA is similar to DNA and plays an important role in making the proteins within cells.





| The nucleolus inside the nucleus.

| The "Double Helix".

501.B ONION CELLS

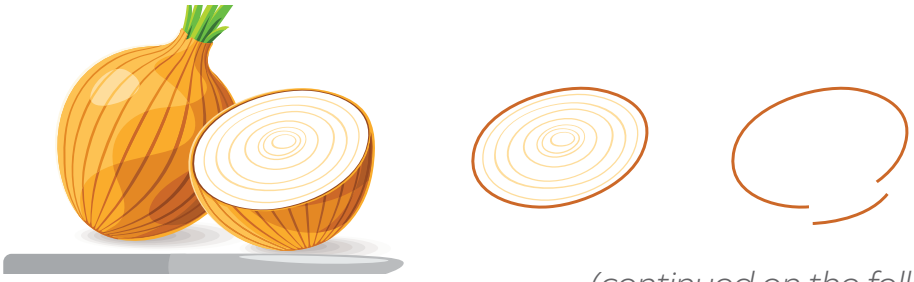
Overview. You will use an optical microscope to observe cells of an onion bulb. **NOTE:** You may cry during this experiment! (The gases from an onion can make your eyes burn and water.)

These supplies are needed:

optical microscope
diluted iodine solution (Lugol's iodine solution)
slide
knife
slide cover
eyedropper (pipet) or toothpick
tweezers (forceps)
onion bulb

Directions. Follows these directions carefully. Place a check mark in the box as you complete each step in these directions.

- ☐ 1. Cut the onion bulb in half widthwise with the knife.
- ☐ 2. Cut a slice from one of the halves.
- ☐ 3. Pull off the outer ring and cut off a small section of the ring.
- ☐ 4. On the inside of the small section of the ring that you just cut off, you will find a very thin layer (or skin) of material. Take the tweezers and carefully pull off this layer from the small section.
- ☐ 5. Place the thin layer of onion on the slide.
- ☐ 6. Use the small eyedropper or a toothpick to place a small drop of diluted iodine solution on the onion layer while it is on the slide. (**NOTE:** This will stain parts of the cells and make them easier to view in the microscope.)
- ☐ 7. Place the slide cover over the stained onion cells.
- ☐ 8. Adjust the microscope settings until you can see the onion cells clearly. (**NOTE:** If you have trouble adjusting the microscope to view the slide, have your teacher assist you.)



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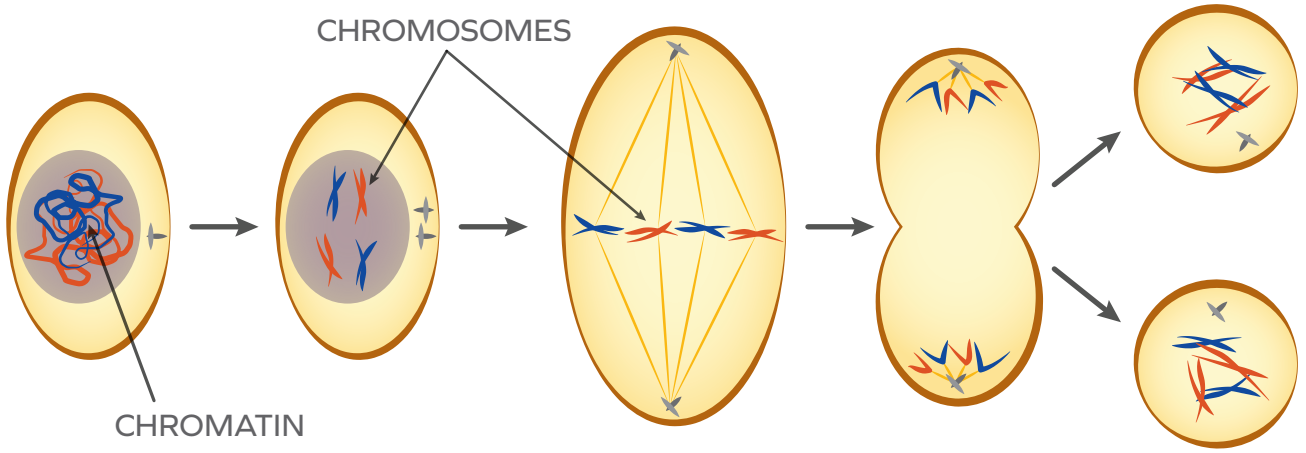
Cell Reproduction

Introduction. All living things begin as one cell. Some living things always remain as one cell (unicellular). However, for all living things that are multicellular, new cells must be produced from the original single cell. In addition, as some cells in multicellular living things die or are damaged, they have to be replaced. New cells must be produced. In addition, one generation of living things produces another generation. This also means that new cells must be produced. This process of producing new cells is called *cell* ***reproduction***. We will now discuss several ways for cell reproduction to occur in living things.

Mitosis. One of the most common ways that cells reproduce is called **mitosis**. It occurs in eukaryote cells only; that is, cells that have a cell membrane, cytoplasm, and a nucleus. Mitosis is the process of one cell splitting apart to form two new cells. This "splitting apart" of the cell is known as *cell division*. Mitosis brings about cell division and two new cells from one original cell.

Mitosis starts when the chromatin within the cell begins to rearrange and condense into orderly strands called *chromosomes*. The chromosomes then move into pairs. After that, the chromosome pairs begin to pull apart from each other. Eventually, the chromosome pairs split apart.

When they split apart, cell division occurs. Then there are two new cells instead of the original single cell. The two new cells are smaller than the original cell. However, because the DNA of the two new cells is the same as the original cell, the two new cells will be like the original cell,



| Mitosis

SCIENCE 502
PLANTS: LIFE CYCLES

KINGDOM	CELL TYPE	FOOD	EXAMPLES
Animals	multicellular	obtain from outside sources	worms, insects, birds, fish, mammals
Plants	multicellular	produce their own	moss, trees, flowering plants
Fungi	unicellular or multicellular	obtain from outside sources	mushrooms, **yeast**, mold
Protists	unicellular or multicellular	produce their own and obtain from outside sources	protozoa, paramecium, green **algae**, red algae
Monerans	unicellular or multicellular	engulfed from outside sources	bacteria, blue-green algae

Table 1 | Classifying Living Things

In this unit, we will examine some similarities and differences among various types of plants, fungi, protists, and monerans. We will especially focus on plants. In the next unit, we will focus on animals.

In this section, we will explore the kinds of plants, the structure of plants, and explain what is meant by the *life cycle* of living things.

Write the answers on the lines.

1.1 _____ of life are important in the lifetime any living thing.

1.2 Scientists classify all living things into five _____ .

1.3 The five _____ of all living things are:

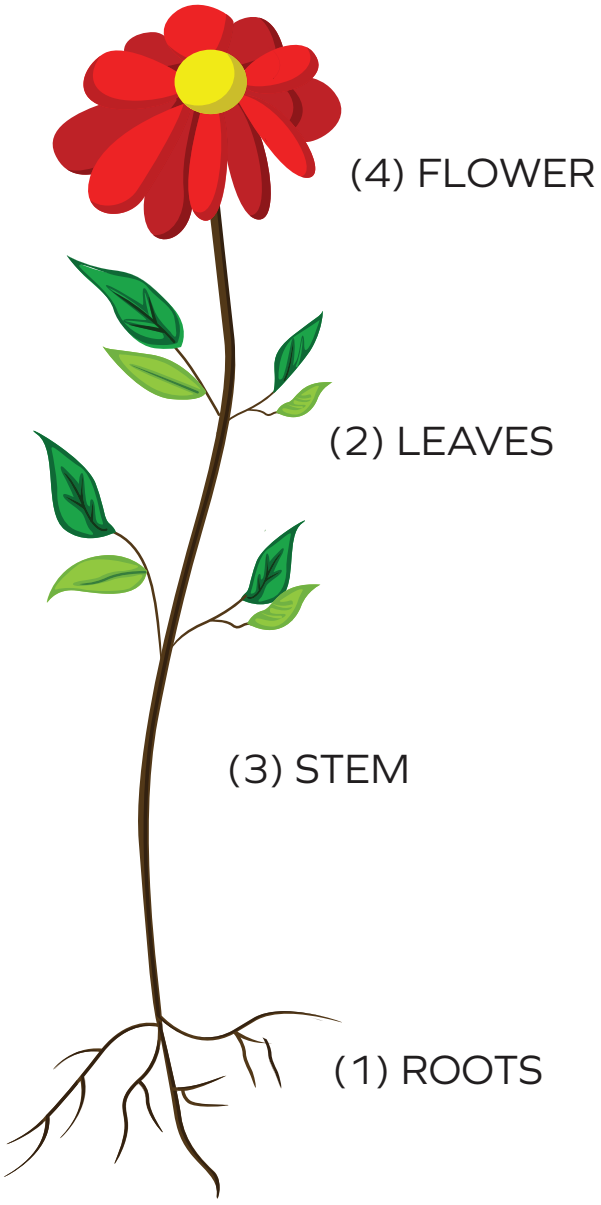
a. _____ b. _____

c. _____ d. _____

e. _____

potatoes, also have storage tissues in the roots to help store food for the plant. Finally, the support tissues help support the plant and keep it stable.

Plants also have different *parts*. Flowering plants, the most common type of plants, have four main parts: 1) roots, 2) leaves, 3) stems, and 4) flowers. The roots , stems, and leaves are called the **vegetative** parts of a plant. The flowers, fruits, and seeds are known as the reproductive parts of the plant. We will learn more about the reproductive parts of flowering plants in Section 2.



| Four parts of a flowering plant

Life Cycles

All living things go through *life stages*. For example, they all have a beginning life stage and an ending life stage. Most living things also have a growth stage and a stage for **adulthood**. All of these stages for a living thing are called a *life cycle*. Similarity in life cycles is also one way we can classify or categorize living things. Many types of plants have similar life cycles. Some plants also have a similar life cycle to types of fungi and protists. Therefore, in this unit, we will focus on similarities in life cycles among various types of plants, fungi, and protists.

The stages of life are important in the life cycle of any living thing. For example, consider the life cycle of a typical corn plant. The four stages of the life cycle of a corn plant are 1) beginning, 2) growth, 3) adulthood, and 4) death — or end. The beginning stage of a corn plant starts when a new seed is made. After the seed is planted and receives proper nourishment of water and minerals, it enters the growth stage. The seed begins to develop into a mature plant. The mature plant occurs when the plant reaches adulthood and begins to produce ears of corn and many new seeds. Finally, the last stage is when the corn plant comes to an end and dies. These four stages in the lifetime of a corn plant are the life cycle of the corn plant.

Flowering Plants

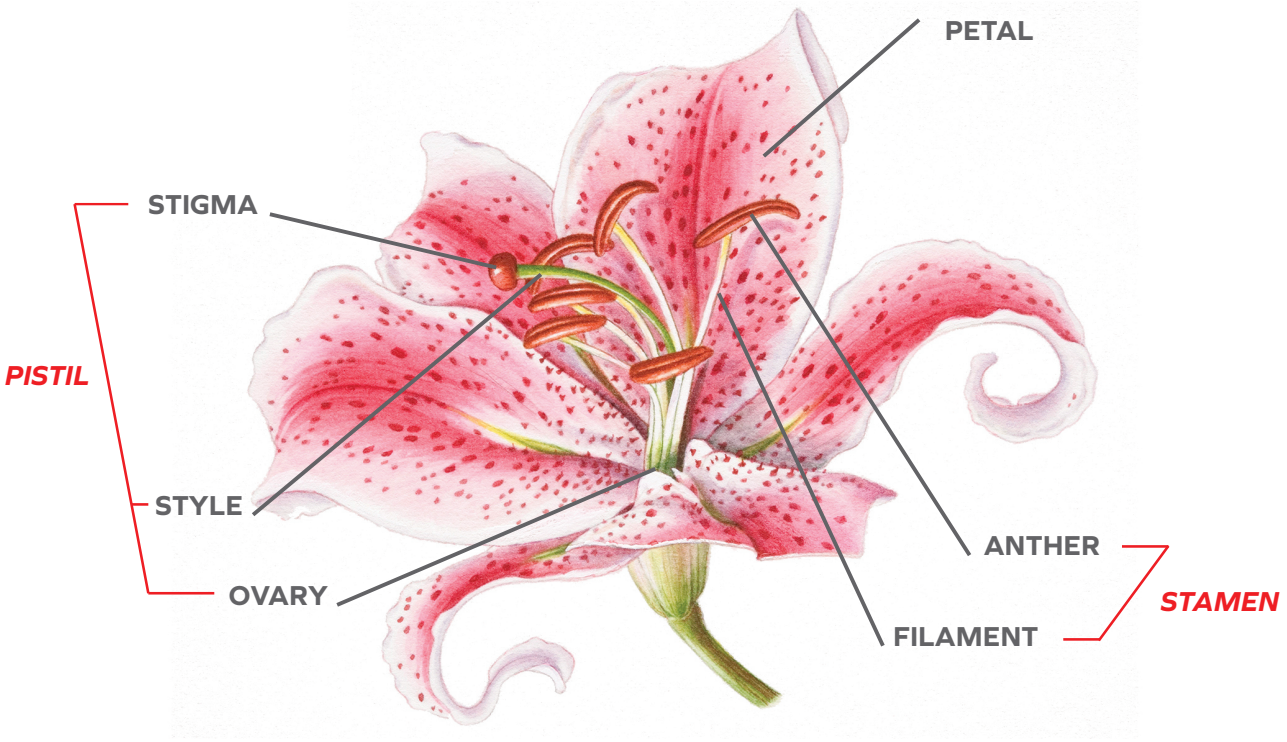
Flowering plants are the most common type of seed-bearing plants. They make up about 90 percent of the more than 260,000 kinds of plants! Flowering plants are also called **angiosperms**. This name comes from two Greek words meaning "enclosed seed." All plants that produce flowers and fruits are called angiosperms.

Since flowering plants are the most common type of plants, you have probably seen many kinds of flowering plants. For example, wild flowers, garden plants, and most trees are flowering plants. In fact, most of the plants that produce the fruits, grains, and vegetables that you and your family eat are flowering plants.

Many flowering plants are grown for their flowers. Tulips, roses, pansies, and lilacs are examples. They are beautiful when their flowers appear, and they also smell very good. What is a flower? Are flowers from one plant similar in structure to flowers from another plant? Do flowers of different plants perform similar functions? The answers to these questions are not as easy as they might seem to be. They can be understood by looking at some flowers carefully.

| Tulips

The male parts of the flower are contained in the **stamen**. The stamen consists of two important parts: the **filament** and the **anther**. The filament grows out of the center section of the flower, and the anther is located at the end of the filament. Pollen is made and stored in the anther. Each grain of pollen holds a sperm cell. The process of reproduction can occur when pollen from the anther (a male part) travels to the stigma (a female part).



| Male and female parts of a flower

Activity 502.C Labeling Two Flowers

2.16 Select two different types of flowers from two different types of flowering plants. On a separate sheet of paper, draw each of the flowers. Label the parts you can see. (You can use the drawing from the cross-section of a flower above to help you identify the parts that you can see.)

Teacher check:

Initials _____ Date _____

3.22

DAILY OBSERVATION CHART

	COLOR	AMOUNT OF MOLD	LOCATION OF MOLD ON BREAD
Day 1			
Day 2			
Day 3			
Day 4			
Day 5			

- ☐ 9. Return the bread to the jar, replace the lid, and store the bread for another day.
- ☐ 10. Remove the bread from the jar on the next day and examine it with a microscope or dissection scope. Record your observations in the "Daily Observation Chart" for the next day.
- ☐ 11. Repeat steps 7-10 for five days. You may check off the boxes below after you have completed the observation and recording for each day.

❑ Day 2 ❑ Day 3 ❑ Day 4 ❑ Day 5

3.23 After 5 days, explain the parts of the life cycle you observed.

_____

_____

_____

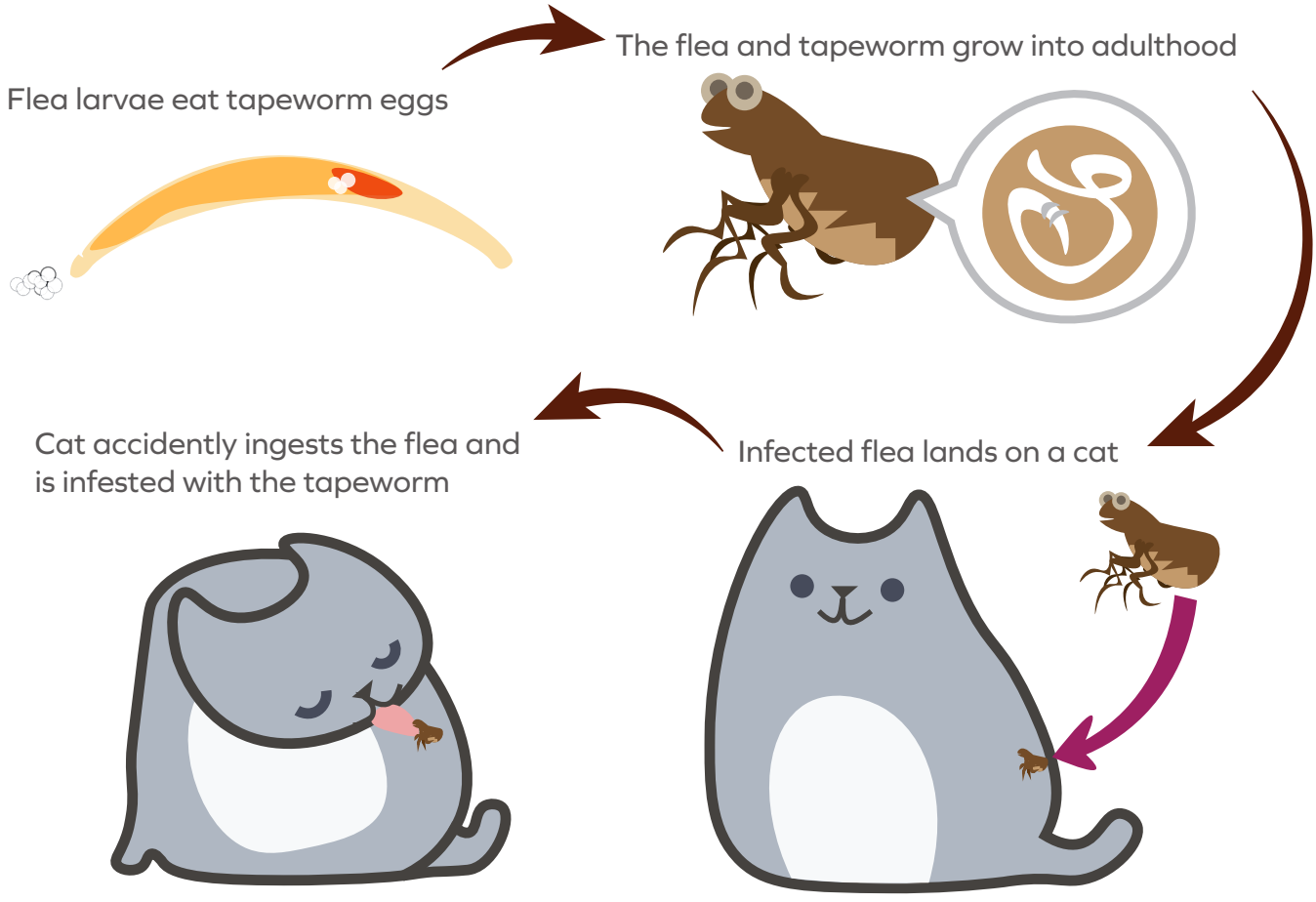
SCIENCE 503
ANIMALS: LIFE CYCLES

Worms. Worms are animals that have soft, slender bodies and no backbone or legs. There are thousands of different kinds of worms. The largest worms are several feet long, and the smallest ones cannot be seen without a microscope.

Worms have no outside covers or bones to give them protection. Since worms have no protective structures, they live in places that are safer for them. Most of their lives are spent under the ground, in water, or inside other animals.

The larvae of some insects sometimes look like worms, but they are not really worms. There are big differences in the life cycles of real worms and the larvae of insects. Larvae will change into adult insects sometime during the life cycle. The adult insects no longer look like worms. Worms will stay worms all their lives. The adult worms can reproduce. Insect larvae cannot reproduce.

The most commonly known worm is the earthworm. **Flukes**, flatworms, roundworms, tapeworms, and leeches are other types of worms. Most of these worms have similar types of life cycles. However, some life cycles of worms cannot be completed unless the worms are located in the right place. The need for the right place to live is especially important to worms who live in other animals. These worms that live in other animals are known as **parasites**. The animal where the parasite lives is called the **host**.



Complete this crossword puzzle.

1.57

Across

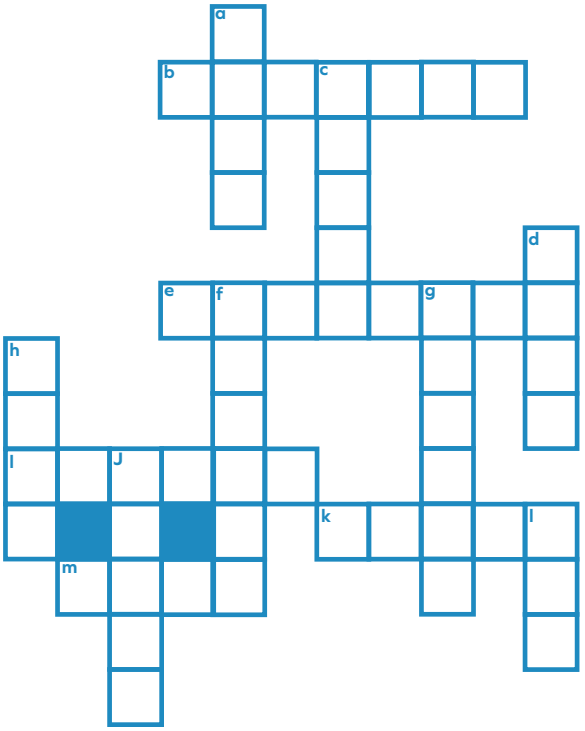
b. A group of soft-bodied animals. Most have shells.

e. An animal that lives on or in other animals.

i. The part of the male animal that produces sperm.

k. All animal species have a life _____ .

m. The form some insects go through during which there is not much movement.



Down

a. A long, thin, soft-bodied animal.

c. The form some insects go through when they look like worms.

d. The unit of life for all living things.

f. A simple, single-celled protozoan.

g. The housefly and crickets are members of this animal group.

h. What some animals do so that the sperm will reach the egg.

j. A mollusk without a hard, outer shell.

l. The female produces this in her ovaries.

Review the material in this section to prepare for the Self Test. The Self Test will check your understanding of this section. Any items you miss on this test will show you what areas you will need to restudy in order to prepare for the unit test.

EXPERIMENT 503.B
EXAMINING A CHICKEN EGG

You will use a magnifying glass to observe some details of a chicken egg. You may also need to do some additional research at the library or on the Internet to answer some questions about parts of the chicken egg.

These supplies are needed:

chicken egg
small dish
magnifying glass
dropper (pipet)
paper towel
food coloring

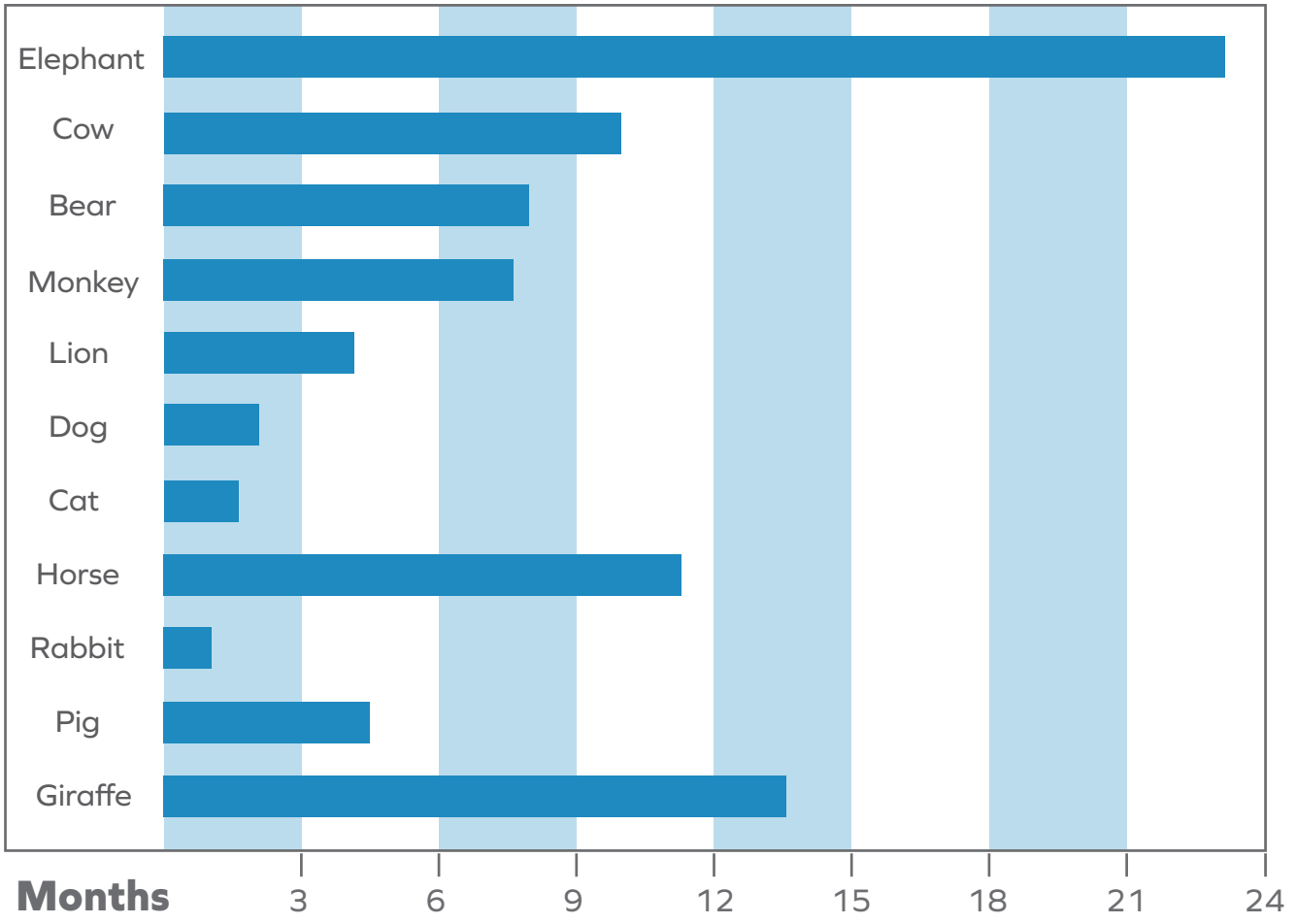
Follow these directions. Check the box at the left of each step when it is completed.

- ☐ 1. Use the magnifying glass to look at the eggshell. Record what you see in 2.26.
- ☐ 2. Use the dropper to put some food coloring on the eggshell. Wipe the shell dry with the tissue. Record what you see in 2.27.
- ☐ 3. Gently crack the egg on one end. Remove a piece of the shell. Record what you see in 2.28.
- ☐ 4. Crack the egg open. Put the contents within the eggshell in the dish. Record what you see in 2.29.

2.26 Record the eggshell observation in this circle.

(Continued on next page)

Gestation Chart



| Length of time for development before birth

2.45

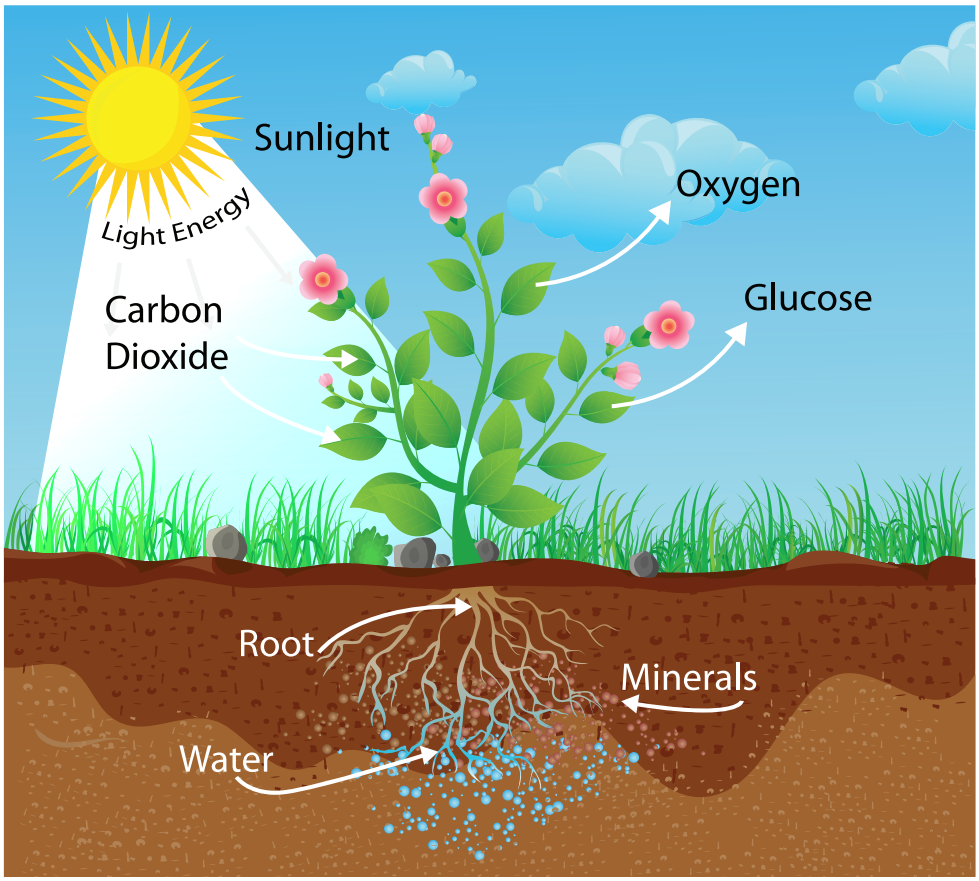
Write a report.

Use the library or the Internet to help you write a report about the mammal you chose to study. Include information about its life cycle. Tell how it feeds, protects, and trains its young.

Teacher check:

Initials _____ Date _____

SCIENCE 504
BALANCE IN NATURE



| Photosynthesis

Carbon cycle. There is another "cycle" in the physical environment that helps support living things and the balance of nature. Green plants use energy from the sun to convert carbon dioxide and water into food and oxygen. As you learned in Science 501, this process is called *photosynthesis*. Plants and animals, in turn, "burn" food by combining it with the oxygen produced by photosynthesis to release energy for growth. Photosynthetic organisms like algae also release oxygen. In fact, most of the world's oxygen is produced by a type of algae that floats on ocean waters. Carbon dioxide and water are given off during photosynthesis,, which is called *respiration*. Respiration is the reverse of photosynthesis. Plants then use the carbon dioxide produced by respiration to produce more oxygen. Thus, there is a cycle of carbon dioxide and oxygen being used and produced by plants and animals. This cycle is called the *carbon cycle*. The oxygen and carbon dioxide produced in the carbon cycle are part of the physical environment that supports life.

The balance of nature also depends on this carbon cycle of oxygen and carbon dioxide. For example, consider what would happen in a small pond if all the plants died. If the plants died, there would not be any more oxygen produced by the plants for the water. Soon, the fish and other microscopic organisms would not have enough oxygen to survive. Other animals that feed on the fish and the microscopic organisms in the pond would not have adequate food supplies, and they, too, would die. The balance of nature would be upset by the death of the plants, and, eventually, the other living things would die. The web of life would be broken.

Write the correct letter and answer in the blank.

1.28 The complex level of organization within nature is called a(n) _____ .

a. physical environment b. ecosystem c. chemical cycle

1.29 A living thing that makes its own food is called a _____ .

a. producer b. consumer c. decomposer

1.30 Some _____ are both primary consumers and secondary consumers.

a. sheep b. bacteria c. birds

1.31 A primary consumer can _____ .

a. digest green plants b. make its own food c. decompose animals

1.32 An example of a producer is _____ .

a. a grasshopper b. a pine tree c. a mushroom

Complete this activity.

1.33 Fill in this chart. Each of the organisms can be put in one or more groups. Put a check mark in the column of the ecological name or names where you think it belongs. You may use library or Internet resources to help you.

ORGANISM	PRODUCER	PRIMARY CONSUMER	SECONDARY CONSUMER	DECOMPOSER
chicken				
lettuce				
tiger				
monkey				
cow				
mouse				
mushroom				
bull snake				
silverfish				
salmon				

Teacher check:

Initials _____ Date _____

EXPERIMENT 504 BUILD A TERRARIUM

Overview: A terrarium is the name for a plastic or glass container in which small land animals and/or plants are kept. The container is usually covered to prevent the loss of moisture. The terrarium is really a model of a natural life system or ecosystem.

In this experiment, you will build a terrarium if conditions permit. You will be gathering examples of living things from a certain place. These living things will be placed inside the terrarium container so you may observe them. You will record your observations over a period of time. Hopefully, you will be able to see how living things depend on each other.

If you are having winter now, you may have difficulty finding an adequate number of living things to establish your terrarium. Three ways to solve this problem are suggested:

1. Use an aquarium as an example of a life system. Do the activities suggested.
2. Ask a friend, parent, or teacher about where you could look for plant or animal life. A hobby store or pet shop may also be of help. If your problem is solved, build the terrarium by following the directions in this experiment.
3. Wait until spring to do this experiment.

After you have discussed your ideas on this experiment, write your plans here and share them with your teacher or parent. _____

_____

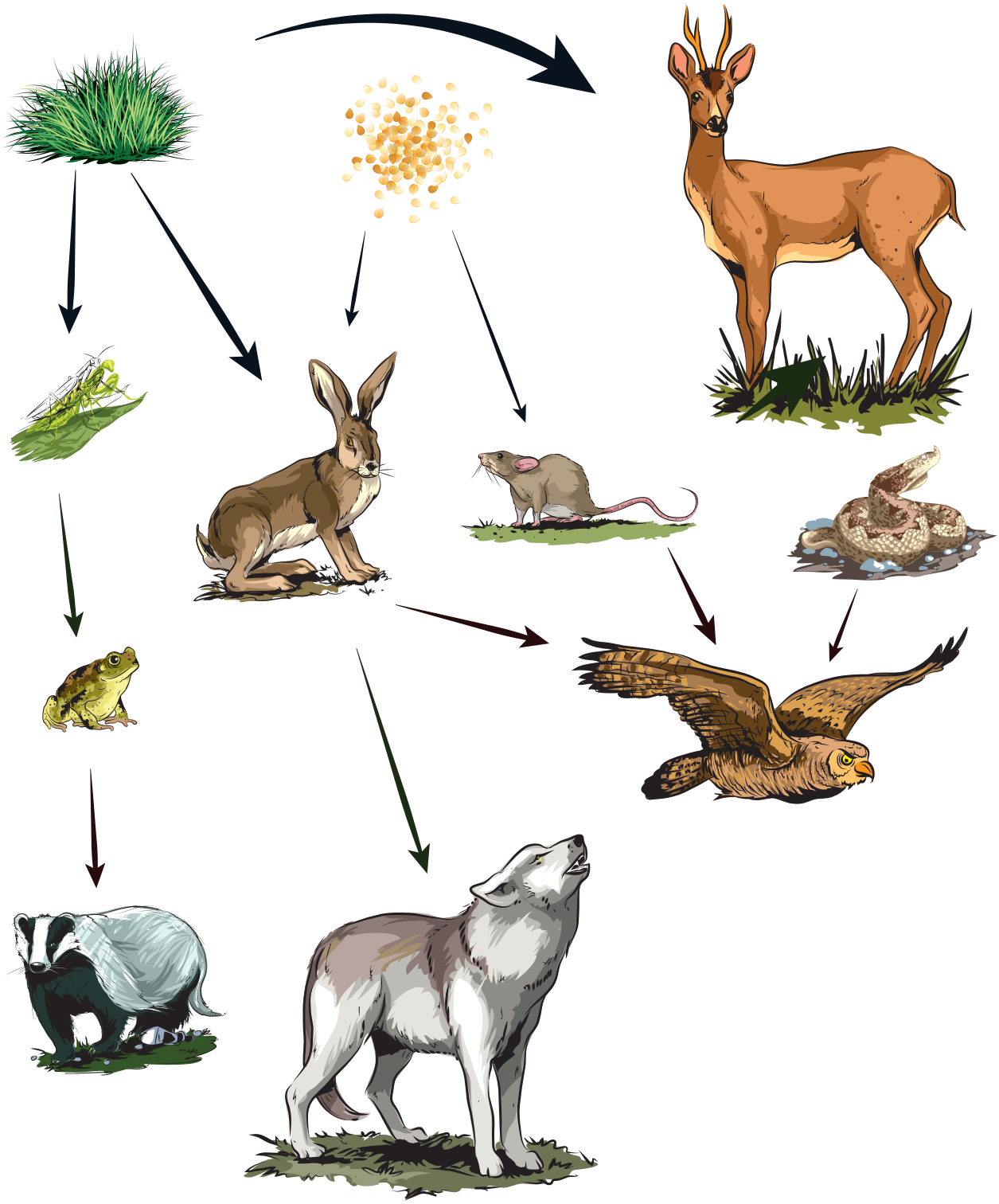
_____

_____

These supplies are needed:

Large container (glass or clear plastic)—at least 2-liter capacity container
cover or lid; or use a terrarium
pebbles, fine gravel
several cans or small jars
small sprinkling can
something to punch holes in lid
potting soil and peat moss
bottle cap
sand
small shovel
water

Food web. When several food chains on the prairie are brought together, they appear interconnected like a web. Therefore, we call it a *food web*. An example of a food web on the prairie is shown by the illustration below.



SCIENCE 505
TRANSFORMATION OF ENERGY

Remember:
resting at greater height = more potential energy
resting at less height = less potential energy
falling from greater height = more kinetic energy
falling from lesser height = less kinetic energy

Write the correct words in the blank spaces.

1.1 Whenever anything moves or grows, _____ is used.

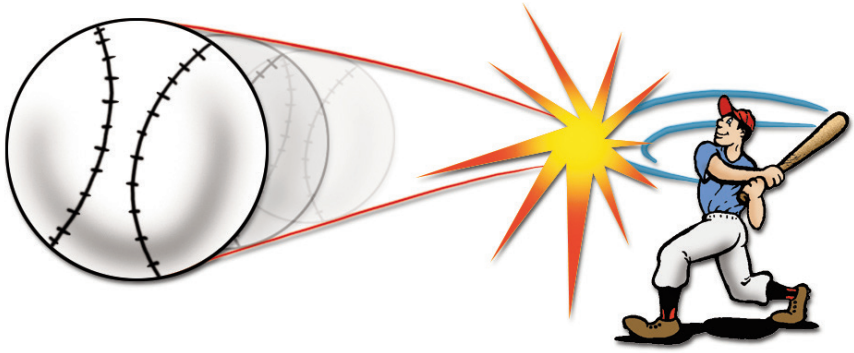
1.2 Energy is the a. _____ to do b. _____ .

1.3 Energy that is stored is called _____ energy.

1.4 Energy that is moving is called _____ energy.

Label these pictures. Use the words *potential energy* and *kinetic energy* to label the pictures.

1.5 _____



1.6 _____

The chemical energy stored in the coal can be transformed into heat energy and other forms of energy when the coal is burned. In fact, coal is burned in many power plants to produce electricity. The chemical energy in coal is eventually transformed into electrical energy.

Oil products are thought to come from the remains of tiny organisms and animal bodies. These remains eventually fell to the sea floor. The pressure of sand and mud caused oil to be formed over a long period of time. Natural gas was often formed along with the oil deposits. Since the animals and organisms got energy from plants, which got energy from the sun, oil has received its stored energy from the sun, too.

The chemical energy stored in oil is used in many ways today. One of the most important uses is to make gasoline, which powers our automobiles. The stored chemical energy in gasoline is used to make heat energy, which is changed into mechanical energy. Work is done from the chemical energy stored in oil.

Chemical energy is constantly being made from light energy and is being stored in plants. Trees may be replaced and new ones grown to take the place of the ones we use. However, coal and gas take a very long time to be formed. The chemical energy of coal and gas is being used up at a great rate by the people who live on earth today. Since the coal and gas take too long to be formed, these sources of chemical energy *cannot* be **renewed**. Therefore, our supply of chemical energy in coal and gas is limited and will no longer be available someday.

| Coal and gas are limited and someday will no longer be available.

Look It Up! Coal and oil deposits are not found everywhere in the world. These sources of chemical energy can only be found in certain locations. Use an atlas, encyclopedia, library books, or the Internet to help you answer these questions about coal and oil deposits.

2.30 Where are the largest coal deposits in the world? (Name at least two countries.)

Stewardship and energy. People have a responsibility to take care of the earth. One way to care for the earth is to be responsible stewards of all things that are part of the earth. Energy should be included in our stewardship of the earth.

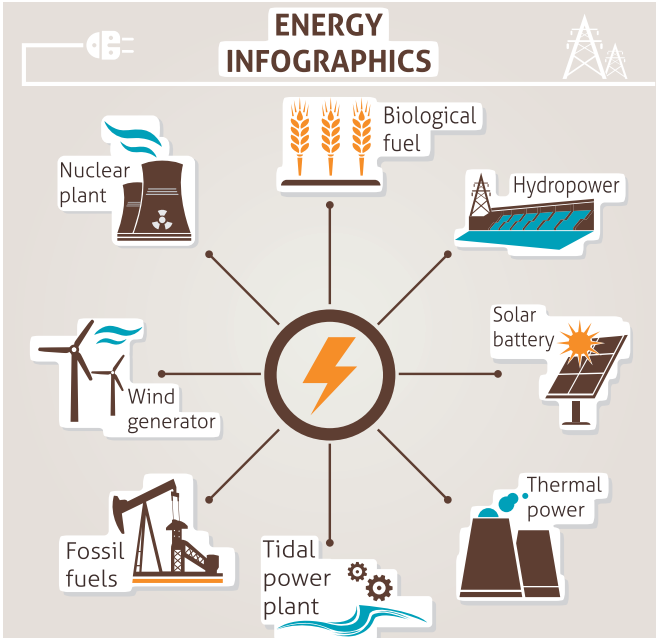
Even though some other living things on earth may be stronger, faster, or more dangerous, there is a reason caring for the earth is our responsibility.

People have **intelligence**. We are capable of intelligent thought to think about solutions for the earth's problems. We are able to think of ways to make and use tools. Some of these tools can be very complex, like computers. We are able to use tools to find the answers to many of the earth's problems. And if we can't find the answer, we can keep learning until we figure it out.

We have the ability to invent new things. It is important that we do not continue to waste the earth's resources so future generations can enjoy the earth as much as we do.

Good stewards are concerned about energy problems. They do not need to stop using oil or coal, but they do need to try cutting down waste of these fuels. To conserve electricity and fuel, perhaps the house temperature could be lowered in the winter and raised in the summer. This is especially good to do when no one is home. Combining several short errands with the car into one longer trip might save gasoline and time. Working at saving energy can be fun and can help us better organize our time to do other activities. It also makes us good stewards of the earth.

Many scientists and engineers are working on energy problems today in order to conserve energy and help solve our energy problems. These men and women need encouragement to continue working toward development of new energy sources. Perhaps some day you will grow up to be a scientist or engineer who helps find ways to conserve the earth's resources!



| It's important that we conserve energy and find new sources of energy for the future.

IN SUNLIGHT			OUT OF SUNLIGHT		
Beginning	_____	degrees	After 20 minutes	_____	degrees
After 5 minutes	_____	degrees	After 25 minutes	_____	degrees
After 10 minutes	_____	degrees	After 30 minutes	_____	degrees
After 15 minutes	_____	degrees	After 35 minutes	_____	degrees
After 20 minutes	_____	degrees	After 40 minutes	_____	degrees

3.12 How does water respond to sunlight?

_____

_____

_____

_____

3.13 What happens to the stored heat after water is removed from the sun?

_____

_____

_____

_____

3.14 How might you keep the water warm longer after you remove it from sunlight?

_____

_____

_____

_____

Teacher check:

Initials _____ Date _____

SCIENCE 505: TEST

Match these items (each answer, 3 points).

1. _____ energy
2. _____ work
3. _____ fossil fuels
4. _____ potential energy
5. _____ kinetic energy
6. _____ heat energy
7. _____ joule
8. _____ solar energy
9. _____ biomass
10. _____ stewardship

a. caused by friction
b. unit of work
c. contained in sun's rays
d. caring for earth's creatures and resources
e. explosion
f. machinery
g. ability to do work
h. force times distance
i. coal, gas, and oil
j. energy that is stored
k. energy that is moving
l. garbage and scrap paper

Answer *true* or *false* (each answer, 2 points).

11. _____ Water and wind are two sources of energy.
12. _____ A falling apple is an example of mechanical energy.
13. _____ The sun is the main source of energy on earth.
14. _____ Energy is never lost.
15. _____ Energy cannot change from one form to another.
16. _____ Chemical energy is stored in coal, gas, and oil.
17. _____ An explosion is an example of sound energy.
18. _____ Heat energy can be received from reflected sunlight.
19. _____ Solar energy is not difficult to store.
20. _____ Oil and coal supplies can be renewed.

SCIENCE 506
PHYSICAL GEOLOGY

Fill in the blank with the correct answer.

1.1 Eratosthenes _____.

a. measured the diameter of the earth.
b. calculated the circumference of the earth.
c. believed the earth was flat.

1.2 Most ancient civilizations believed the earth was _____.

a. flat b. round c. oblong

1.3 Greek philosopher _____ used logic and physical evidence to prove the earth was round.

a. Eratosthenes b. Aristotle c. Ptolemy

The three main categories of rock in the earth's crust are igneous, sedimentary, and metamorphic. **Igneous** rocks were originally molten; then, they formed by cooling. Moving water laid the sedimentary rocks in place. Pre-existing igneous or sedimentary rocks that were subject to intense heat and/or pressure formed the metamorphic rocks.

Igneous Rocks. Igneous rocks are the oldest rocks on earth. They make up the ocean floor and the bottom of many mountains. These rocks are made from hot, melted minerals deep inside the earth. The melted minerals are called magma. When magma cools, it hardens. Hardened magma becomes igneous rock.

Most of the time, magma cools inside the earth. Over time, rocks on the surface are eroded and the igneous rocks show. Sometimes, magma cools outside on the surface. This happens when volcanoes erupt and let magma pour out. Magma on the surface is called lava.

| Volcanic obsidian, lava from Aeolian islands

Igneous rocks are made of crystals. The crystals can be large or small. The size of crystals depends on how fast the magma cools. Slow cooling makes large crystals. Granite and gabbro are examples of igneous rocks with large crystals. Fast cooling creates small crystals. Basalt is a rock with small crystals. Obsidian is a rock that cools so quickly it has no crystals at all.

Mountain Rocks

Mountains are made of sedimentary rock, igneous rock, or a combination of both.

The ark was made of gopherwood. "Gopherwood" is thought to mean the wood of the cypress tree, which was used for shipbuilding throughout the ancient Middle East. Cypress is an evergreen that provides strong wood from a large trunk and limbs.

Volcanoes. The formation of volcanoes is the simplest type of mountain to understand. Volcanic mountains consist of shields of lava flows or cones of volcanic cinders that exploded into air above a vent, or combinations of the two. A cinder cone can begin on a flat field and grow into a small mountain in a few weeks. It will erode much faster than other mountains.

Plates. Although we think of the surface of the earth as firm and solid, it is actually constantly shifting. Geologists have identified sections of the earth that move as a unit. These sections are called plates, as shown in the diagram above. Sometimes these plates bump into each other. This causes a large amount of pressure that can fold the earth's crust.

Most volcanoes lie along zones of weakness where the earth's crust has been broken. Some are over "hot spots" where magma has forced its way up by melting rock in its way. Volcanoes in Hawaii formed as the Pacific Ocean drifted over a hot spot. Yellowstone National Park has a major hot spot under the North American plate.

Rapid-Folded Mountains. Sedimentary rocks were originally laid down in nearly flat, horizontal layers in a sea, lake, or floodplain. Over time, the rock layers were folded by movement of the earth's crust. When plates collide, they are squeezed together. This causes the rocks in the fold to push toward each other. In areas where the crust was weak, these folds formed mountains. The Appalachian Mountains were formed in this way when the North American plate and the Eurasian plate collided.

| Blue Ridge Mountains. A segment of the Appalachian Mountains

3. OCEAN

Have you ever been to a beach? Or perhaps you've been on a boat, in the open waters of an ocean. If you've ever looked at a globe of the earth, you may have noticed most of the earth is water and there are land masses scattered among the blue waters. In this section, you'll learn how those land masses weren't always where they are now. You'll learn about the plates in the earth that shifted over time, creating our mountains and splitting up the land masses you see on the globe from one giant supercontinent scientists believe once existed called Pangaea.

Objectives

Review these objectives. When you have completed this section, you should be able to:

11. Explain plate tectonics.
12. Tell about oceanic ridges and rift valleys.
13. Understand how lagoons, lakes, and groundwater are formed.

Vocabulary

Study these new words. Learning the meanings of these words is a good study habit and will improve your understanding of this unit.

continental plates (kän tə nen' təl plāts). Plates under large land masses.

Pangaea (pan jē' ə). The giant supercontinent scientists believed once existed.

plate tectonics (plāt tek tä' niks). Theory on the spreading of the sea floor to explain the building of mountains and the shapes of continents.

rift valley (rift va' lē). Lowland regions that split oceanic ridges.

Pronunciation Key: h**a**t, **ā**ge, c**ä**re, f**ä**r; l**e**t, **ē**qual, t**ė**rm; **i**t, **ī**ce; h**o**t, **ō**pen, **ô**rder; **oi**l; **ou**t; c**u**p, p**u̇**t, r**ü**le; **ch**ild; lo**ng**; **th**in; /ŦH/ for **th**en; /zh/ for mea**s**ure; /u/ or /ə/ represents /a/ in **a**bout, /e/ in take**n**, /i/ in penc**i**l, /o/ in lem**o**n, and /u/ in circ**u**s.

Plate Tectonics

As long ago as the 16th century, geographers noticed the similarity between the coastal shapes of Brazil and Africa. They proposed the hypothesis that South America and Africa were once united in a single large land mass.

In the early part of the 20th century, Alfred Wegener and others gathered facts from the geology of South America and of Africa in an effort to prove that they were once united with Antarctica, Australia, and India. The single southern continent was named Gondwana (originally Gondwanaland). The single northern continent was called Laurasia. At first, no one believed Mr. Wegener.

Before the early 1960s, most geologists believed that the world's continents had always been where they are now. However, in 1960, geologists began comparing minerals and fossils in Africa with those in South America. The minerals and fossils of both continents matched perfectly.

Modern scientists now believe that the continents were once one big landmass. Scientists believe that all the major continents once formed one giant supercontinent, which they called **Pangaea**. Then, something happened. It could have been a giant earthquake, or perhaps a huge storm, or perhaps a buildup of heat. Pangaea split in two. These two huge land masses continued to move apart, riding on separate plates, until they reached the positions they currently occupy. These continents are still on the move today.

SCIENCE 507
RECORDS IN ROCK: FOSSILS

Complete this activity.

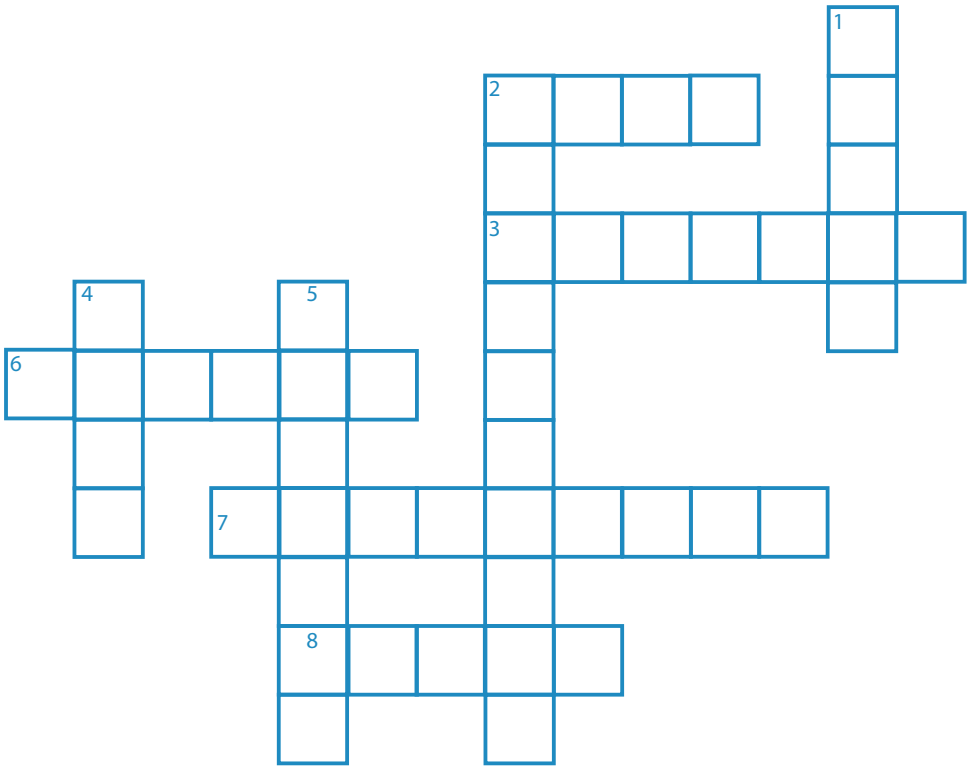
1.26 This is a crossword puzzle. The words that will be used in the puzzle have been discussed in this unit. Use the definitions below to identify the words and then write the words in the puzzle.

ACROSS

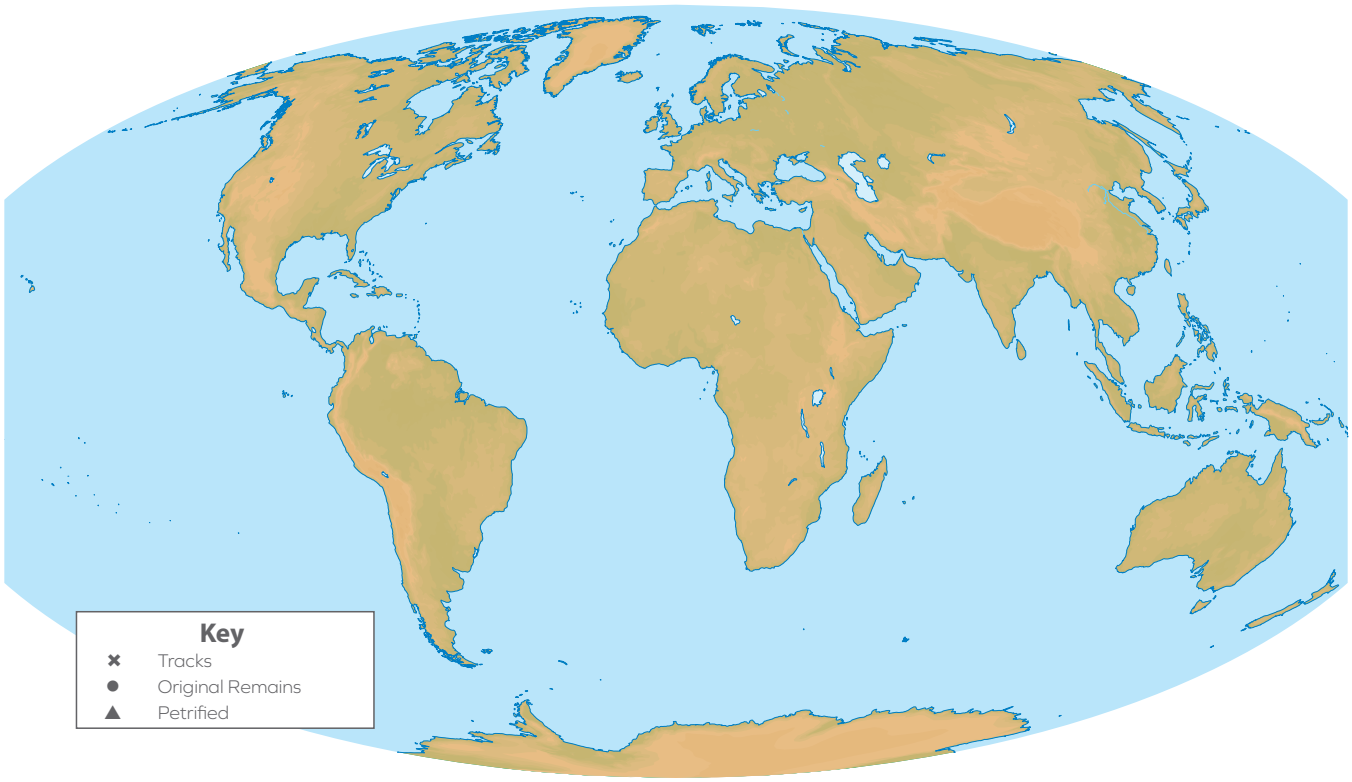
2. A kind of print fossil. It forms when minerals from water fill up a mold of a living thing.
3. Something that is left from a living thing after it dies.
6. Part of the physical record of ancient times. It was formed by a living thing.
7. A type of fossil that is formed by minerals, either by permineralization or by replacement.
8. A yellowish, gum-like material from ancient, cone-bearing trees that has hardened.

DOWN

1. A type of fossil formed from an imprint of a living thing.
2. A type of fossil formed from carbon left over from the original plant or animal.
4. A kind of print fossil. It forms from an imprint of the original plant or animal into sediment. The original material then dissolves or decays away.
5. A material usually contained in water that helps to form fossils.



1.42 On the world map below, locate the sites of the famous fossil deposits listed on the previous page. Place the symbols (shown in the **Key**) in the general area on the map where they would be found.



Complete this optional activity. There are other well-known fossil sites around the world that were not included in this unit. In this optional activity, you can search several resources — such as the library or internet or a museum — to locate some of these other major fossil deposits around the world. Perhaps you will find the locations of deposits that contain mold fossils, cast fossils, and carbonized fossils, too. When you have located several new sites, complete the activities below.

1.43 On another piece of paper, list the fossil deposit sites that you located.

1.44 On another piece of paper, classify the locations under the different types of fossils.

1.45 Add new symbols to the **Key** for the world map if needed. Then locate your additional "fossil finds" on the world map above.

Teacher check:

Initials _____ Date _____

Identification

When people first found animal bones at the La Brea Tar Pits in Los Angeles, they thought that these were just common bones. After many years, the bones were recognized as fossils. This kind of experience happened often in the past. People were not aware that they were finding fossils. Some of the fossils were destroyed or damaged. Others were lost. Many people did not know how to identify fossils. Fortunately, there is much more information about fossils and the identity of fossils today.

The **identification** of fossils can be done in many ways. You will now consider two rather simple ways to identify fossils: 1) by *fossil type* and 2) by *plant* or *animal type*. Let's consider each of these two ways to identify fossils.

Identity by fossil type. You have learned that there are several fossil types. You have also learned that certain fossil types are more likely to be found in some places than in others.

Fossils can be identified by their type. A mold fossil of a shell looks different than an original-remains fossil of a shell. Petrified wood does not appear the same as a cast fossil of wood. So some fossils can be classified by their fossil type just by sight.

Some fossils are harder to identify by type. Often, petrified bones look very much like the original bone. Someone who is not trained to tell the difference might be confused. A fossil expert would be able to **determine** the fossil type.

| Original-remains fossil

| Petrified fossil

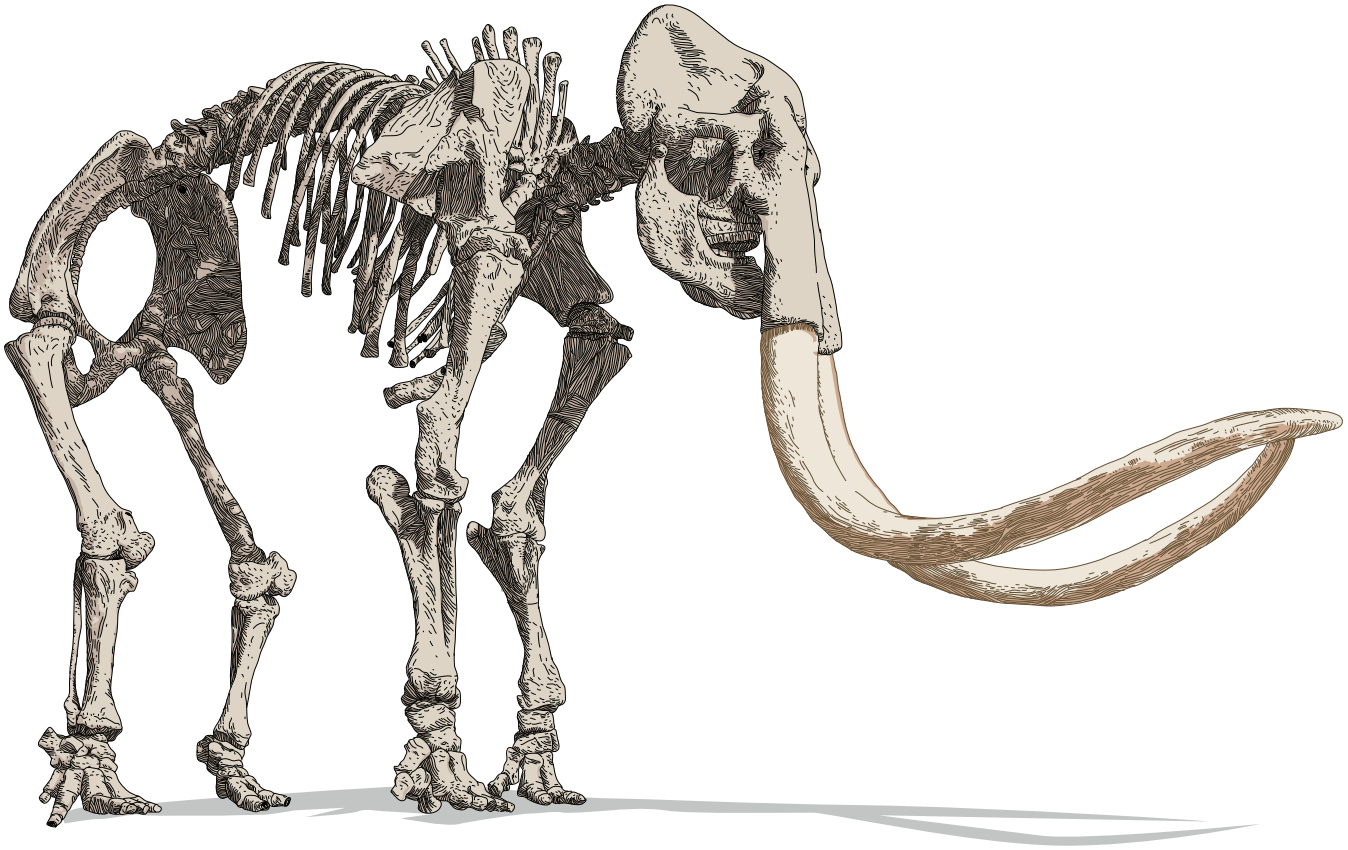
| Carbonized fossil

| Cast fossil

| Mold fossil

Complete this activity.

2.46 Here is a drawing of a skeleton. Make some inferences about how the live animal may have looked. Use colored pencils to fill in the skeleton, creating features that reflect your inferences.



Teacher check:

Initials _____ Date _____

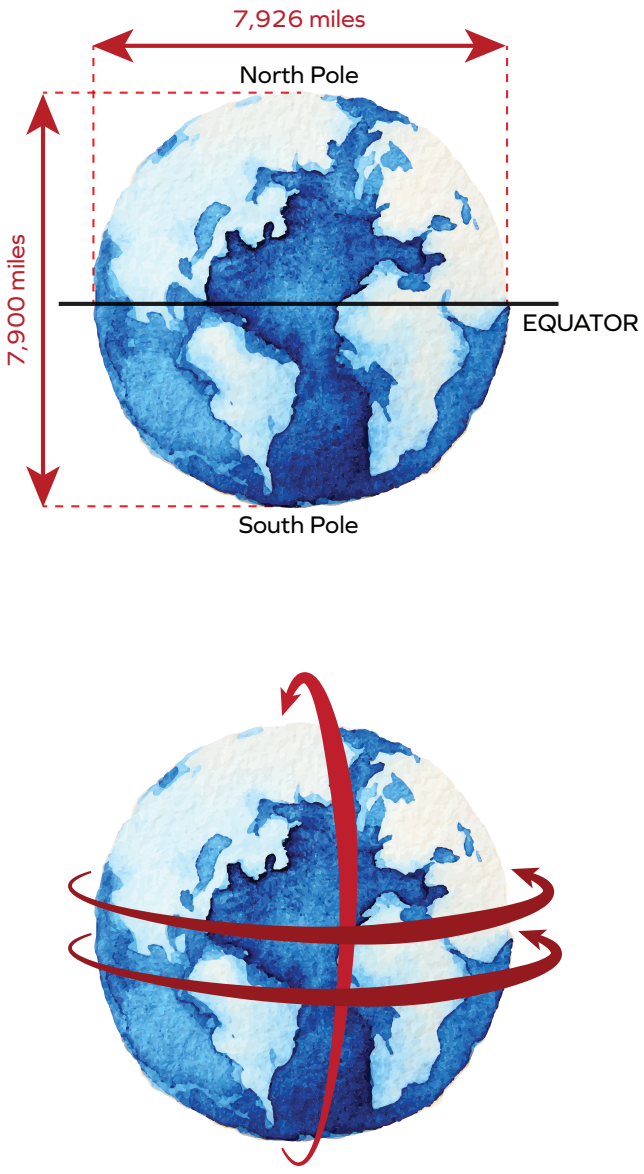
SCIENCE 508
RECORDS IN ROCK: GEOLOGY

Features of Earth

Viewed from space, the earth appears as a large sphere (ball). It has vast patches of white clouds, blue oceans, and brown and green land areas. At the top of the earth is the North Pole, and the South Pole is near the bottom of the earth. The white areas surrounding the poles are large ice-covered landmasses. This view of the earth from space, showing its overall structure, is truly beautiful. Let's consider some details about the overall structure of the earth.

Size and shape. The earth is shaped like a large sphere. However, the earth is not perfectly round. It is slightly flattened at the poles. This means that the diameter of the earth measured from the North Pole to the South Pole is slightly less that the diameter across the middle of the earth at the **equator**. From pole to pole, the diameter of the earth is about 7,900 miles (12,714 kilometers). At the equator, the diameter of the earth is about 7,926 miles (12,756 kilometers). Therefore, the distance from pole to pole is 26 miles (42 kilometers) less than the diameter of the earth at the equator. This is why the earth is actually slightly flattened at the poles, although it may look perfectly round when viewed from far away in space.

In the same way, the distance around the earth is shorter at the poles than at the equator. At the poles, the earth is 24,860 miles (40,008 kilometers) around. At the equator, it is slightly greater: 24,902 miles (40,075 kilometers) around. However, the equator is not actually the "fattest" part of the earth. The distance around the earth is greatest along a circle slightly south of the equator. Therefore, the earth's shape is a little like a pear, which has its fattest part just below its middle. But this bulge in the earth's shape is so small that the earth still looks like a perfectly round sphere when viewed from space.



| The size and shape of the earth vary slightly. The "fattest" part of the earth from north to south is 24,860 miles around, and from east to west is 24,902.

Many of our sedimentary rocks were probably formed at the time of the Flood. The water that covered the whole earth probably carried many sediments that became rock. Today, sedimentary rocks form very slowly.

Sedimentary rock is found in *layers*. The layers look like they were built one by one on top of another. Some of the layers appear very thin. Other layers seem very thick. Even within one small rock, layers can be seen.

| Conglomerate rock

Shale is a very common sedimentary rock made of very tiny grains of clay. Since the grains of clay are small and light, they are found under quiet water. *Sandstone* is similar to shale, but it contains larger grains of sand. Sandstone is found near shores and in valley floors. **Conglomerate** is a sedimentary rock formed when a mass of large pebbles are cemented together. Today, you may find these types of rock material accumulating slowly in narrow strips along streambeds and river channels. You may have walked carefully over cobbles and boulders while on a hike.

Limestone is formed from a dissolved mineral known as lime. Sometimes clays are mixed with lime. Most limestone is found in warm seawater or where a sea was once located. Coral and chalk are types of limestone.

Complete this activity.

1.62 Identify the "sediments" as either conglomerate, shale, or sandstone by writing the term under each box.

508.C EROSION

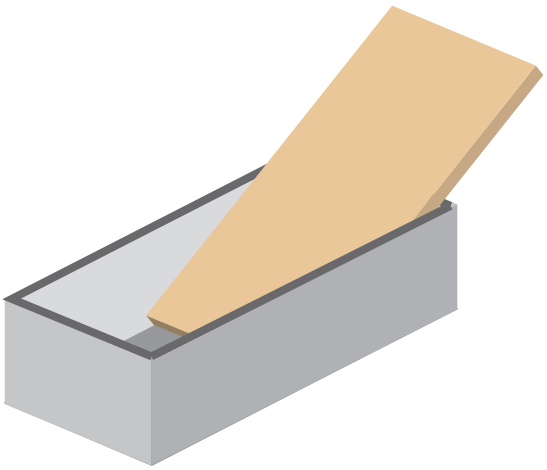
Using a mixture of soil, sand, and pebbles on an inclined board, you will see how water can cause erosion of the earth's surface.

These supplies are needed:

plastic tub or metal pan
mixture of soil, sand, large and small pebbles (or fine gravel and course sand)
glass of water
short board

Follow these directions carefully.. Put a check in the box after each step is completed.

☐ 1. Place the board inside the container. Have one end resting on the edge of the container, and the other end resting on the bottom. (See the illustration below.)



☐ 2. Place the mixture of soil, sand, and pebbles on the board.

☐ 3. Make a groove in the surface of the mixture from top to bottom. (Do not make the groove go all the way to the board.)

2.13 Explain what you think will happen if you pour water down the board.

_____

_____

☐ 4. Pour water slowly down the groove. (Use more water if needed.)

2.28 Select the most important change. _____

Why do you think it was the most important? _____

_____

_____

Teacher check:

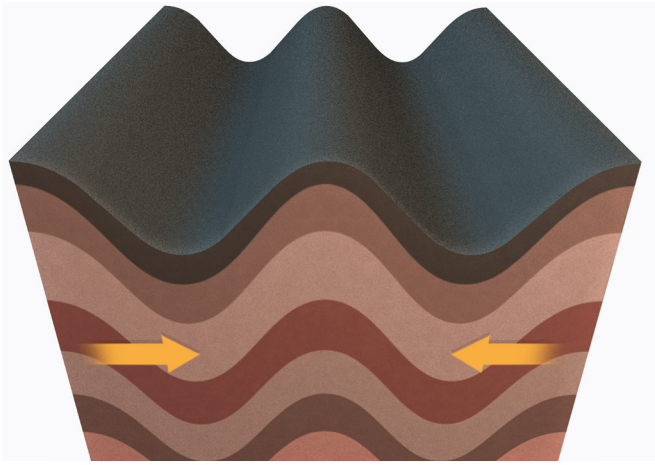
Initials _____ Date _____

Forces from under the Surface

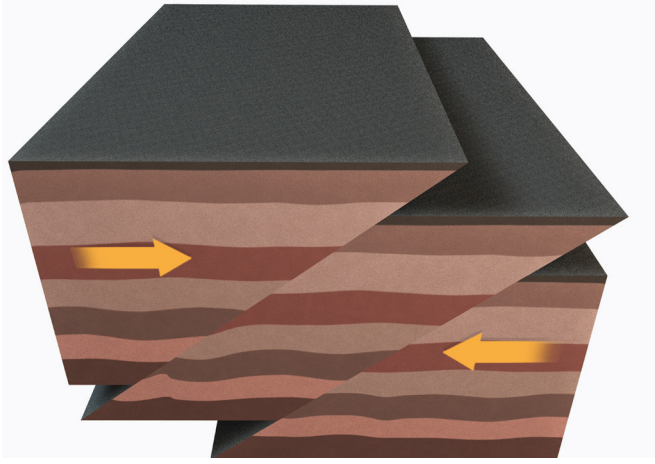
Surface forces can cause many changes in the earth, but additional changes come from underground forces. You have learned that deep inside the earth is movement. At times, the movement inside the earth causes great and sudden surface changes. Some forces work so slowly to change the earth that the results cannot be seen from day to day.

Folding and faulting. The earth's crust is always in motion. In some places the crust is sinking while other areas of the crust are rising. Sometimes the underground motion causes a twisting of the land. Most of these movements occur over a period of many years. Scientific instruments can measure the motion. Scientists can observe the movement of the earth over a long period of time.

Folding is often the result of the movement of the inner Earth. When some parts of the layered crust push against each other to bend and twist the rock layers, the result is a folded layer of rock. Some parts are pushed up or forced downward. Layers of rock overlap each other. Sometimes fresh roadcuts show how layers have folded.



| Folding



| Faulting

Match these items (each answer, 3 points).

11. _____ landforms

12. _____ minerals

13. _____ Magellan

14. _____ volcanoes

15. _____ color

16. _____ glaciers

17. _____ floods

18. _____ Earth

19. _____ folding

20. _____ core

21. _____ crystal

a. igneous

b. move large quantities of soil

c. land areas are squeezed together

d. at Earth's center

e. shaped like a sphere

f. hills, valleys, mountains, rivers

g. led first ship around the earth

h. about 3,000 types

i. produce lava

j. drag rocks underneath

k. physical test on rocks

l. sedimentary

m. regular structure of atoms

Label this diagram (each part, 3 points).

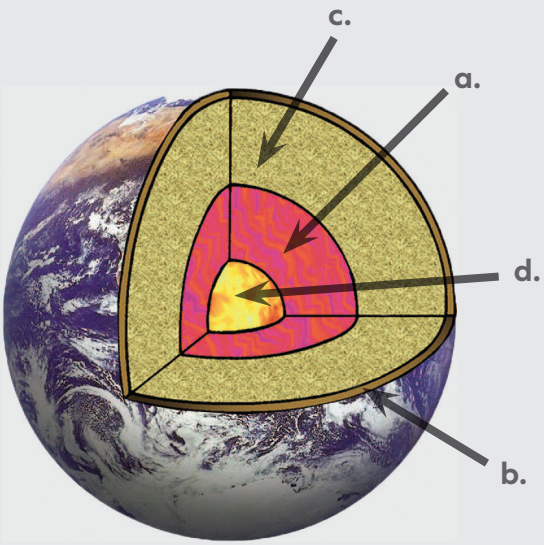
22. This diagram is a cross section of the earth. Write the correct name of the layer on the line.

a. _____

b. _____

c. _____

d. _____



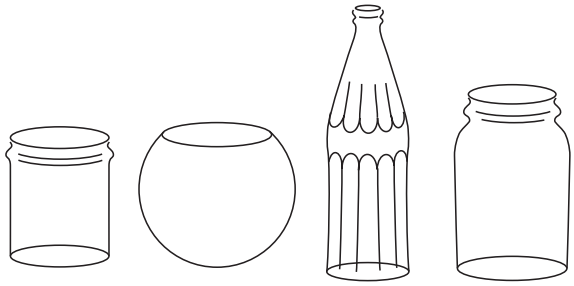
SCIENCE 509
CYCLES IN NATURE

509.C WATER IN LIQUID STATE

Water will be poured into four different types of containers in order to demonstrate some things about liquids.

These supplies are needed:

a baby food jar or similar small container
4 other differently shaped clear containers (see examples below)
water



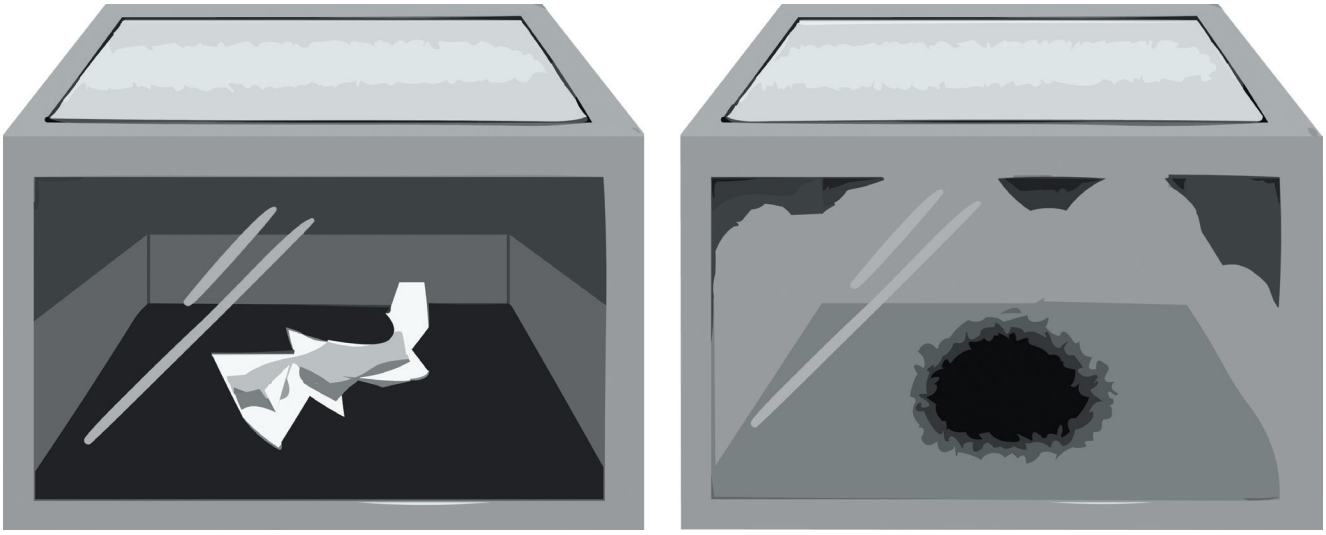
Follow these directions carefully. Put a check mark in the box when each step is completed.

☐ 1. Draw a picture of a different container in the boxes below.

Container 1 | Container 2 | Container 3 | Container 4

☐ 2. Fill the baby food jar (or other small container) full with water and pour one full jar of water into each one of the other four containers.

☐ 3. In each of your drawings, shade the area that now contains the water.



| The total mass before and after burning is the same.

Conservation of matter. You have seen things burn. You have observed ice melting. Perhaps you have seen glass break. What happens to the matter during all these changes? Is matter lost? Is it used up?

Matter often appears to be lost when it changes. For example, when paper burns, it seems like only a small amount of ash is left. The ashes are much smaller in volume than the original paper. The paper appears to have been destroyed. However, the matter has not been lost in this case. The matter has changed to different materials. The same amount of mass remains as before.

Scientists have learned how mass is not lost through burning. They have conducted experiments with burning to show this **conservation** of matter. The scientists use an airtight container to conduct the experiments so that no mass can escape from it. The mass of the matter to be burned and the mass of the air inside the container are measured. Then the material is burned within the container. After burning, the mass of the burned matter (the ashes), the unburned matter, the gases, and smoke is measured. The scientists always find that the total mass inside the container is exactly the same before burning and after burning. Chemical changes do not change the total mass of materials. There is *conservation of matter* during chemical changes.

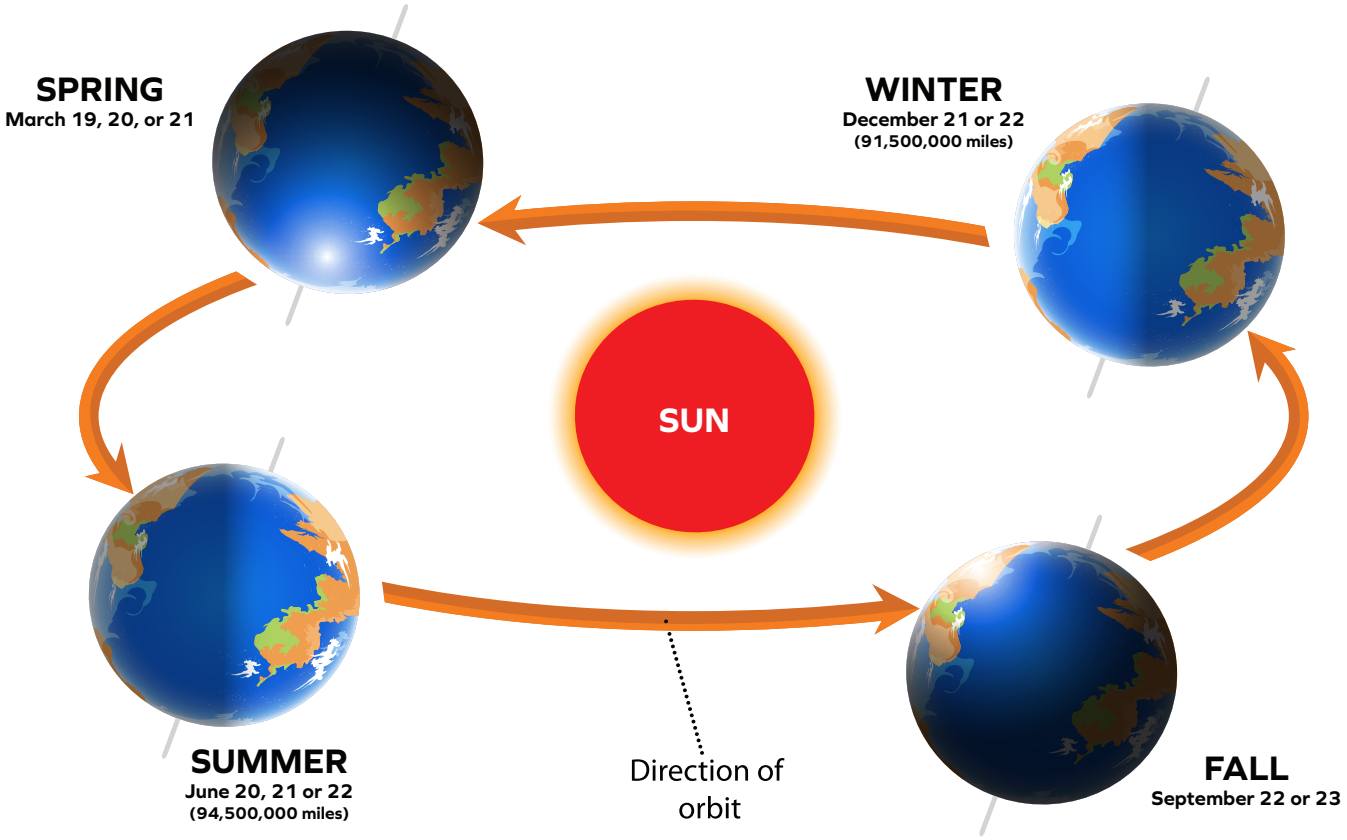
The same results happen during physical changes of matter. When matter changes from one state to another, the total mass is conserved. For example, when water is boiled, the level of water in the container appears to get lower. It appears that there is less mass of the water as it boils. However, experiments conducted in airtight containers show that no mass is lost when water boils and changes from the liquid to gas state. One kilogram of water could be changed into steam inside an airtight container. However, the mass of the resulting steam would also be one kilogram. No mass is lost or destroyed during the boiling of water. There is *conservation of matter* during physical changes and changes from one state to another.

opposite happens in the Southern Hemisphere. When it is summer in the Northern Hemisphere, it is winter in the Southern Hemisphere. The opposite is also true. When it is winter in the Northern Hemisphere, it is summer in the Southern Hemisphere.

Slanted rays cover a larger area and are spread out. Matter receives less energy from the slanted rays. At the same time, the **atmosphere** keeps the slanted rays from bringing as much heat. Some heat energy is absorbed before it reaches the earth.

The days are also shorter in wintertime. So, the sun's rays have less time to heat the matter.

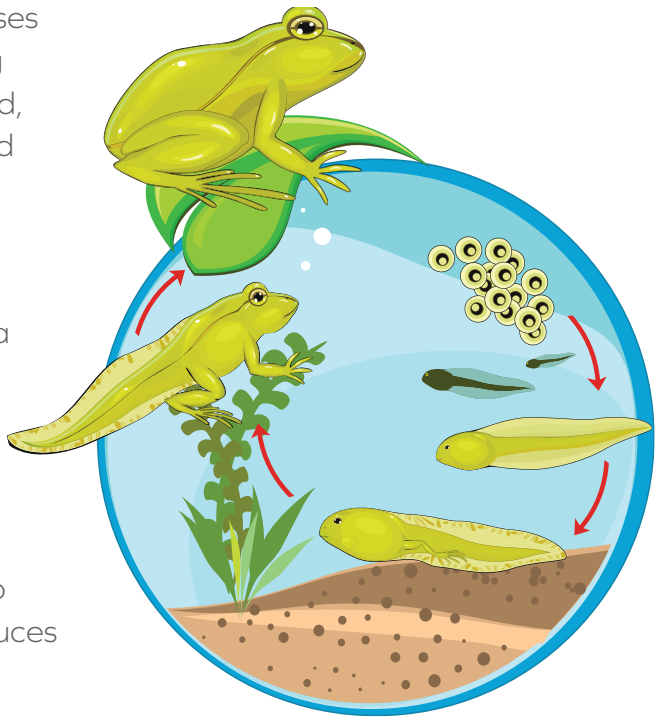
How is matter affected by the rays from the sun? Heat causes molecules to move faster. Some matter changes to liquid or gas. With less heat from the sun, some liquids change to solid and some gases become liquid.



Life

Cycles in nature are important to life on Earth. Life on Earth couldn't continue without comets or seasons. The cycling of matter must happen for life to go on. Other cycles support life. You have studied about some of them. Now you will consider these cycles from another point of view. The order of nature is shown in these life-supporting cycles.

Formation and decay. A plant or animal life cycle includes birth, reproduction, and death. This life cycle causes each species to survive. The bodies of these living things are in a cycle, too. These bodies are formed, grow, die, and decay. This cycle happens over and over. Both plants and animals are involved in this cycle.



| Every living thing has a life cycle.

Each body is composed of matter. Life begins as one cell produced by a parent. After fertilization a body begins to grow for a multi-celled plant or animal. Matter is brought into the body in the form of food. The matter is changed chemically, and work is done. This work produces new cells, so some of the matter stays with the body. More and more matter is added to the body until it is mature. This process also produces the cells for fertilization.

When death occurs, the body decays. Bacteria in the soil helps the decaying process. These bacteria work on the body's matter to change it chemically. Some of the matter is returned to the soil where it can be used as food or nutrients for plants. The plants make new cells with the matter and the cycle continues. The conservation of matter happens during this cycle.

SCIENCE 510
LOOK AHEAD

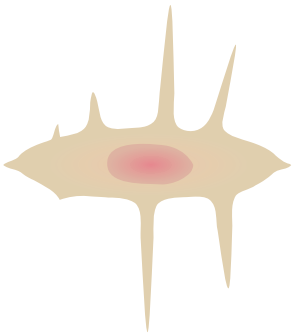
Many animal species exist. They may be classified in several ways. One way to classify animals is to group them according to whether or not they have a backbone. Thus, animals are either vertebrates (with a backbone) or invertebrates (no backbone). Within these two groups are animals of various types.

Cells. The cells of animals do not have to be rigid like those of plants and fungi. Thus, animal cells do not need cell walls. Also, animals do not undergo photosynthesis. They have no chloroplasts or chlorophyll within their cells.

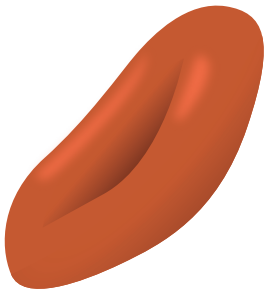
Animal cells need to vary in size and shape because of the functions they perform. Blood cells must be round and unattached in order to move throughout the body system. Epithelial cells need to be long and thin to cover the body's surface. All of these cells are joined together to form tissues and the animal's body.

Animal cells function somewhat similar to those of plants and fungi. They take in food and store it. They use the food stored in cells for survival. However, animal cells use oxygen and give off carbon dioxide. In plants, it is just the opposite because photosynthesis takes in carbon dioxide and produces oxygen.

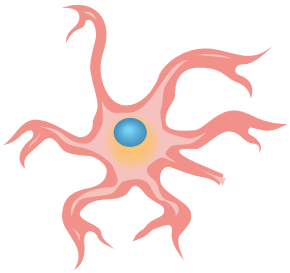
Animal tissues include epithelial, connective, muscular, and nervous tissue. In each of these tissues, the cells are similar and are grouped to perform similar body functions. Muscle tissues help move the body. Nervous tissues carry messages. Connective tissues join and support all of the body's cells. Epithelial cells cover the body and protect it. Linings within the body are also made of epithelial cells.



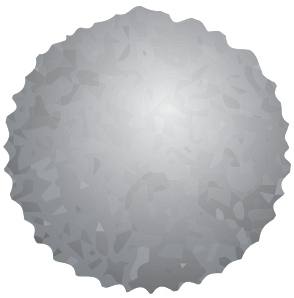
| Bone cell



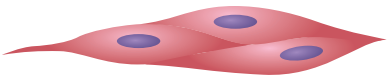
| Red blood cell



| Nerve cell



| White blood cell



| Muscle cells

Use the internet or library.

1.42 Now use the internet, other books, or Science 503, to find the names of other animal-like protists, insects, worms, and mollusks. Using your list in number 1.41 plus the additional names that you discover, write the names of the various creatures in the table below. (You may not have room for all of them that you find. Choose those that have different features.)

	ANIMAL-LIKE PROTISTS	INSECTS	WORMS	MOLLUSKS
A.				
B.				
C.				
D.				
E.				
F.				
G.				
H.				
I.				
J.				

Teacher check:

Initials _____ Date _____

Vertebrates are animals with backbones. Their backbones and other bones form their skeletons. Skeletons give shape to the bodies of these animals and protect their internal organs. All vertebrates are multicellular. They have many varieties of bodies and differing life cycles. Fish, amphibians, reptiles, and birds are egg-laying vertebrates. Mammals are vertebrates that are live-bearing.

Fish are vertebrates that live in the water. They use gills to breathe. Most fish are egg-layers. Their eggs are laid by females and then fertilized by the sperm of males. After fertilization, the parents do not stay near the eggs. The eggs hatch into tiny copies of the parents. A few of the adults grow into adulthood and reproduce. Several fish species are live-bearing. The parents do not care for or protect the offspring.

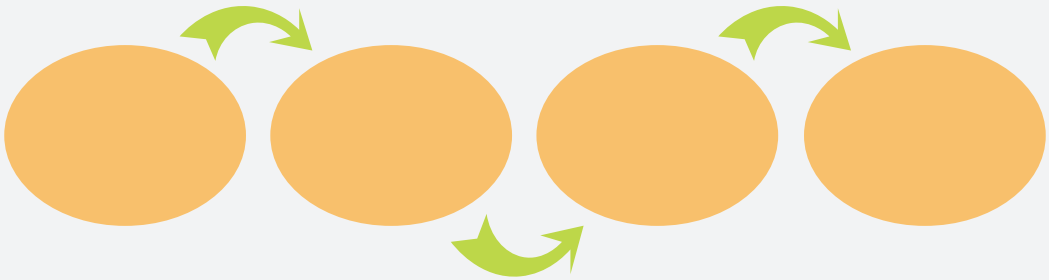
Amphibians live part of their lives in the water like fish, but then change and live part of their lives on land. This process of change is called *metamorphosis*. Frogs are an example of amphibians. Their eggs are laid and fertilized in the water. After the eggs hatch, the new offspring appear more like fish than their parents. During this part of their life cycle, the amphibians live like small fish and cannot survive out of the water. Soon, the amphibians begin to change and grow lungs and legs. Tails disappear, and the offspring now appear more like their parents. They can no longer live underwater without coming to the surface for air.

Reptiles are vertebrates that are covered with scales, or plates, for protection. Reptiles include alligators, lizards, snakes, and turtles. They usually live near water but cannot breathe underwater. Female reptiles lay their eggs on land rather than in water. Once they lay their eggs on the land, they do not stay near the nest to warm or protect their eggs. Newborn baby reptiles usually look like the parents, except their scales or plates are not yet hard.

Birds are the only animals that have feathers. All birds have wings, and almost all of them can fly. They have two legs. Their eggs are fertilized when still inside the females' bodies. Shells of the fertilized eggs become hardened before the female lays them. Parents need to keep the eggs warm and moist before hatching.

Label this diagram (this question, 10 points).

1.015 Use these words to label the diagram of a food chain: primary consumer, decomposer, secondary consumer, producer.



Write *true* or *false* (each answer, 3 points).

1.016 _____ Flowering plants produce seeds for reproduction.

1.017 _____ Prokaryote cells have three basic parts.

1.018 _____ Fish care for and nourish their young after birth.

1.019 _____ Animal cells contain chloroplasts.

1.020 _____ Mollusks are a type of fish.

1.021 _____ Only plants and fungi have cell walls.

1.022 _____ The balance of nature depends upon the water cycle.

1.023 _____ Birds are the only animals that have feathers.

1.024 _____ Humans cannot affect the balance of nature.

1.025 _____ Riding a bicycle instead of taking a car can show good stewardship.

Complete this maze.

2.31 This maze is of a volcano. Start at the arrow on the top of the cone. You will come out at one of the arrows at the bottom.

Review the material in this section to prepare for the Self Test. The Self Test will check your understanding of this section and will review the other sections. Any items you miss on this test will show you what areas you will need to restudy in order to prepare for the unit test.

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