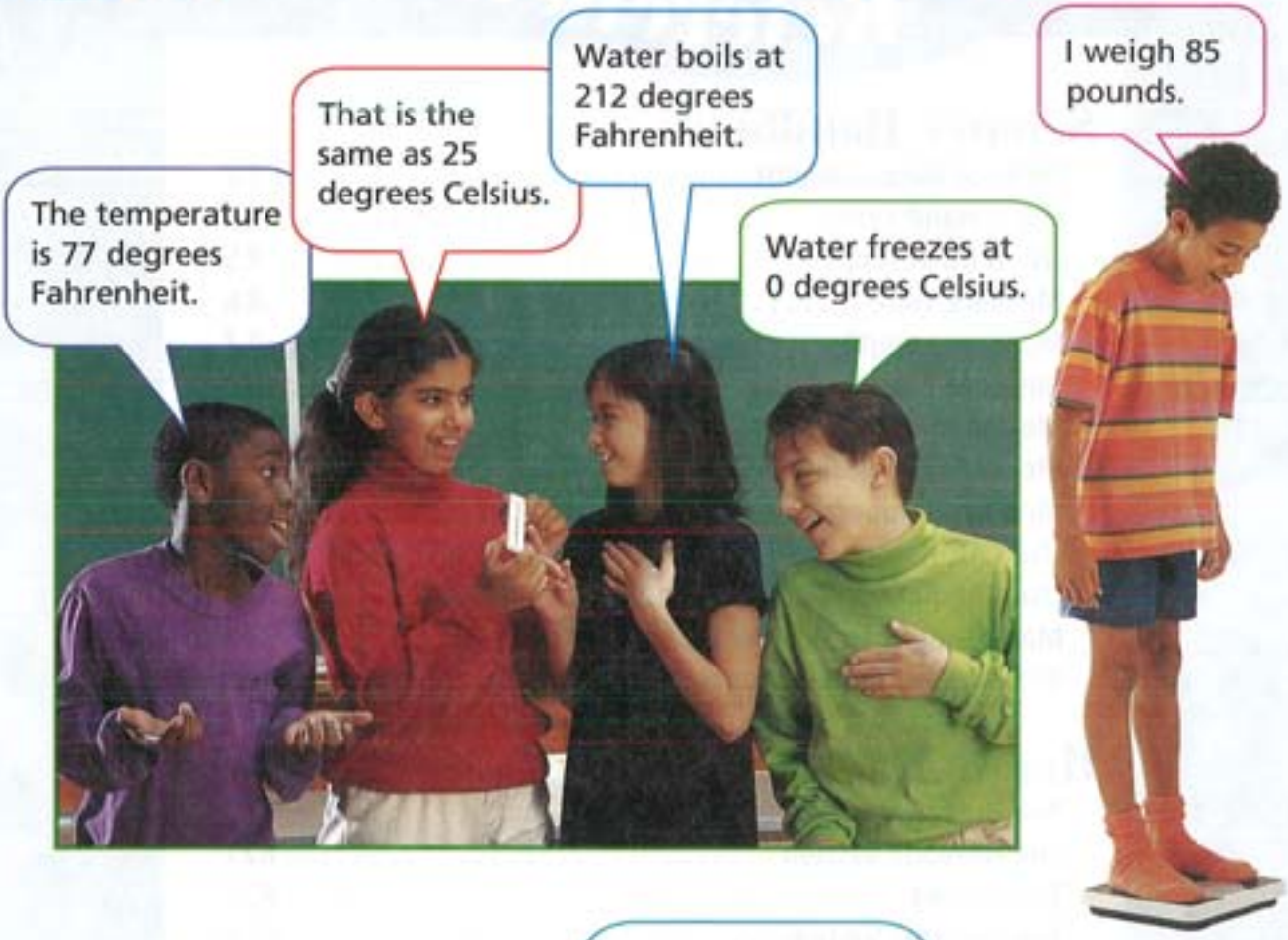
For Your Reference

Science Handbook

Health Handbook

SCIENCE Handbook

Units of Measurement



Units of Measurement

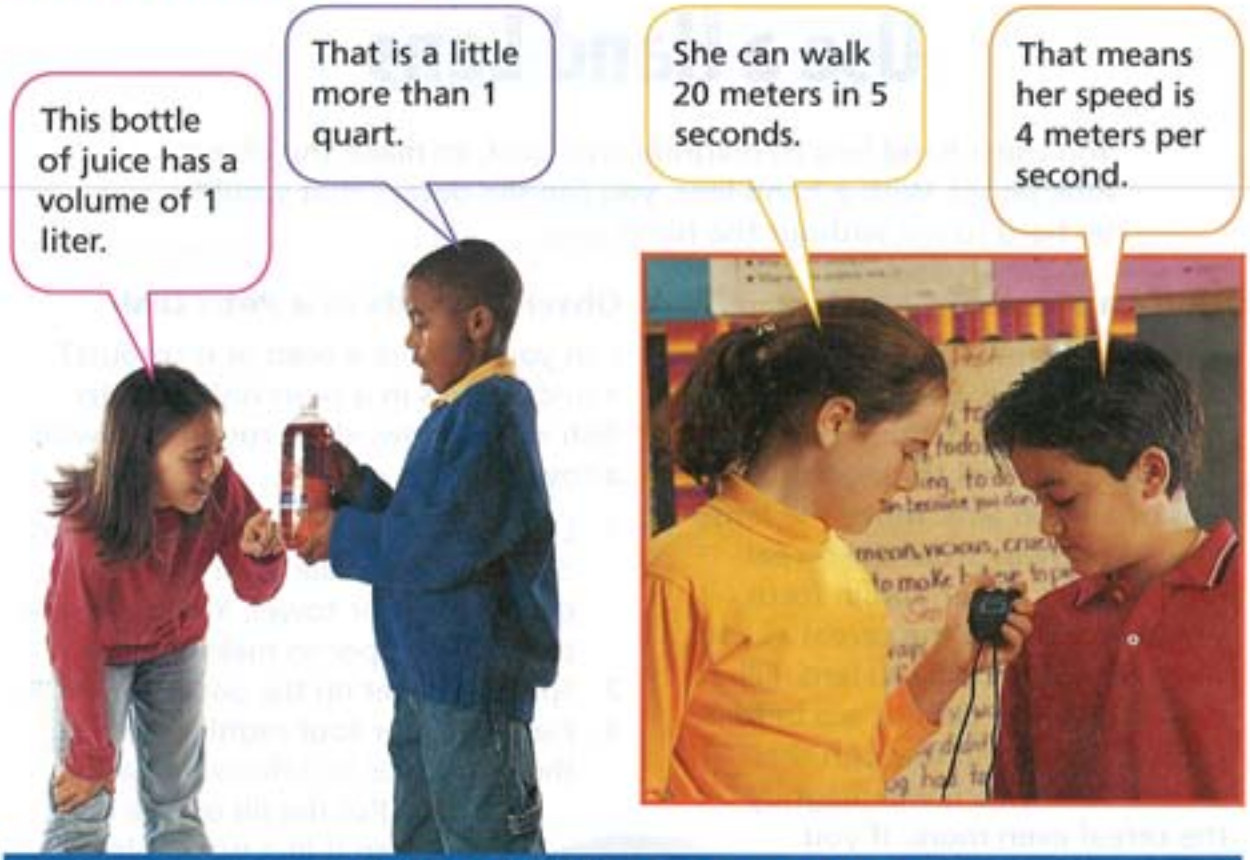


Table of Measurements

International System of Units (SI)	English System of Units
Temperature Water freezes at 0°C and boils at 100°C.	**Temperature** Water freezes at 32°F and boils at 212°F.
Length and Distance 1,000 meters (m) = 1 kilometer (km) 100 centimeters (cm) = 1 meter 10 millimeters (mm) = 1 centimeter	**Length and Distance** 5,280 feet = 1 mile 3 feet = 1 yard 12 inches = 1 foot
Volume 1,000 milliliters (mL) = 1 liter (L) 1 cubic centimeter (cm^3) = 1 milliliter	**Volume of Fluids** 4 quarts = 1 gallon 2 pints = 1 quart 2 cups = 1 pint 8 fluid ounces = 1 cup
Mass 1,000 grams (g) = 1 kilogram (kg)	**Weight** 2,000 pounds = 1 ton 16 ounces = 1 pound

Use a Hand Lens

You use a hand lens to magnify an object, or make the object look larger. With a hand lens, you can see details that would be hard to see without the hand lens.

Magnify a Piece of Cereal

1. Place a piece of your favorite cereal on a flat surface. Look at the cereal carefully. Draw a picture of it.
2. Look at the cereal through the large lens of a hand lens. Move the lens toward or away from the cereal until it looks larger and in focus. Draw a picture of the cereal as you see it through the hand lens. Fill in details that you did not see before.
3. Look at the cereal through the smaller lens, which will magnify the cereal even more. If you notice more details, add them to your drawing.
4. Repeat this activity using objects you are studying in science. It might be a rock, some soil, or a seed.

Observe Seeds in a Petri Dish

Can you observe a seed as it sprouts? You can if it's in a petri dish. A petri dish is a shallow, clear, round dish with a cover.

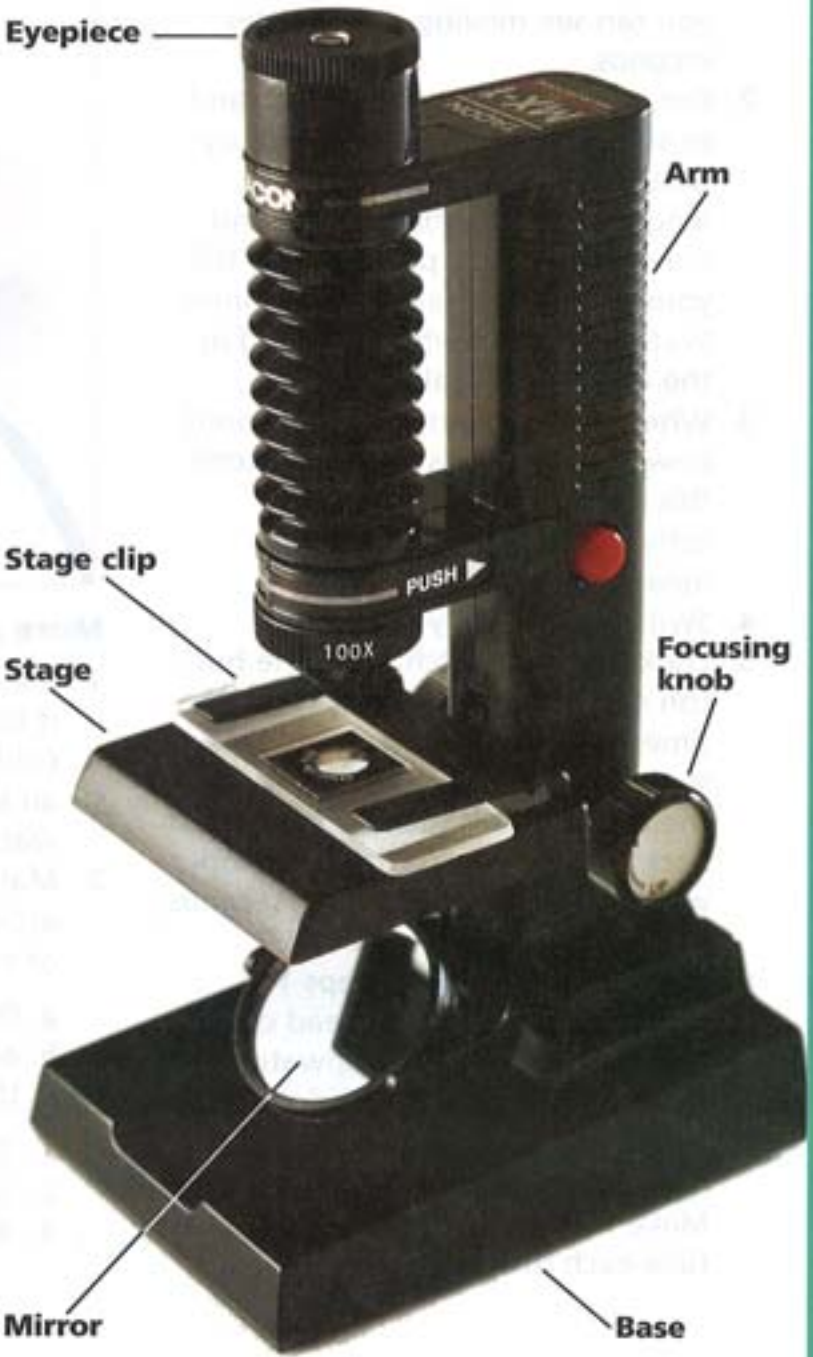
1. Line the sides and bottom of a petri dish with a double layer of filter paper or paper towel. You may have to cut the paper to make it fit.
2. Sprinkle water on the paper to wet it.
3. Place three or four radish seeds on the wet paper in different areas of the dish. Put the lid on the dish, and keep it in a warm place.
4. Observe the seeds every day for a week. Use a hand lens to look for a tiny root pushing through the seed. Record how long it takes each seed to sprout.

Use a Microscope

Hand lenses make objects look several times larger. A microscope, however, can magnify an object to look hundreds of times larger.

Examine Salt Grains

1. Look at the photograph to learn the different parts of your microscope.
2. Place the microscope on a flat surface. Always carry a microscope with both hands. Hold the arm with one hand, and put your other hand beneath the base.
3. Move the mirror so that it reflects light up toward the stage. Never point the mirror directly at the Sun or a bright light. Bright light can cause permanent eye damage.
4. Place a few grains of salt on the slide. Put the slide under the stage clips. Be sure that the salt grains you are going to examine are over the hole in the stage.
5. Look through the eyepiece. Turn the focusing knob slowly until the salt grains come into focus.
6. Draw what the grains look like through the microscope.
7. Look at other objects through the microscope. Try a piece of leaf, a human hair, or a pencil mark.

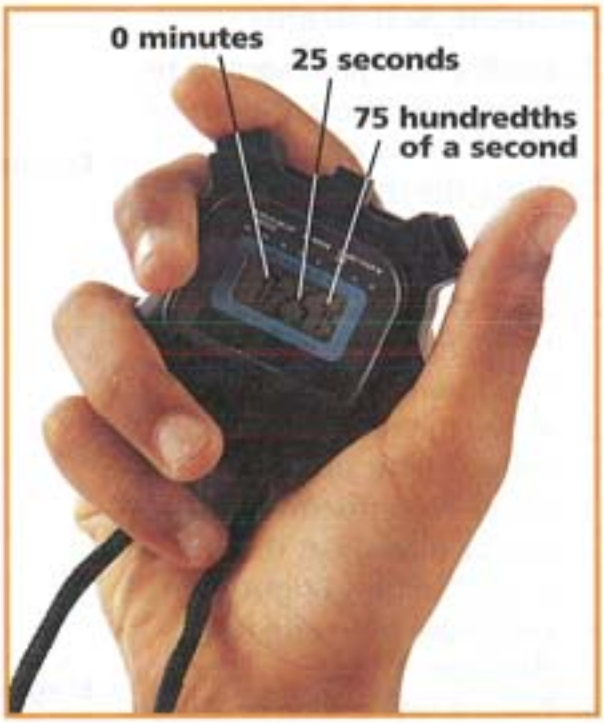


Measure Time

You use timing devices to measure how long something takes to happen. Some timing devices you use in science are a clock with a second hand and a stopwatch. Which one is more accurate?

Comparing a Clock and Stopwatch

1. Look at a clock with a second hand. The second hand is the hand that you can see moving. It measures seconds.
2. Get an egg timer with falling sand or some device like a wind-up toy that runs down after a certain length of time. When the second hand of the clock points to 12, tell your partner to start the egg timer. Watch the clock while the sand in the egg timer is falling.
3. When the sand stops falling, count how many seconds it took. Record this measurement. Repeat the activity, and compare the two measurements.
4. Switch roles with your partner.
5. Look at a stopwatch. Click the button on the top right. This starts the time. Click the button again. This stops the time. Click the button on the top left. This sets the stopwatch back to zero. Notice that the stopwatch tells time in minutes, seconds, and hundredths of a second.
6. Repeat the activity in steps 1–3, using the stopwatch instead of a clock. Make sure the stopwatch is set to zero. Click the top right button to start timing the reading. Click it again when the sand stops falling. Make sure you and your partner time each other twice.



More About Time

1. Use the stopwatch to time how long it takes an ice cube to melt under cold running water. How long does an ice cube take to melt under warm running water?
2. Match each of these times with the action you think took that amount of time.

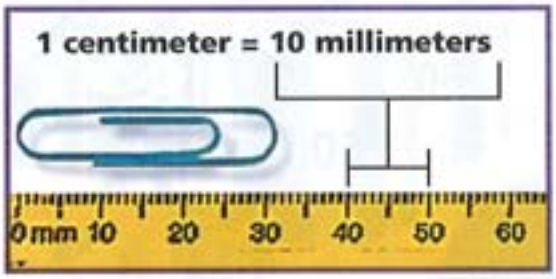
   a. 00:14:55
   b. 44:39:45
   c. 10:23:00

   1. Taking a shower
   2. Saying the Pledge of Allegiance
   3. Recess

Measure Length

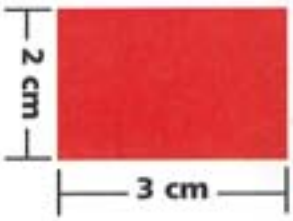
Find Length with a Ruler

1. Look at this section of a ruler. Each centimeter is divided into 10 millimeters. How long is the paper clip?
2. The length of the paper clip is 3 centimeters plus 2 millimeters. You can write this length as 3.2 centimeters.
3. Place the ruler on your desk. Lay a pencil against the ruler so that one end of the pencil lines up with the left edge of the ruler. Record the length of the pencil.
4. Trade your pencil with a classmate. Measure and record the length of each other's pencil. Compare your answers.



Measuring Area

Area is the amount of surface something covers. To find the area of a rectangle, multiply the rectangle's length by its width. For example, the rectangle here is 3 centimeters long and 2 centimeters wide. Its area is 3 cm x 2 cm = 6 square centimeters. You write the area as 6 cm^2.



Opposite sides of a rectangle are parallel. The adjacent sides are perpendicular to each other (at right angles). Rectangles have symmetry. When folded in half, both halves are identical in size and shape. This is known as congruence.The two halves fit over each other exactly.

Find Length with a Meterstick

1. Line up the meterstick with the left edge of the chalkboard. Make a chalk mark on the board at the right end of the meterstick.
2. Move the meterstick so that the left edge lines up with the chalk mark. Keep the stick level. Make another mark on the board at the right end of the meterstick.
3. Continue to move the meterstick and make chalk marks until the meterstick meets or overlaps the right edge of the board.
4. Record the length of the chalkboard in centimeters by adding all the measurements you've made. Remember, a meterstick has 100 centimeters.

Estimating Length

Try estimating the length of objects in the room. Then measure the length, and compare the estimation with the measurement.

Measure Mass

Mass is the amount of matter an object has. You use a balance to measure mass. To find the mass of an object, you balance it with objects whose masses you know. Let's find the mass of a box of crayons.

Measure the Mass of a Box of Crayons

1. Place the balance on a flat, level surface. Check that the two pans are empty and clean.
2. Make sure the empty pans are balanced with each other. The pointer should point to the middle mark. If it does not, move the slider a little to the right or left to balance the pans.
3. Gently place a box of crayons on the left pan. This pan will drop lower.
4. Add masses to the right pan until the pans are balanced.
5. Add the numbers on the masses that are in the right pan. The total is the mass of the box of crayons, in grams. Record this number. After the number write a *g* for "grams."

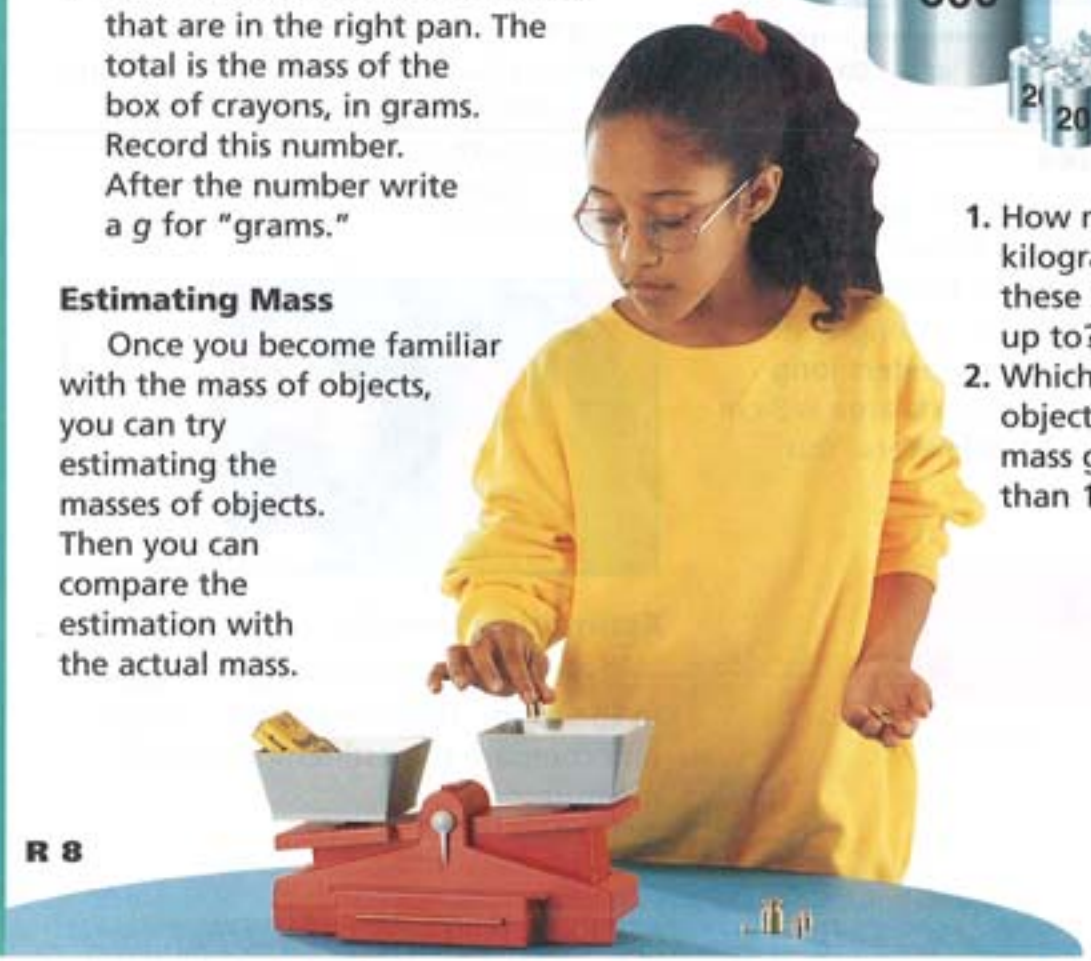
Estimating Mass

Once you become familiar with the mass of objects, you can try estimating the masses of objects. Then you can compare the estimation with the actual mass.

More About Mass

The mass of your crayons was probably less than 100 grams. You may not have enough masses to balance a pineapple. It has a mass of about 1,000 grams. That's the same as 1 kilogram, because *kilo* means "1,000."

1. How many kilograms do all these masses add up to?
2. Which of these objects have a mass greater than 1 kilogram?



Measure Volume

Volume is the amount of space something takes up. In science you usually measure the volume of liquids by using beakers and graduated cylinders. These containers are marked in milliliters (mL).

Measure the Volume of a Liquid

1. Look at the beaker and at the graduated cylinder. The beaker has marks for each 25 mL up to 200 mL. The graduated cylinder has marks for each 1 mL up to 100 mL.
2. The surface of the water in the graduated cylinder curves up at the sides. You measure the volume by reading the height of the water at the flat part. What is the volume of water in the graduated cylinder? How much water is in the beaker? They both contain 75 mL of water.
3. Pour 50 mL of water from a pitcher into a beaker.
4. Now pour the 50 mL of water into a graduated cylinder.

Find the Volume of a Solid

Here's a way to find the volume of a solid, such as a rock.

1. Start with 50 mL of water in a graduated cylinder.
2. Place a small rock in the water. The water level rises.
3. Measure the new water level. Subtract 50 mL from the new reading. The difference is the volume of the rock. Record the volume in cm^3.

Estimating Volume

Once you become familiar with the volumes of liquids and solids, you can estimate volumes. Estimate the amount of liquid in a glass or can. Estimate the volume of an eraser.

Measure Weight/Force

You use a spring scale to measure weight. An object has weight because the force of gravity pulls down on the object. Therefore, weight is a force. Weight is measured in newtons (N) like all forces.

Measure the Weight of an Object

1. Look at your spring scale to see how many newtons it measures. See how the measurements are divided. The spring scale shown here measures up to 5 N. It has a mark for every 0.1 N.
2. Hold the spring scale by the top loop. Put the object to be measured on the bottom hook. If the object will not stay on the hook, place it in a net bag. Then hang the bag from the hook.
3. Let go of the object slowly. It will pull down on a spring inside the scale. The spring is connected to a pointer. The pointer on the spring scale shown here is a small bar.
4. Wait for the pointer to stop moving. Read the number of newtons next to the pointer. This is the object's weight. The mug in the picture weighs 4 N.

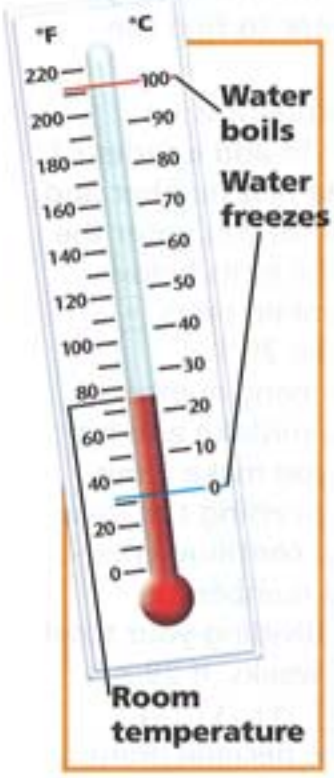
More About Spring Scales

You probably weigh yourself by standing on a bathroom scale. This is a spring scale. The force of your body stretches a spring inside the scale. The dial on the scale is probably marked in pounds—the English unit of weight. One pound is equal to about 4.5 newtons.

A bathroom scale, a grocery scale, and a kitchen scale are some other spring scales you may have seen.

Measure Temperature

You use a thermometer to measure temperature—how hot or cold something is. A thermometer is made of a thin tube with colored liquid inside. When the liquid gets warmer, it expands and moves up the tube. When the liquid gets cooler, it contracts and moves down the tube. You may have seen most temperatures measured in degrees Fahrenheit (°F). Scientists measure temperature in degrees Celsius (°C).



Read a Thermometer

1. Look at the thermometer shown here. It has two scales—a Fahrenheit scale and a Celsius scale.
2. What is the temperature shown on the thermometer? At what temperature does water freeze?

What Is Convection?

1. Fill a large beaker about two-thirds full of cool water. Find the temperature of the water by holding a thermometer in the water. Do not let the bulb at the bottom of the thermometer touch the sides or bottom of the beaker.
2. Keep the thermometer in the water until the liquid in the tube stops moving—about 1 minute. Read and record the temperature in °C.
3. Sprinkle a little fish food on the surface of the water in the beaker. Do not knock the beaker, and most of the food will stay on top.
4. Carefully place the beaker on a hot plate. A hot plate is a small electric stove. Plug in the hot plate, and turn the control knob to a middle setting.
5. After 1 minute measure the temperature of water near the bottom of the beaker. At the same time, a classmate should measure the temperature of water near the top of the beaker. Record these temperatures. Is water near the bottom of the beaker heating up faster than near the top?
6. As the water heats up, notice what happens to the fish food. How do you know that warmer water at the bottom of the beaker rises and cooler water at the top sinks?

Use Calculators

Sometimes after you make measurements, you have to analyze your data to see what it means. This might involve doing calculations with your data. A calculator helps you do time-consuming calculations.

Find an Average

After you collect a set of measurements, you may want to get an idea of a typical measurement in that set. What if, for example, you are doing a weather project? As part of the project, you are studying rainfall data of a nearby town. The table shows how much rain fell in that town each week during the summer.

Week	Rain (cm)
1	2.0
2	1.4
3	0.0
4	0.5
5	1.2
6	2.5
7	1.8
8	1.4
9	2.4
10	8.6
11	7.5

What if you want to get an idea of how much rain fell during a typical week in the summer? In other words, you want to find the average for the set of data. There are three kinds of averages—mean, median, and mode. Does it matter which one you use?

Find the Mean

The mean is what most people think of when they hear the word *average*. You can use a calculator to find the mean.

1. Make sure the calculator is on.
2. Add the numbers. To add a series of numbers, enter the first number and press [+]. Repeat until you enter the last number. See the hints below. After your last number, press [=]. Your total should be 29.3.
3. While entering so many numbers, it's easy to make a mistake and hit the wrong key. If you make a mistake, correct it by pressing the clear entry key, [CE]. Then continue entering the rest of the numbers.
4. Find the mean by dividing your total by the number of weeks. If 29.3 is displayed, press [÷] [1] [1] [=]. Rounded up to one decimal point, your mean should be 2.7.

Hints:

- If the only number to the right of the decimal point is 0, you don't have to enter it into the calculator. To enter 2.0, just press [2].
- If the only number to the left of the decimal point is 0, you don't have to enter it into the calculator. To enter 0.5, just press [.] [5].

Use Technology

Find the Median

The median is the middle number when the numbers are arranged in order of size. When the rainfall measurements are arranged in order of size, they look like this.

0.0
0.5
1.2
1.4
1.4
1.8 ——— The median is 1.8. This number is in the middle; there are five numbers above it and five numbers below it.
2.0
2.4
2.5
7.5
8.6

Find the Mode

The mode is the number that occurs most frequently. From the ranked set of data above, you can see that the most frequent number is 1.4. It occurs twice. Here are your three different averages from the same set of data.

Average Weekly Rainfall (cm)

Mean	2.7
Median	1.8
Mode	1.4

Why is the mean so much higher than the median or mode? The mean is affected greatly by the last two weeks when it rained a lot. A typical week for that summer was much drier than either of those last two weeks. The median or mode gives a better idea of rainfall for a typical week.

Find the Percent

Sometimes numbers are given as percents (%). *Percent* literally means "per hundred." For example, 28% means 28 out of 100. What if there are about 14,000 trees in the forest and 28% are over 50 years old? How many of them are over 50 years old? Use your calculator. You want to find 28% of 14,000. Press [1][4][0][0][0] [×] [2][8][%]. The answer should be 3,920.

Mathematical Operations

Addition and subtraction are reverse operations, or inverses of each other. For example:

$2 + 3 = 5$;
$5 - 3 = 2$;
$5 - 2 = 3$.

Similarly, multiplication and division are also inverses of each other. For example:

$6 \times 3 = 18$;
$18 \div 6 = 3$;
$18 \div 3 = 6$.

Mathematical Statements

Mathematical statements using symbols may be true only when the symbols are replaced by certain numbers. For example:

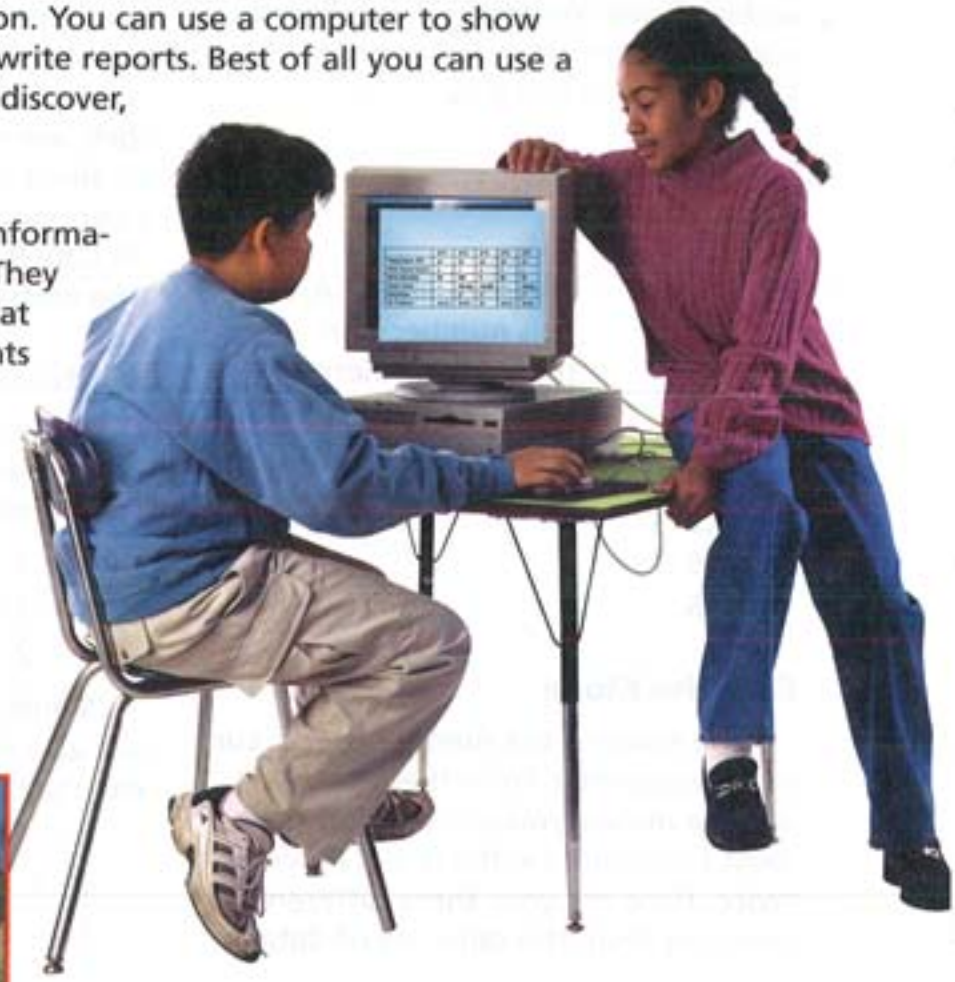
$A < B$

If $A = 2$ and $B = 3$, the statement is true.
If $A = 3$ and $B = 2$, the statement is false.

Use Computers

A computer has many uses. The Internet connects your computer to many other computers around the world, so you can collect all kinds of information. You can use a computer to show this information and write reports. Best of all you can use a computer to explore, discover, and learn.

You can also get information from CD-ROMs. They are computer disks that can hold large amounts of information. You can fit a whole encyclopedia on one CD-ROM.



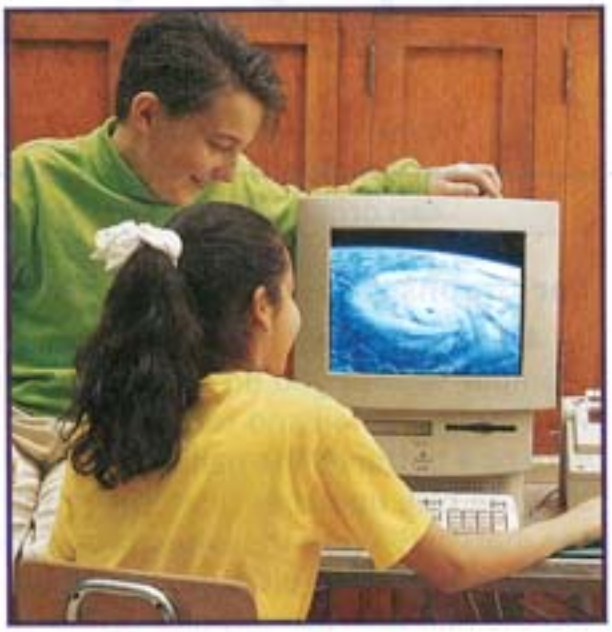
Use Computers for a Project

Here is how one group of students uses computers as they work on a weather project.

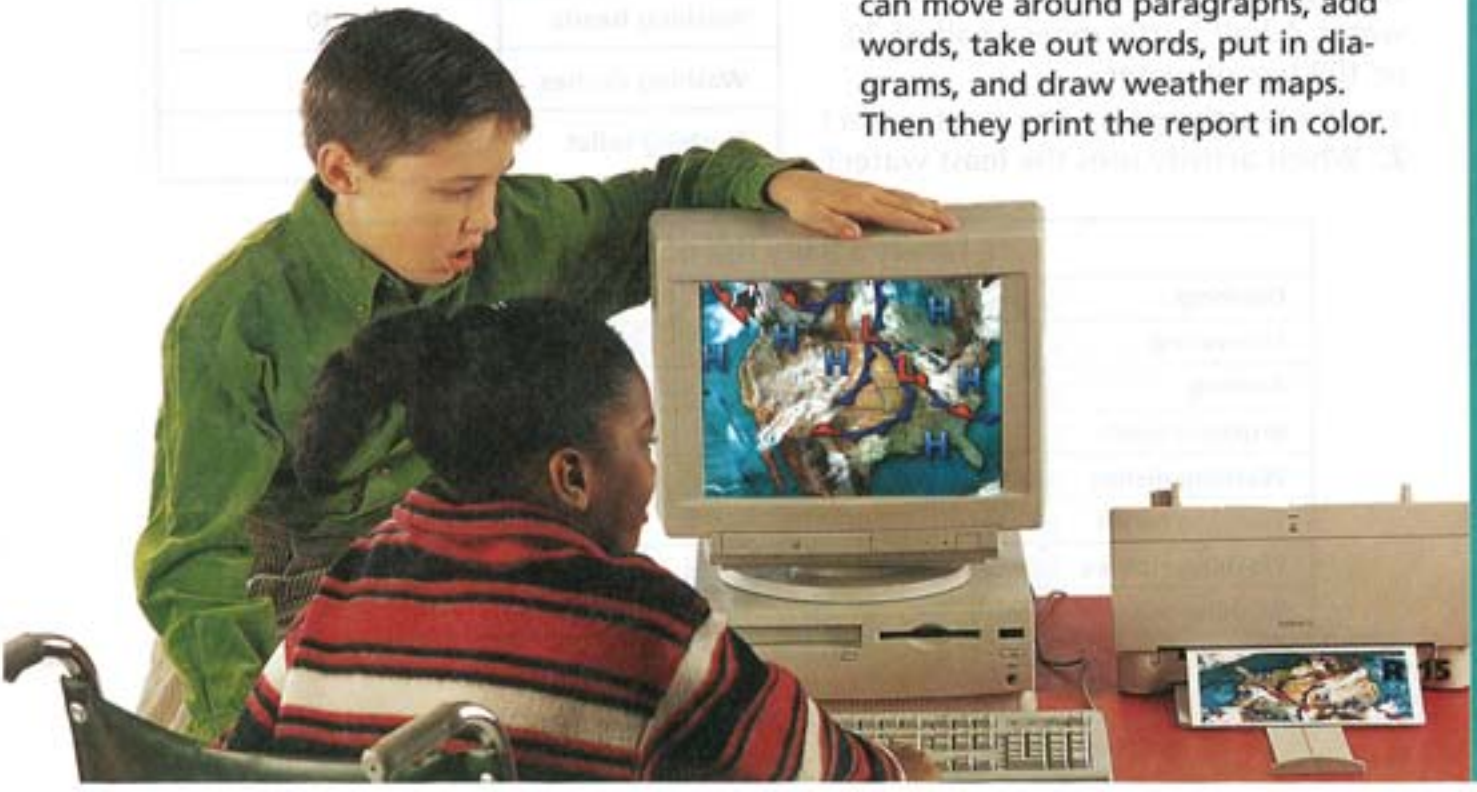
1. The students use instruments to measure temperature, wind speed, wind direction, and other parts of the weather. They input this information, or data, into the computer. The students keep the data in a table. This helps them compare the data from one day to the next.

Use Technology

2. The teacher finds out that another group of students in a town 200 kilometers to the west is also doing a weather project. The two groups use the Internet to talk to each other and share data. When a storm happens in the town to the west, that group tells the other group that it's coming their way.
3. The students want to find out more. They decide to stay on the Internet and send questions to a local TV weather forecaster. She has a Web site and answers questions from students every day.



4. Meanwhile some students go to the library to gather more information from a CD-ROM. The CD-ROM has an encyclopedia that includes movie clips. The clips give examples of different kinds of storms.
5. The students have kept all their information in a folder called Weather Project. Now they use that information to write a report about the weather. On the computer they can move around paragraphs, add words, take out words, put in diagrams, and draw weather maps. Then they print the report in color.

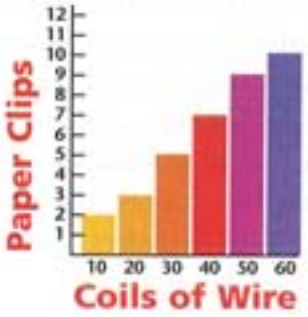


Make Graphs to Organize Data

When you do an experiment in science, you collect information. To find out what your information means, you can organize it into graphs. There are many kinds of graphs.

Bar Graphs

A bar graph uses bars to show information. For example, what if you do an experiment by wrapping wire around a nail and connecting the ends of the wire to a battery? The nail then becomes a magnet that can pick up paper clips. The graph shows that the more you wrap the wire around the nail, the more paper clips it picks up. How many paper clips did the nail with 20 coils pick up? With 50 coils?



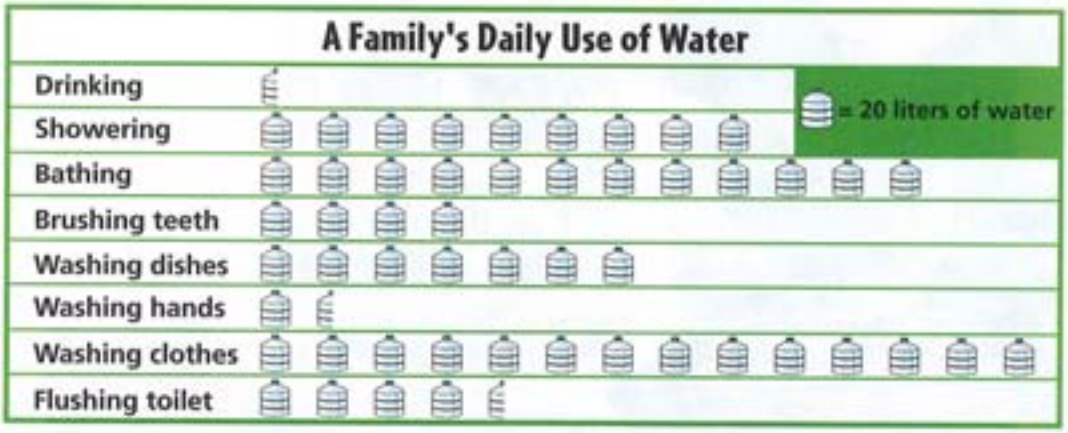
Pictographs

A pictograph uses symbols, or pictures, to show information. What if you collect information about how much water your family uses each day? The table shows what you find.

You can organize this information into the pictograph shown here. The pictograph has to explain what the symbol on the graph means. In this case each bottle means 20 liters of water. A half bottle means half of 20, or 10 liters of water.

1. Which activity uses the most water?
2. Which activity uses the least water?

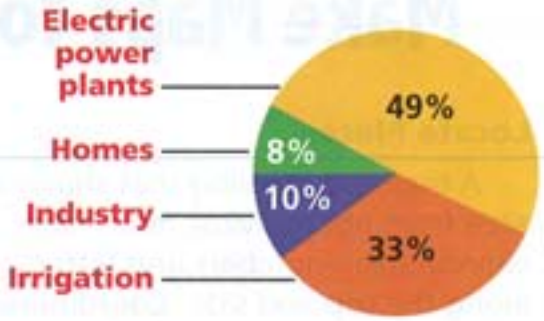
Activity	Water Used Each Day (L)
Drinking	10
Showering	180
Bathing	240
Brushing teeth	80
Washing dishes	140
Washing hands	30
Washing clothes	280
Flushing toilet	90



Represent Data

Circle Graphs

A circle graph is helpful to show how a complete set of data is divided into parts. The circle graph here shows how water is used in the United States. What is the single largest use of water?



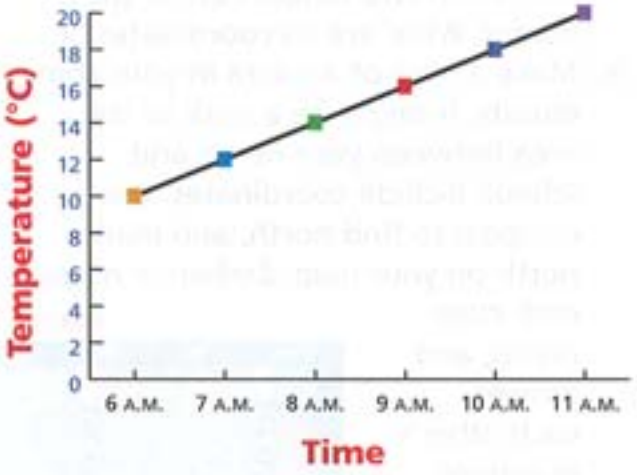
Line Graphs

A line graph shows information by connecting dots plotted on the graph. It shows change over time. For example, what if you measure the temperature out of doors every hour starting at 6 A.M.? The table shows what you find.

Time	Temperature (°C)
6 A.M.	10
7 A.M.	12
8 A.M.	14
9 A.M.	16
10 A.M.	18
11 A.M.	20

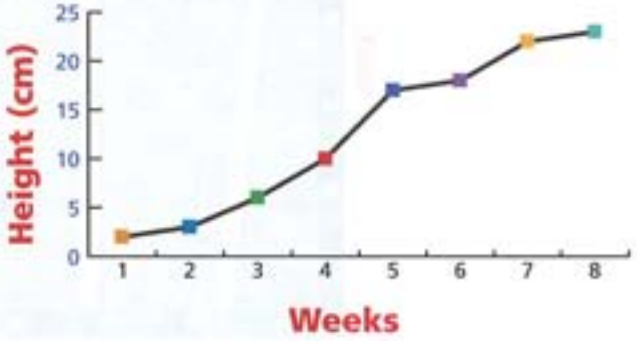
You can organize this information into a line graph. Follow these steps.

1. Make a scale along the bottom and side of the graph. The scales should include all the numbers in the chart. Label the scales.
2. Plot points on the graph. For example, place your finger at the "6 A.M." on the bottom line. Place a finger from your other hand on the "10" on the left line. Move your "6 A.M." finger up and your "10" finger to the right until they meet, and make a pencil point. Plot the other points in this way.
3. Connect the points with a line.



The line graph to the right organizes measurements you collected so that you can easily compare them.

1. Between which two weeks did the plant grow most?
2. When did plant growth begin to level off?

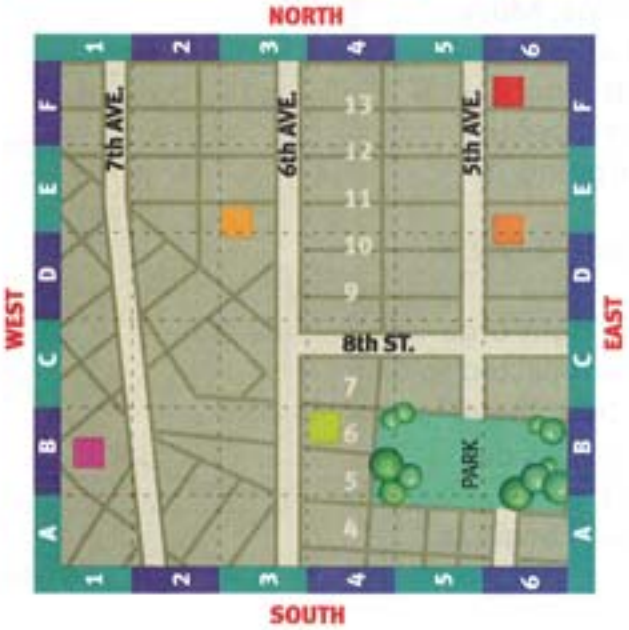


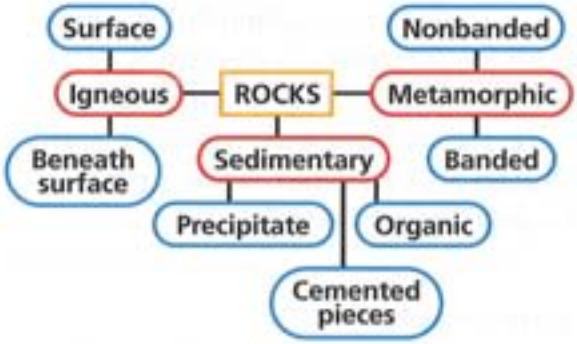
Make Maps to Show Information

Locate Places

A map is a drawing that shows an area from above. Most maps have coordinates—numbers and letters along the top and side. Coordinates help you find places easily. For example, what if you wanted to find the library on the map? It is located at B4. Place a finger on the letter B along the side of the map, and another finger on the number 4 at the top. Then move your fingers straight across and down the map until they meet. The library is located where the coordinates B and 4 meet, or very nearby.

1. What color building is located at F6?
2. The hospital is located three blocks north and two blocks east of the library. What are its coordinates?
3. Make a map of an area in your community. It might be a park or the area between your home and school. Include coordinates. Use a compass to find north, and mark north on your map. Exchange maps with classmates, and answer each other's questions.





Idea Maps

The map below shows how places are connected to each other. Idea maps, on the other hand, show how ideas are connected to each other. Idea maps help you organize information about a topic.

The idea map above connects ideas about rocks. This map shows that there are three major types of rock—igneous, sedimentary, and metamorphic. Connections to each rock type provide further information. For example, this map reminds you that igneous rocks are classified into those that form at Earth's surface and far beneath it.

Make an idea map about a topic you are learning in science. Your map can include words, phrases, or even sentences. Arrange your map in a way that makes sense to you and helps you understand the ideas.

Make Tables and Charts to Organize Information

Tables help you organize data during experiments. Most tables have columns that run up and down, and rows that run across. The columns and rows have headings that tell you what kind of data goes in each part of the table.

A Sample Table

What if you are going to do an experiment to find out how long different kinds of seeds take to sprout? Before you begin the experiment, you should set up your table. Follow these steps.

1. In this experiment you will plant 20 radish seeds, 20 bean seeds, and 20 corn seeds. Your table must show how many radish seeds, bean seeds, and corn seeds sprouted on days 1, 2, 3, 4, and 5.

2. Make your table with columns, rows, and headings. You might use a computer to make a table. Some computer programs let you build a table with just the click of a mouse. You can delete or add columns and rows if you need to.
3. Give your table a title. Your table could look like the one here.

Make a Table

Now what if you are going to do an experiment to find out how temperature affects the sprouting of seeds? You will plant 20 bean seeds in each of two trays. You will keep each tray at a different temperature, as shown below, and observe the trays for seven days. Make a table you can use for this experiment.

Make a Chart

A chart is simply a table with pictures as well as words to label the rows or columns.

HEALTH Handbook

The Human Body

Like all organisms, humans are made up of cells. In fact, the human body is made of trillions of cells. These cells are organized into tissues, a group of similar cells that perform a specific function. Tissues, in turn, form organs. Your heart and lungs are examples of organs. Finally, organs work together as part of organ systems. Your heart, for example, is part of the circulatory system.

Levels of Organization

- Cells
- Tissues
- Organs
- Organ Systems
- Organism

Including the skin, or integumentary system, the human body has 11 major organ systems. These body systems each have specific functions, and they also work together as parts of the human body as a whole.

Human Body Systems

System	Function
Nervous System	control
Skeletal System	support
Integumentary System	protection
Muscular System	movement
Circulatory System	transport
Respiratory System	oxygen/ carbon dioxide exchange
Digestive System	food absorption
Excretory System	waste removal
Endocrine System	regulation and control
Reproductive System	reproduction
Immune System	protection

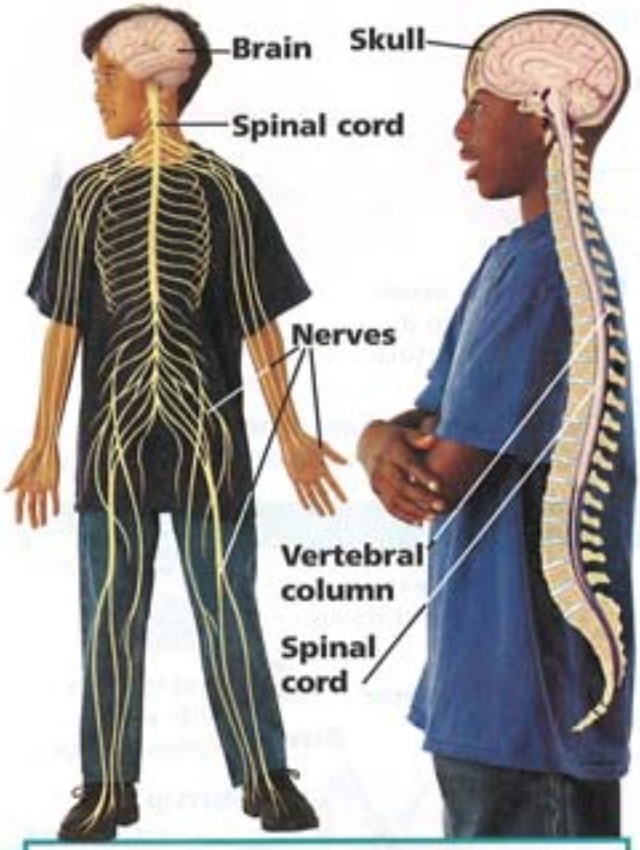
The Nervous System

The nervous system has two parts. The brain and the spinal cord are the central nervous system. All other nerves are the outer, or peripheral, nervous system.

The largest part of the brain is the cerebrum. A deep groove separates the right half, or hemisphere, of the cerebrum from the left half. Both the right and left hemispheres of the cerebrum contain control centers for the senses.

The cerebellum lies below the cerebrum. It coordinates the skeletal muscles so they work smoothly together. It also helps in keeping balance.

The brain stem connects to the spinal cord. The lowest part of the brain stem is the medulla. It controls heartbeat, breathing, blood pressure, and the muscles in the digestive system.



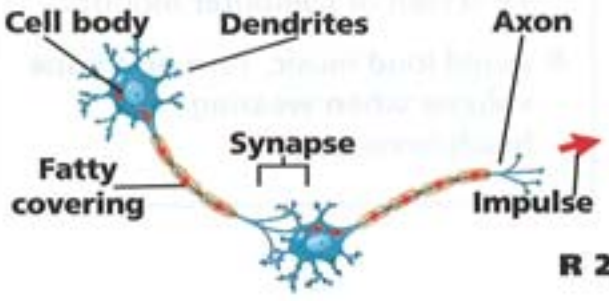
CARE!

- Wear protective headgear when you play sports or exercise.
- Stay away from drugs, such as stimulants, which can speed up the nervous system.
- Stay away from alcohol, which is a depressant and slows down the nervous system.

Parts of a Neuron

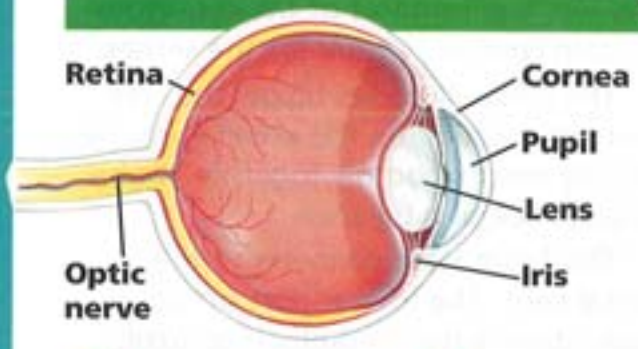
The nerves in the nervous system are made up of nerve cells called *neurons*. Each neuron has three main parts—a cell body, dendrites, and an axon. Dendrites are branching nerve fibers that carry impulses, or electrical signals, toward the cell body. An axon is a nerve fiber that carries impulses away from the cell body.

When an impulse reaches the tip of an axon, it must cross a tiny gap to reach the next neuron. This gap between neurons is called a *synapse*.

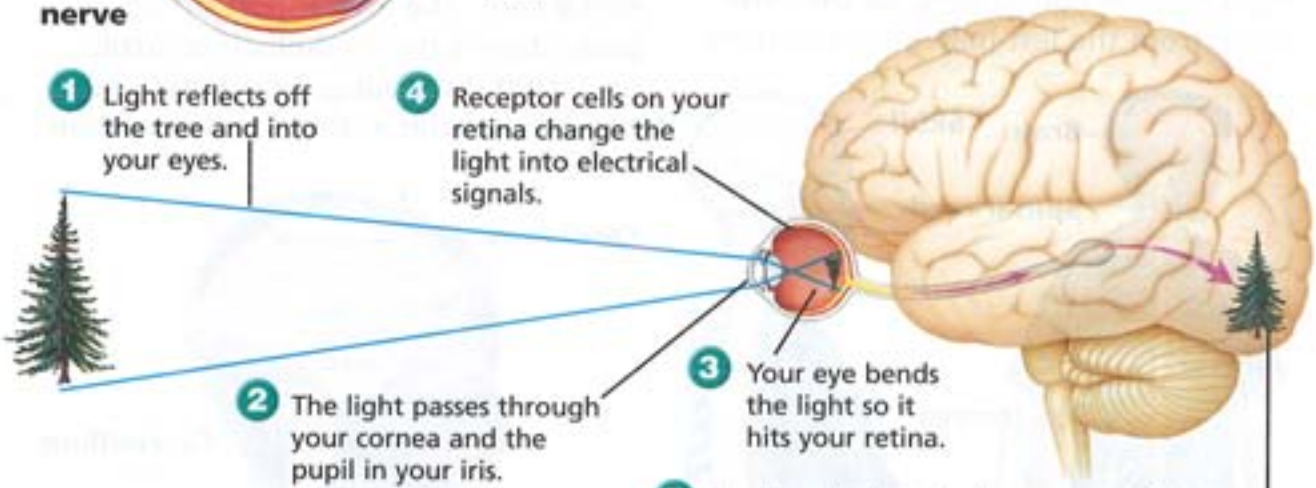


The Senses

Seeing



Light reflected from an object enters the eye and falls on the retina. Receptor cells change the light into electrical signals, or impulses. These impulses travel along the optic nerve to the vision center of the brain.



Hearing

Sound waves enter the ear and cause the eardrum to vibrate. Receptor cells in the ear change the sound waves into impulses that travel along the auditory nerve to the hearing center of the brain.

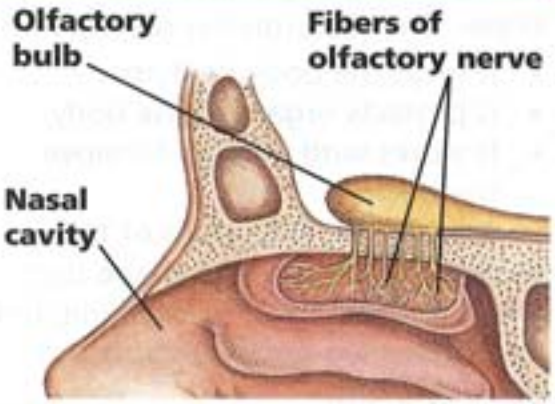
CARE!

- **To avoid straining your eye muscles, don't sit too close to the TV screen or computer monitor.**
- **Avoid loud music. Turn down the volume when wearing headphones.**

The Senses

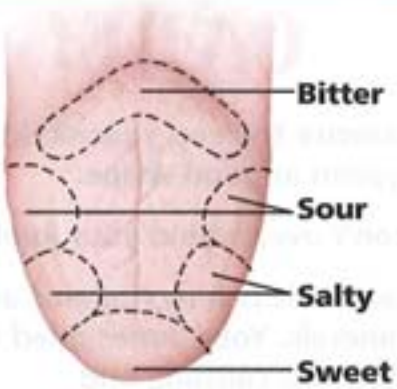
Smelling

The sense of smell is really the ability to detect chemicals in the air. When a person breathes, chemicals dissolve in mucus in the upper part of the nose. When the chemicals come in contact with receptor cells, the cells send impulses along the olfactory nerve to the smelling center of the brain.



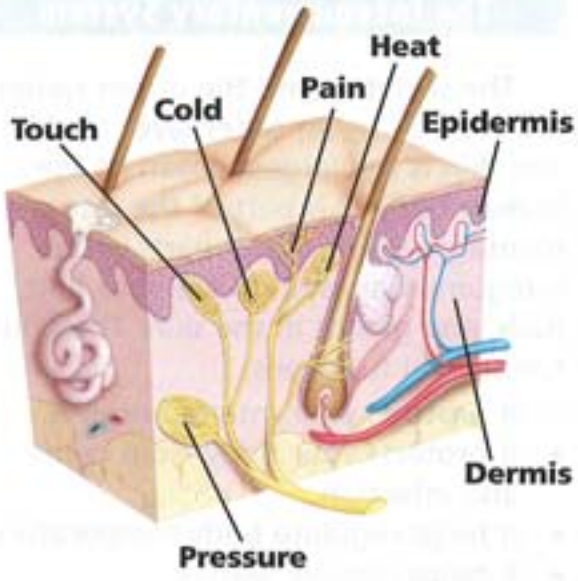
Tasting

When a person eats, chemicals in food dissolve in saliva. Saliva carries the chemicals to taste buds on the tongue. Inside each taste bud are receptors that can sense the four main tastes—sweet, sour, salty, and bitter. The receptors send impulses along a nerve to the taste center of the brain. The brain identifies the taste of the food, which is usually a combination of the four main tastes.



Touching

Receptor cells in the skin help a person tell hot from cold, wet from dry, and the light touch of a feather from the pressure of stepping on a stone. Each receptor cell sends impulses along sensory nerves to the spinal cord. The spinal cord then sends the impulses to the touch center of the brain.



CARE!

- **To prevent the spread of germs, always cover your mouth and nose when you cough or sneeze.**

The Skeletal System

The body has a supporting frame, called a skeleton, which is made up of bones. The skeleton has several jobs.

- It gives the body its shape.
- It protects organs in the body.
- It works with muscles to move the body.

Each of the 206 bones of the skeleton is the size and shape best fitted to do its job. For example, long and strong leg bones support the body's weight.

CARE!

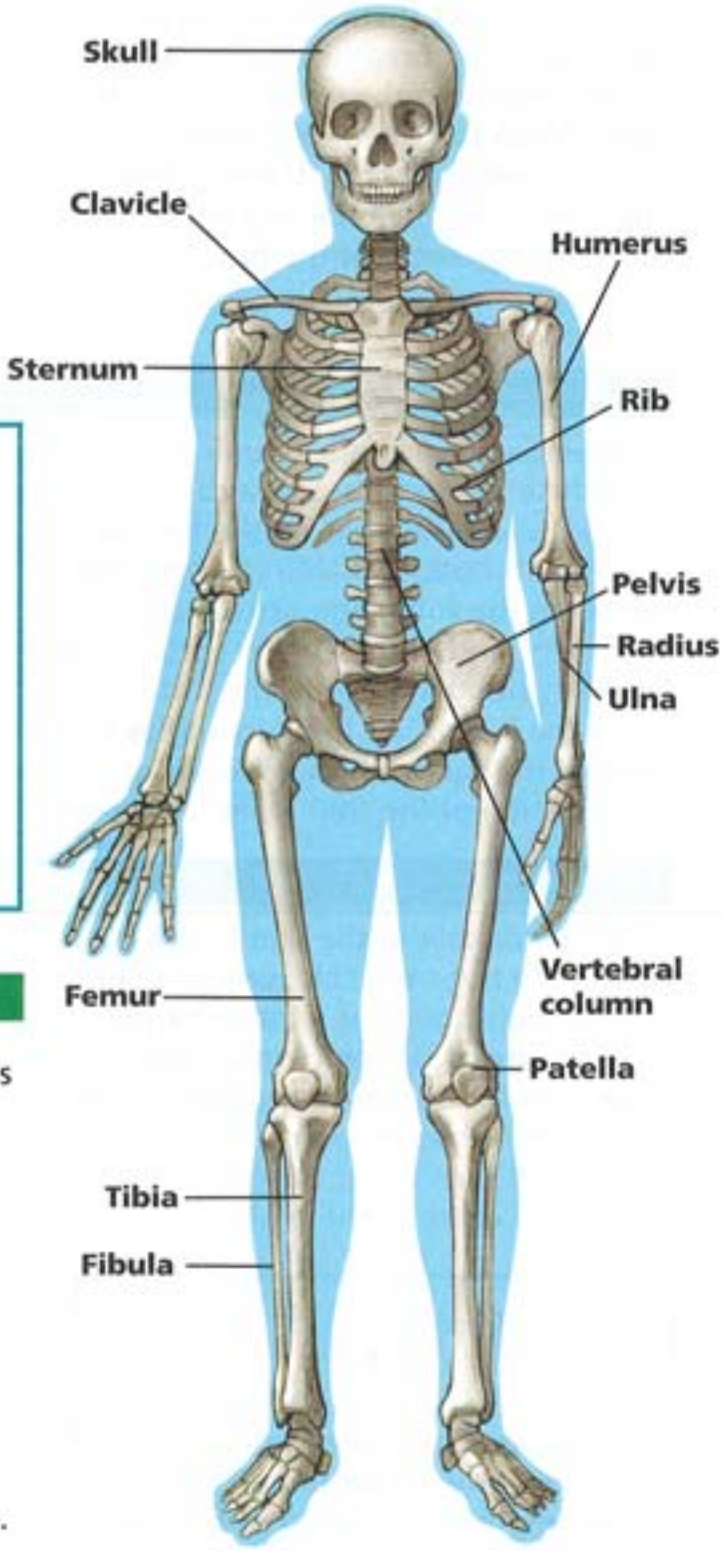
- **Exercise to keep your skeletal system in good shape.**
- **Don't overextend your joints.**
- **Eat foods rich in vitamins and minerals. Your bones need the minerals, calcium, and phosphorus to grow strong.**

The Integumentary System

The skeleton and the organ systems are covered by an outer layer of skin. The skin is the largest organ of the human body. It is part of the integumentary system. Other parts of the integumentary system are your hair, nails, and glands in the skin. The skin has several functions.

- It protects your internal organs.
- It protects your body from injury and infection.
- It helps regulate body temperature.
- It helps remove wastes.

The Skeleton



Joints

The skeleton has different types of joints. A joint is a place where two or more bones meet. Joints can be classified into three major groups—immovable joints, partly movable joints, and movable joints.

Types of Joints

Immovable Joints

Head

Immovable joints are places where bones fit together too tightly to move. Nearly all the 29 bones in the skull meet at immovable joints. Only the lower jaw can move.

Partly Movable Joints

Partly movable joints are places where bones can move only a little. Ribs are connected to the sternum, or breastbone, with these joints.

Sternum

Ribs

Movable Joints

Movable joints are places where bones can move easily.

Gliding joint

Hand and wrist

Small bones in the wrists and ankles meet at gliding joints. The bones can slide against one another. These joints allow some movement in all directions.

Ball-and-socket joint

The hips are examples of ball-and-socket joints. The ball of one bone fits into the socket, or cup, of another bone. These joints allow bones to move back and forth, in a circle, and side to side.

Hip

Hinge joint

Knee

The knees are hinge joints. A hinge joint is similar to a door hinge. It allows bones to move back and forth in one direction.

Pivot joint

The joint between the skull and neck is a pivot joint. It allows the head to move up and down, and side to side.

Neck

The Muscular System

Three types of muscles make up the body—skeletal muscle, cardiac muscle, and smooth muscle.

The muscles that are attached to and move bones are called *skeletal muscles.* These muscles are attached to bones by a tough cord called a *tendon.* Skeletal muscles pull bones to move them. Muscles do not push bones.

Cardiac muscles are found in only one place in the body—the heart. The walls of the heart are made of strong cardiac muscles. When cardiac muscles contract, they squeeze blood out of the heart. When cardiac muscles relax, the heart fills with more blood.

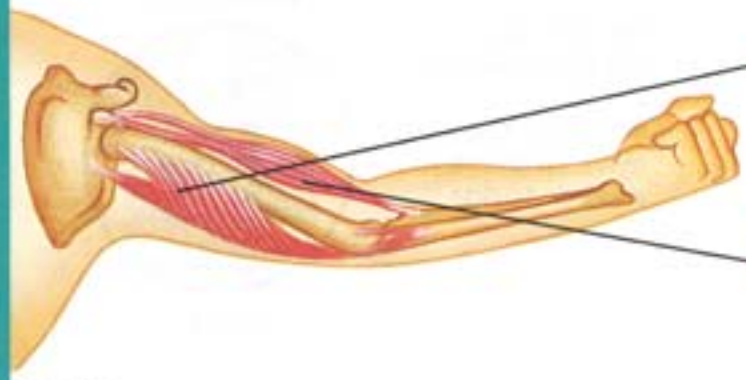
Smooth muscles make up internal organs and blood vessels. Smooth muscles in the lungs help a person breathe. Those in the blood vessels help control blood flow around the body.

CARE!

- **Exercise to strengthen your muscles.**
- **Eat the right foods.**
- **Get plenty of rest.**
- **Never take steroids unless your doctor tells you to.**

1. A message from your brain causes this muscle, called the biceps (BIGH-seps), to contract. When a muscle contracts, it becomes shorter and thicker. As the biceps contracts, it pulls on the arm bone it is attached to.

2. Most muscles work in pairs to move bones. This muscle, called the triceps (TRIGH-seps), relaxes when the biceps contracts. When a muscle relaxes, it becomes longer and thinner.



3. To straighten your arm, a message from your brain causes the triceps to contract. When the triceps contracts, it pulls on the bone it is attached to.

4. As the triceps contracts, the biceps relaxes. Your arm straightens.

Stimulus and Response

The nervous system, the skeletal system, and the muscular system work together to help you adjust to your surroundings. Anything in the environment that requires your body to adjust is called a *stimulus* (plural: stimuli). A reaction to a stimulus is called a *response*.

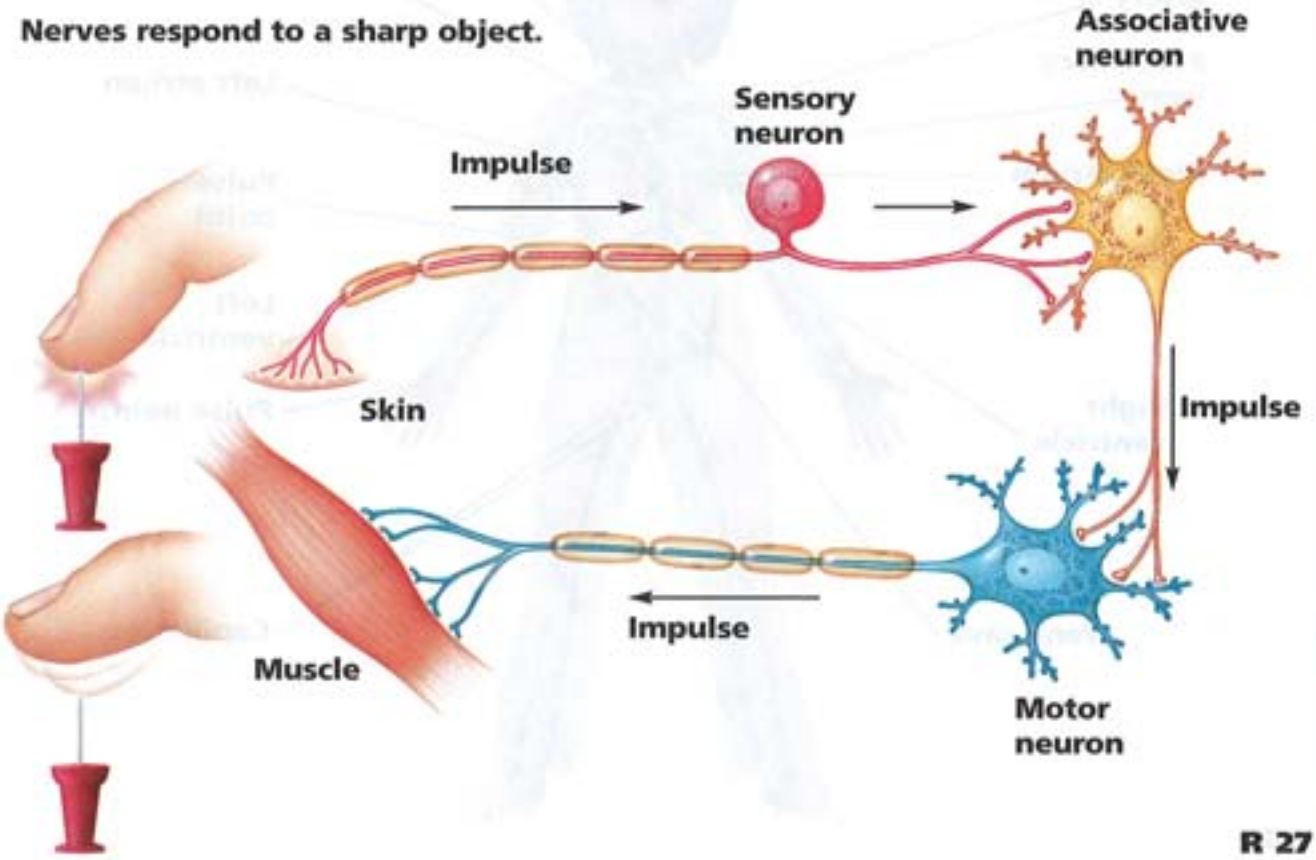
As you learned, nerve cells are called *neurons*. There are three kinds of neurons: sensory, associative, and motor. Each kind does a different job to help your body respond to stimuli.

- The job of your sensory neurons is to collect information from stimuli and send it to your brain and spinal cord. When you touch a sharp tack, sensory neurons alert your brain. The sensory neurons carry the message that your finger has touched a tack (stimulus) to the associative neurons in the brain and spinal cord.
- Associative neurons pass impulses from sensory to motor neurons. The message is interpreted and sent to the motor neurons.
- Motor neurons carry impulses from your brain and spinal cord to your muscles. The motor neurons cause your finger to move away from the tack (response).

In addition to responding to external stimuli, your body also responds to internal changes. Your body regulates its internal environment to maintain a stable condition for survival. This is called a *steady-state* condition.

Nerve Response

Nerves respond to a sharp object.



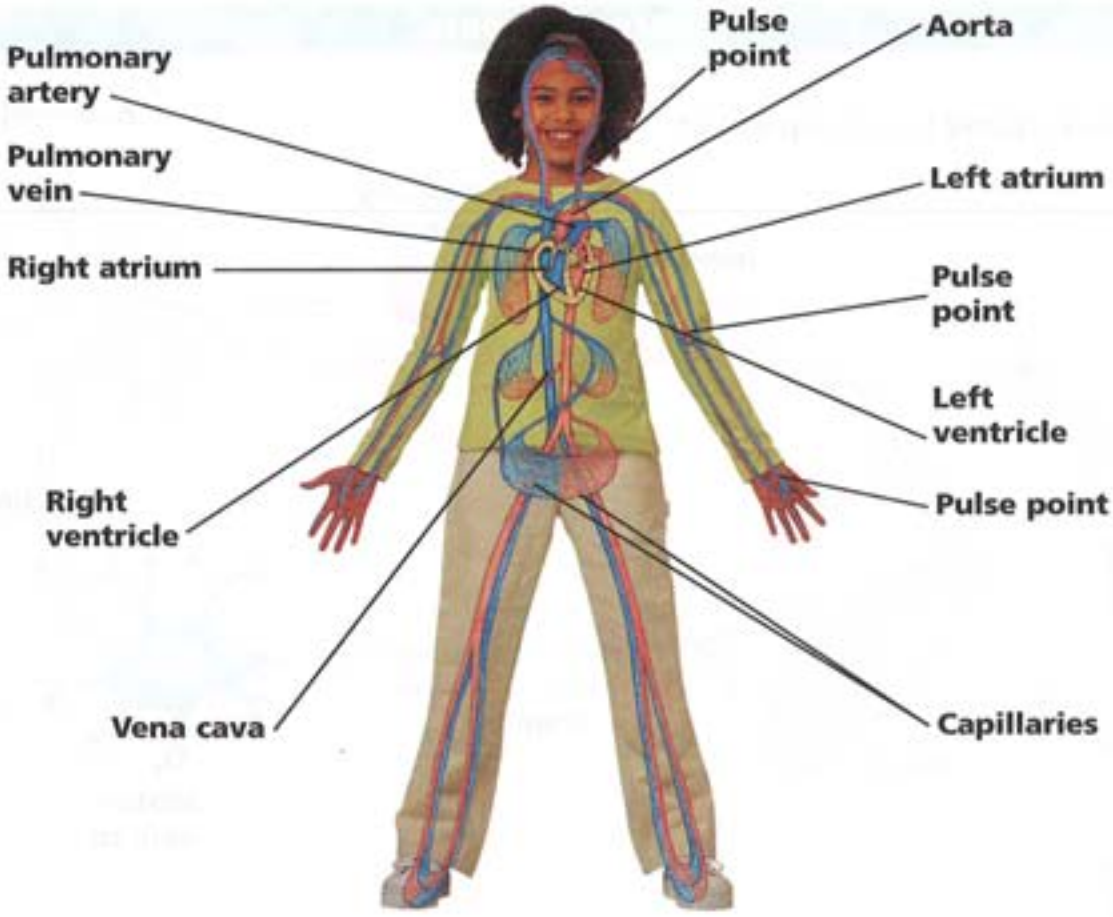
The Circulatory System

The circulatory system consists of the heart, blood vessels, and blood. Circulation is the flow of blood through the body. Blood is a liquid that contains red blood cells, white blood cells, and platelets. Red blood cells carry oxygen and nutrients to cells. White blood cells work to fight germs that enter the body. Platelets are cell fragments that make the blood clot.

The heart is a muscular organ about the size of a fist. It beats about 70 to 90 times a minute, pumping blood through the blood vessels. Arteries carry blood away from the heart. Some arteries carry blood to the lungs, where the cells pick up oxygen. Other arteries carry oxygen-rich blood from the lungs to all other parts of the body. Veins carry blood from other parts of the body back to the heart. Blood in most veins carries the wastes released by cells and has little oxygen. Blood flows from arteries to veins through narrow vessels called capillaries.

Pulse Rate and Pulse Points

You can tell how fast your heart is beating by checking your *pulse rate*. Take your pulse by putting the first and second fingers of one hand on the inside of the wrist of the other hand, just below the thumb. What you feel is the blood being pumped by your heart through arteries that lie close to the surface of the skin. Count the number of times you feel your heart pump in one minute. This is your pulse rate.



The Heart

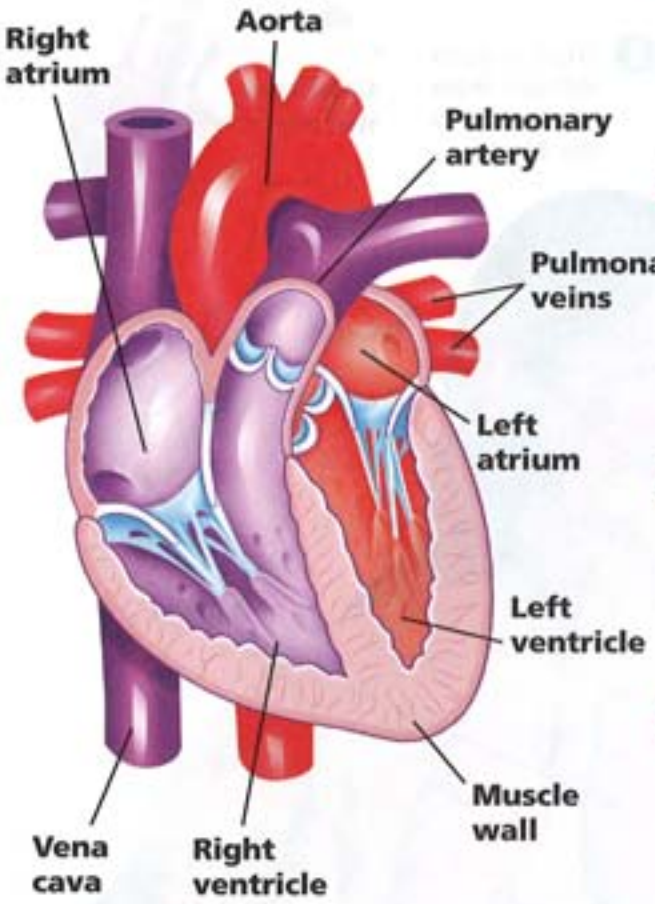
The heart has two sides, right and left, separated by a thick muscular wall. Each side has two chambers for blood. The upper chamber is the atrium. The lower chamber is the ventricle. Blood enters the heart through the vena cava. It leaves the heart through the aorta.

The pulmonary artery carries blood from the body into the lungs. Here carbon dioxide leaves the blood to be exhaled by the lungs. Fresh oxygen enters the blood to be carried to every cell in the body. Blood returns from the lungs to the heart through the pulmonary veins.

CARE!

- **Don't smoke. The nicotine in tobacco makes the heart beat faster and work harder to pump blood.**
- **Never take illegal drugs, such as cocaine or heroin. They can damage the heart and cause heart failure.**

How the Heart Works



To the Lungs

1. The right atrium fills.
2. Right atrium squeezes blood into right ventricle.
3. Right ventricle squeezes blood into pulmonary artery.

From the Lungs

1. The left atrium fills.
2. Left atrium squeezes blood into left ventricle.
3. Left ventricle squeezes blood into aorta.

The Respiratory System

The process of getting and using oxygen in the body is called respiration. When a person inhales, air is pulled into the nose or mouth. The air travels down into the trachea. In the chest the trachea divides into two bronchial tubes. One bronchial tube enters each lung. Each bronchial tube branches into smaller tubes called bronchioles.

At the end of each bronchiole are tiny air sacs called alveoli. The alveoli exchange carbon dioxide for oxygen.

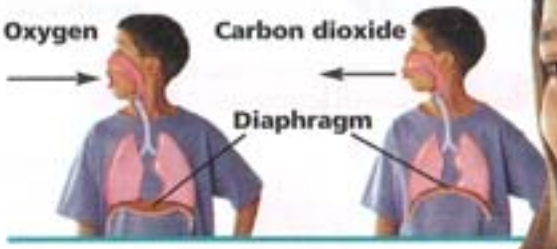
Oxygen comes from the air a person breathes. Two main muscles control breathing. One is located between the ribs. The other is a dome-shaped sheet of muscle called the diaphragm.

To inhale, the diaphragm contracts and pulls down. Other muscles pull the ribs up and out. This makes more room in the chest. Air rushes into the lungs and fills the space.

To exhale, the diaphragm relaxes and returns to its dome shape. The lungs get smaller and force the air out.

CARE!

- **Don't smoke. Smoking damages your respiratory system.**
- **Exercise to strengthen your breathing muscles.**
- **If you ever have trouble breathing, tell an adult at once.**

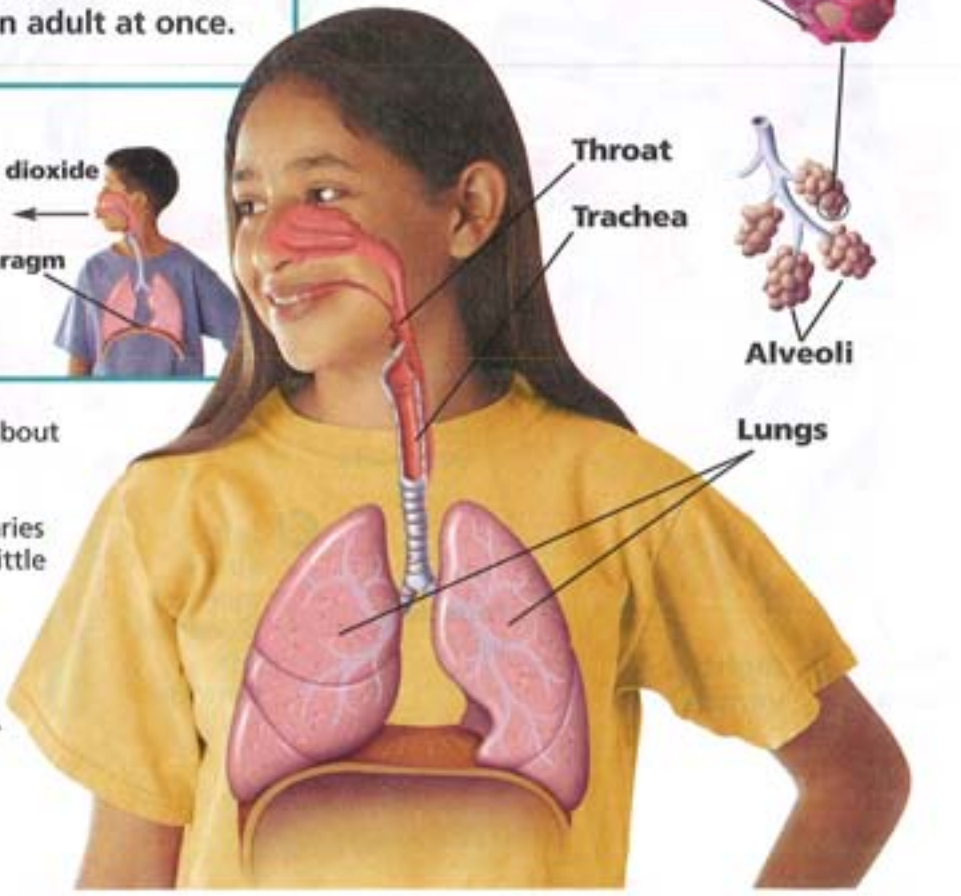


The air you breathe is about 21 percent oxygen.

The blood in the capillaries of your lungs has very little oxygen.

The blood has a higher concentration of carbon dioxide than air.

1. Carbon dioxide diffuses into the alveoli. From there it is exhaled.
2. Fresh oxygen diffuses from the alveoli to the blood.



Effects of Exercise

Any type of exercise uses your muscles. When you exercise, your muscles need three things:

- They need oxygen.
- They need to remove wastes.
- They need to get rid of heat.

When you exercise, several things happen to your body. Your heart beats faster, you breathe heavier and faster, and you sweat.

If you are going to be exercising for more than a couple of minutes, your body needs to get oxygen to the muscles or the muscles will stop working. Your body increases the flow of oxygen-rich blood to working muscle as follows:

- Your rate and depth of breathing increase to take in more oxygen.
- Your heart beats faster so that it can pump more oxygen-rich blood to the muscles.

Sweating helps remove both wastes and heat that result from exercise.

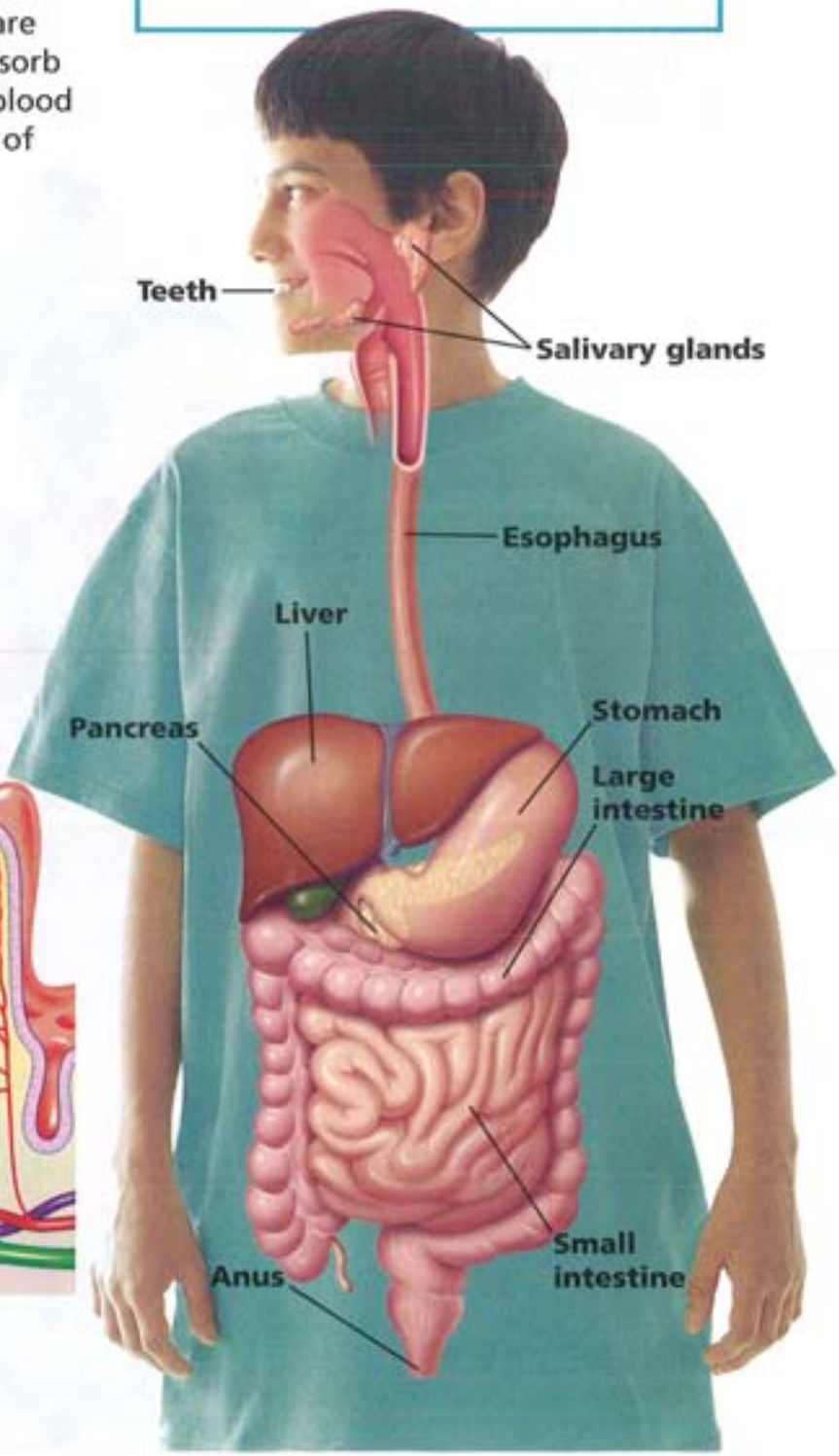
The Digestive System

Digestion is the process of breaking down food into simple substances the body can use. Digestion begins when a person chews food. Chewing breaks the food down into smaller pieces and moistens it with saliva. Saliva is produced by the salivary glands.

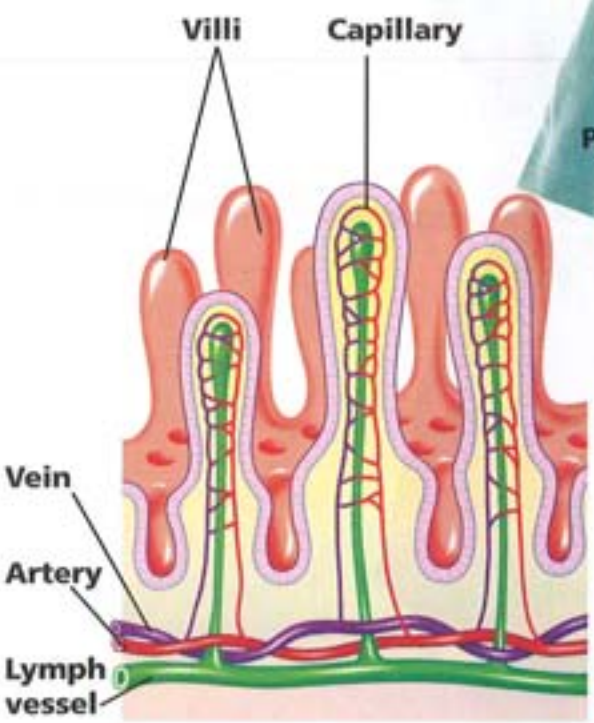
Digested food is absorbed in the small intestine. The walls of the small intestine are lined with villi. Villi are tiny fingerlike projections that absorb digested food. From the villi the blood transports nutrients to every part of the body.

CARE!

- Chew your food well.
- Drink plenty of water to help move food through your digestive system.



The shape of the small intestine's villi increases the amount of nutrients that can be absorbed from the food.

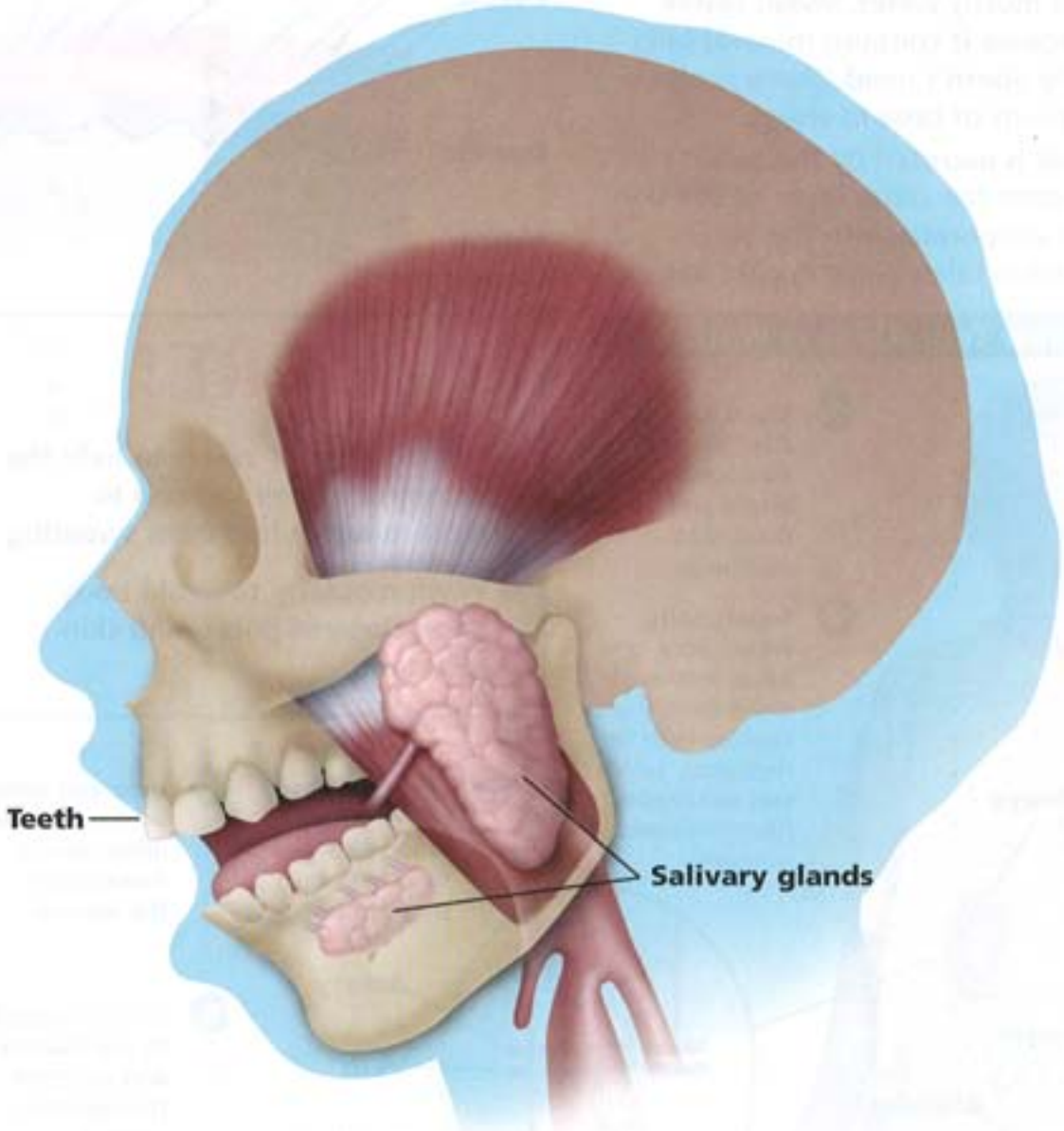


The Digestive System

Mechanical and Chemical Digestion

Digestion is both mechanical and chemical. Chewing is the first step in digestion. Chewing is *mechanical digestion*, the physical process of breaking food down into smaller pieces. As you chew, saliva begins to break the food into simpler molecules. This is *chemical digestion*.

After you swallow your food, both mechanical and chemical digestion continue in the stomach. Stomach muscles churn food particles into smaller pieces. Glands lining the stomach produce strong digestive juices.



The Excretory System

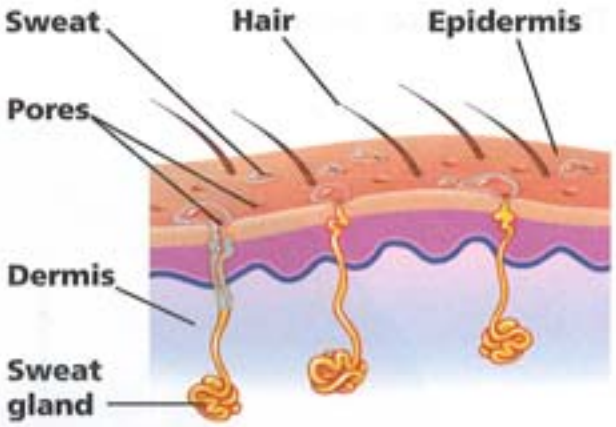
Excretion is the process of removing waste products from the body. The liver filters wastes from the blood and converts them into urea. Urea is then carried to the kidneys for excretion. Each kidney contains more than a million nephrons. Nephrons are structures in the kidneys that filter blood.

The skin takes part in excretion when a person sweats. Glands in the inner layer of the skin produce sweat. Sweat is mostly water. Sweat tastes salty because it contains mineral salts the body doesn't need. There is also a tiny amount of urea in sweat.

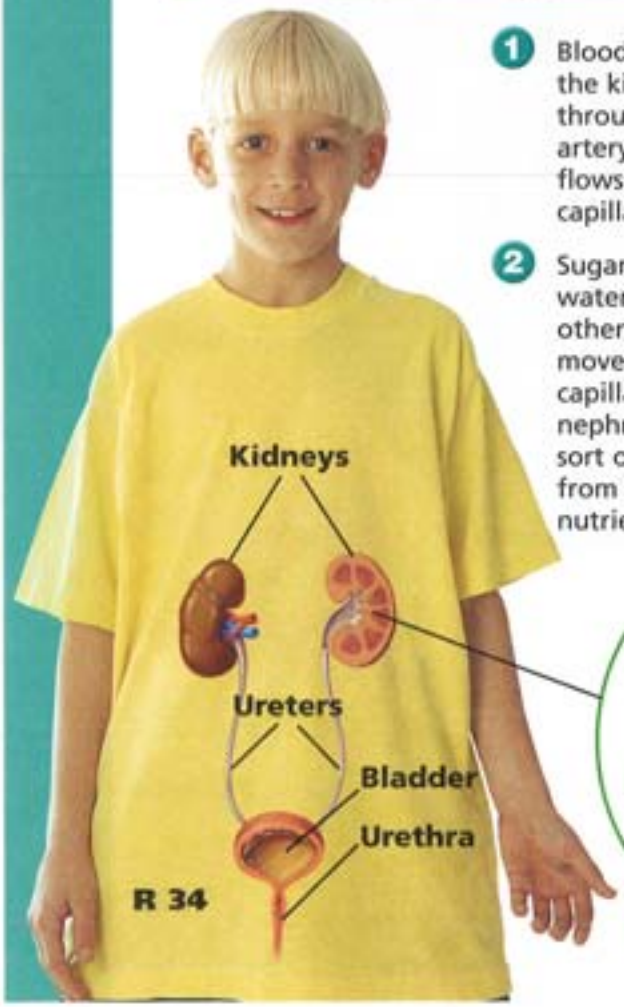
Sweat is excreted by the sweat glands onto the outer layer of the skin. There it evaporates into the air. Evaporation takes place in part because of body heat. When sweat evaporates, a person feels cooler. On hot days or when exercising, a person sweats more to keep the body from overheating.

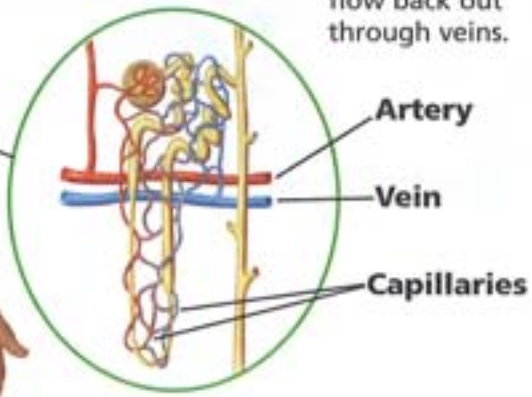
How You Sweat

Glands under your skin push sweat up to the surface, where it collects.



How Your Kidneys Work





1. Blood enters the kidney through an artery and flows into capillaries.
2. Sugars, salts, water, urea, and other wastes move from the capillaries to tiny nephrons, which sort out wastes from the useful nutrients.
3. The nutrients return to the blood and flow back out through veins.
4. Urea and other wastes become urine, which flows down the ureters.
5. Urine is stored in the bladder and excreted through the urethra.

CARE!

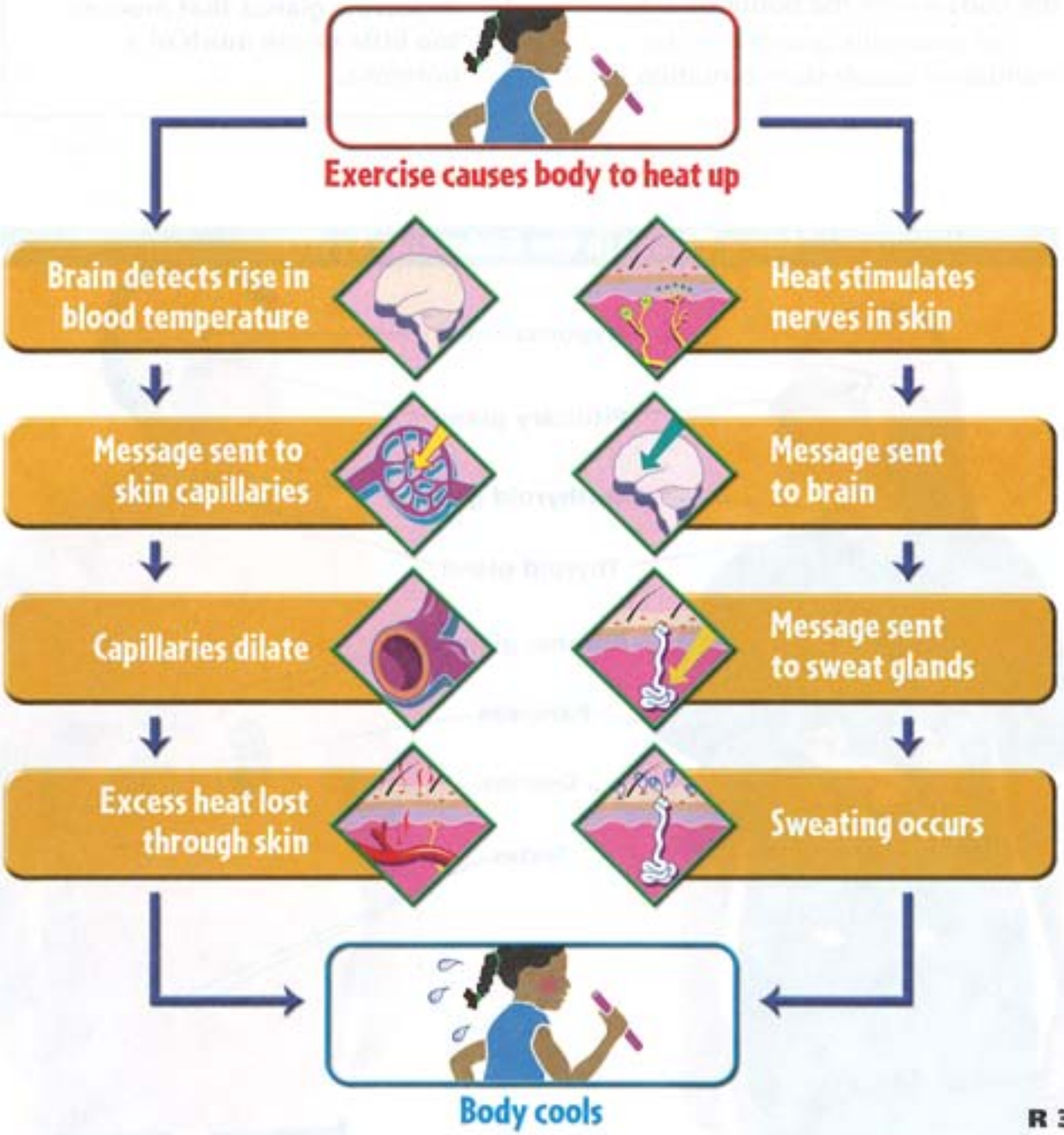
- **Drink plenty of water to help the kidneys do their job and to replace water loss from sweating.**
- **Wash regularly to avoid body odor, clogged pores, and skin irritation.**

The Excretory System

Removing Excess Heat

In addition to waste removal, one of the skin's most important jobs is to maintain internal body temperature. The skin does this by removing excess heat. Two things happen when you exercise: your face gets red and you sweat. Both are ways of getting rid of excess heat.

The nervous system, the circulatory system, and the skin all work together to regulate body temperature. The diagram below shows what happens when your body heats up as a result of exercise.



The Endocrine System

Hormones are chemicals that control body functions. A gland that produces hormones is called an endocrine gland. Sweat from sweat glands flows out of tubes called ducts. Endocrine glands have no ducts.

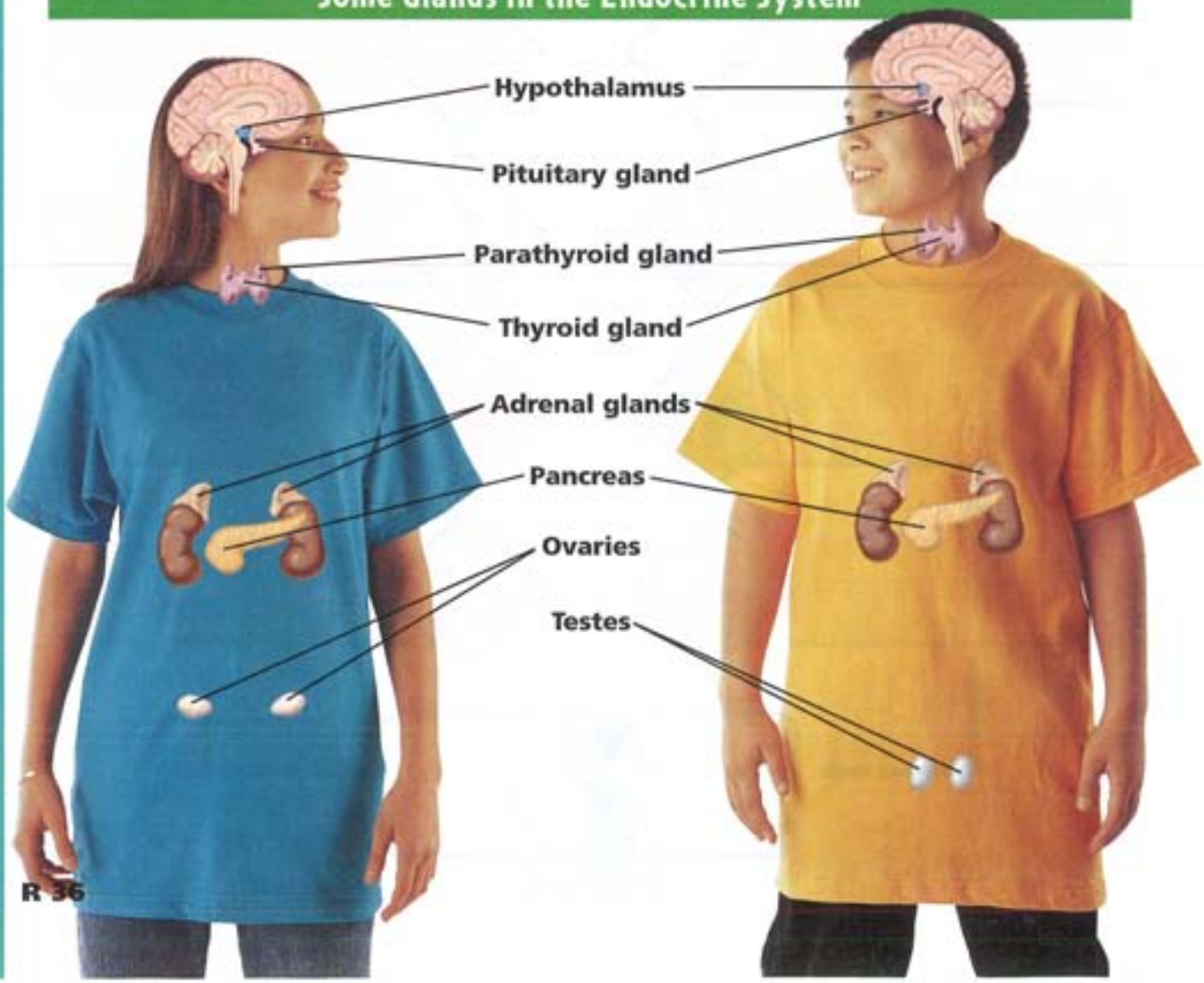
The endocrine glands are scattered around the body. Each gland makes one or more hormones. Every hormone seeks out a target organ, the place in the body where the hormone acts.

The endocrine glands help to maintain a *steady-state* condition in your body. They can turn the production of hormones on or off when they sense that too little or too much is being produced.

CARE!

- **Doctors can treat many diseases, such as diabetes, caused by endocrine glands that produce too little or too much of a hormone.**

Some Glands in the Endocrine System



The Reproductive System

The testes are the male reproductive organs. At puberty the testes begin to produce sperm. Sperm move through sperm ducts, where they mix with fluid from endocrine glands.

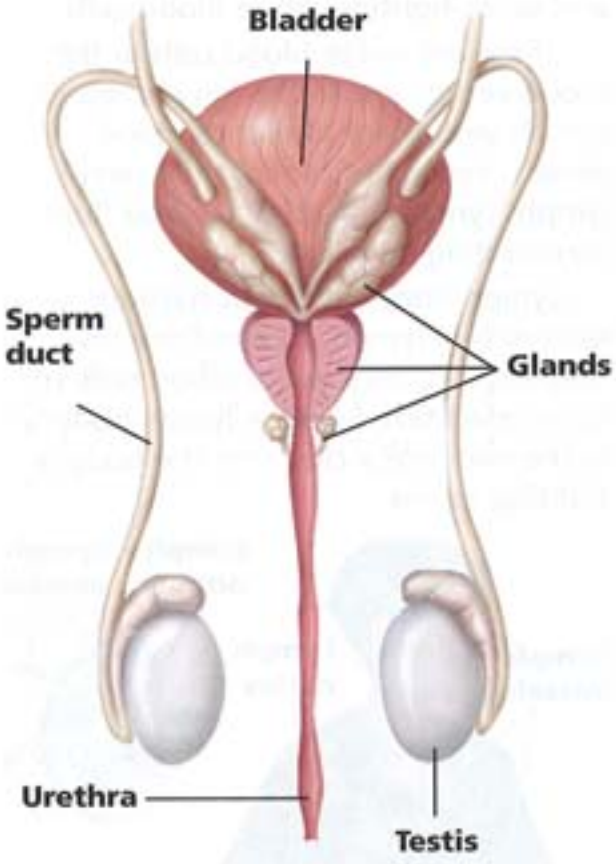
The ovaries are the female reproductive organs, which contain eggs. After puberty one mature egg is released about once every 28 days. The egg moves to the oviduct, a narrow tube leading from the ovary.

CARE!

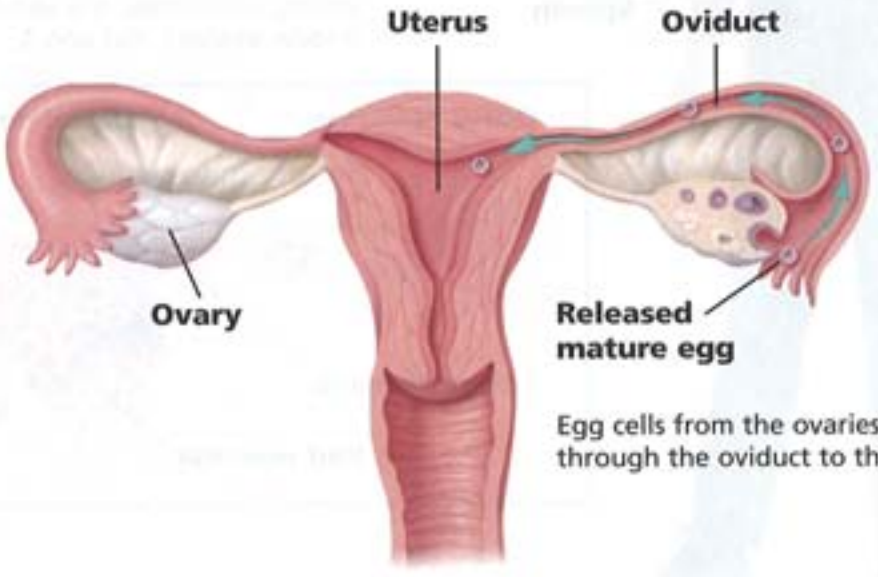
- **Abstinence is the only sure way to avoid sexually transmitted diseases.**

The Male Reproductive System

Sperm move from the testes through sperm ducts, where they mix with fluid from the glands. The sperm and fluid move through the urethra.



The Female Reproductive System



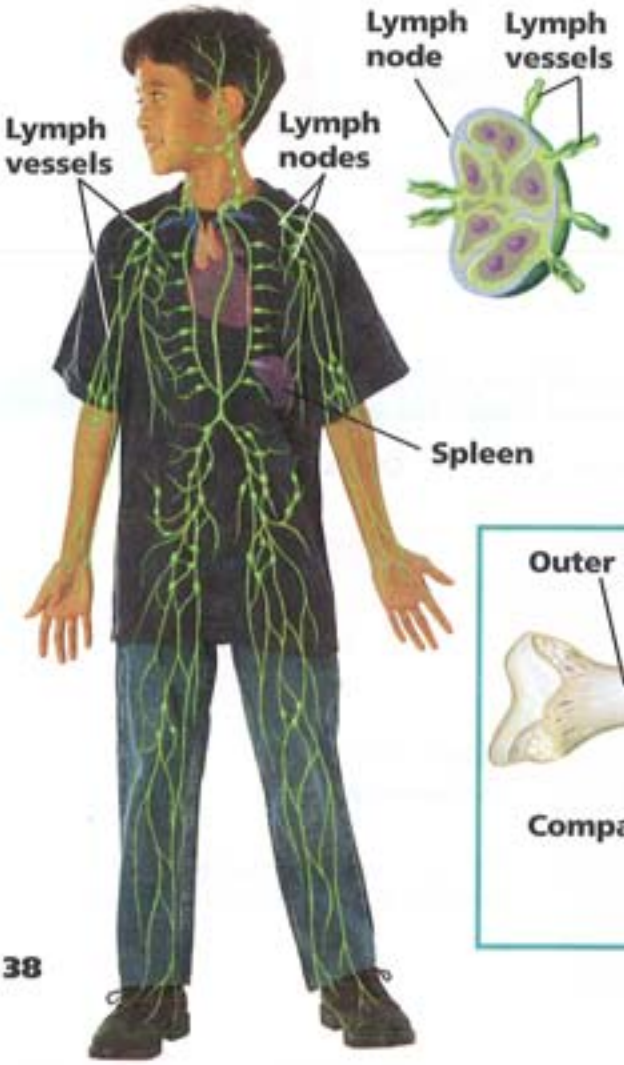
Egg cells from the ovaries move through the oviduct to the uterus.

The Immune System

The immune system helps the body fight disease. Inside some bones is a soft tissue known as red marrow that fills the spaces in spongy bone. Red marrow makes new red blood cells, platelets that stop a cut from bleeding, and germ-fighting white blood cells.

There are white blood cells in the blood vessels and in the lymph vessels. Lymph vessels are similar to blood vessels. Instead of blood, they carry lymph. Lymph is a straw-colored fluid surrounding body cells.

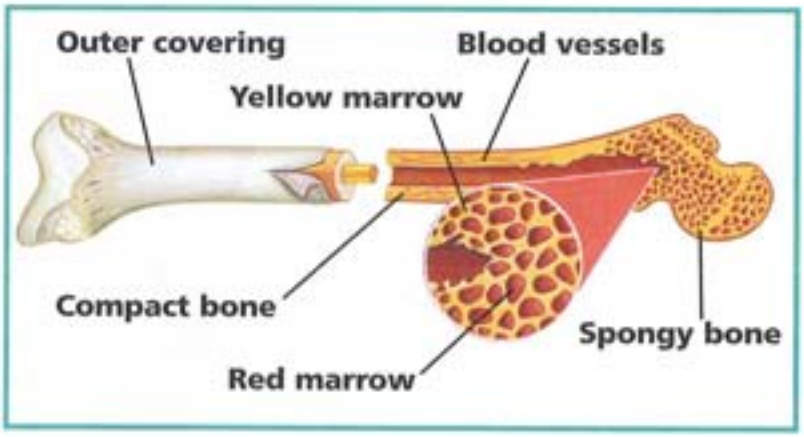
Lymph nodes filter out harmful materials in lymph. Like red marrow, they also produce white blood cells to fight infections. Swollen lymph nodes in the neck are a clue that the body is fighting germs.



CARE!

- **Be sure to get immunized against common diseases.**
- **Keep cuts clean to prevent infection.**

1. A bone is covered with a tough but thin membrane that has many small blood vessels. The blood vessels bring nutrients and oxygen to the living parts of the bone and remove wastes.
2. Inside some bones is a soft tissue known as marrow. Yellow marrow is made mostly of fat cells and is one of the body's energy reserves. It is usually found in the long, hollow spaces of long bones.
3. Part of the bone is compact, or solid. It is made up of living bone cells and nonliving materials. The nonliving part is made up of layers of hardened minerals such as calcium and phosphorus. In between the mineral layers are living bone cells.
4. Red marrow fills the spaces in spongy bone. Red marrow makes new red blood cells, germ-fighting white blood cells, and platelets that stop a cut from bleeding.
5. Part of the bone is made of bone tissue that looks like a dry sponge. It is made of strong, hard tubes. It is also found in the middle of short, flat bones.



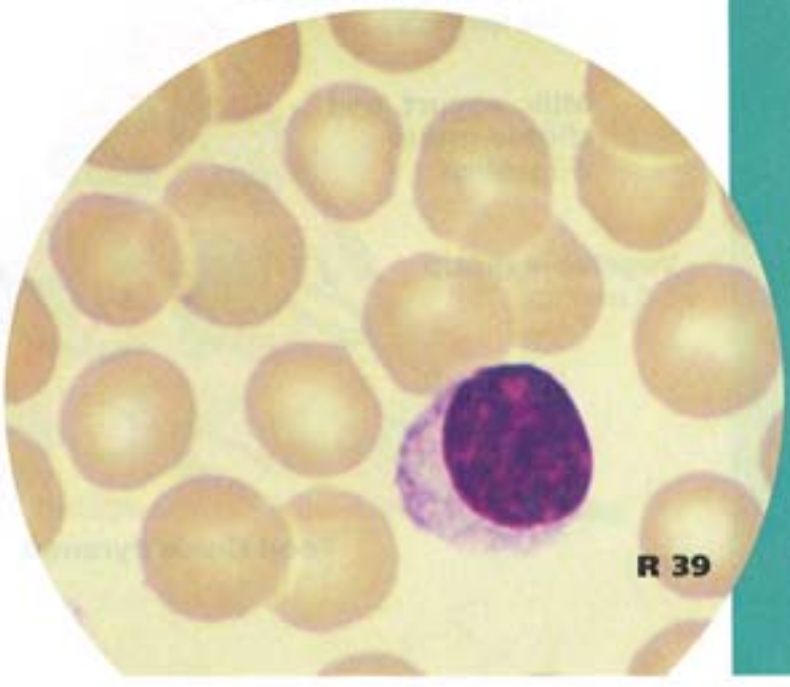
Infectious Diseases

A disease is anything that breaks down the normal functions of the body. Some diseases are inherited. Others are caused by harmful materials in the environment. Many diseases, however, are caused by organisms.

Disease-causing organisms include bacteria and viruses. Diseases caused by these organisms are called *infectious diseases* because the organisms enter, or infect, the body.

Human Infectious Diseases

Disease	Caused by	Organ System Affected
Chicken pox	Virus	Skin
Smallpox	Virus	Skin
Polio	Virus	Nervous system
Rabies	Virus	Nervous system
Influenza	Virus	Respiratory system
Measles	Virus	Skin
Mumps	Virus	Salivary glands
Tuberculosis	Bacteria	Respiratory system
Tetanus	Bacteria	Nervous system
Food poisoning	Bacteria	Digestive system



White blood cells are your body's main protection against infectious disease. The white blood cells leave the blood vessels or lymph vessels to fight disease organisms in your tissues.

Staying Healthy

Physical fitness is the condition in which the body is healthy and works the best it can. It involves working the skeletal muscles, bones, joints, heart, and respiratory system.

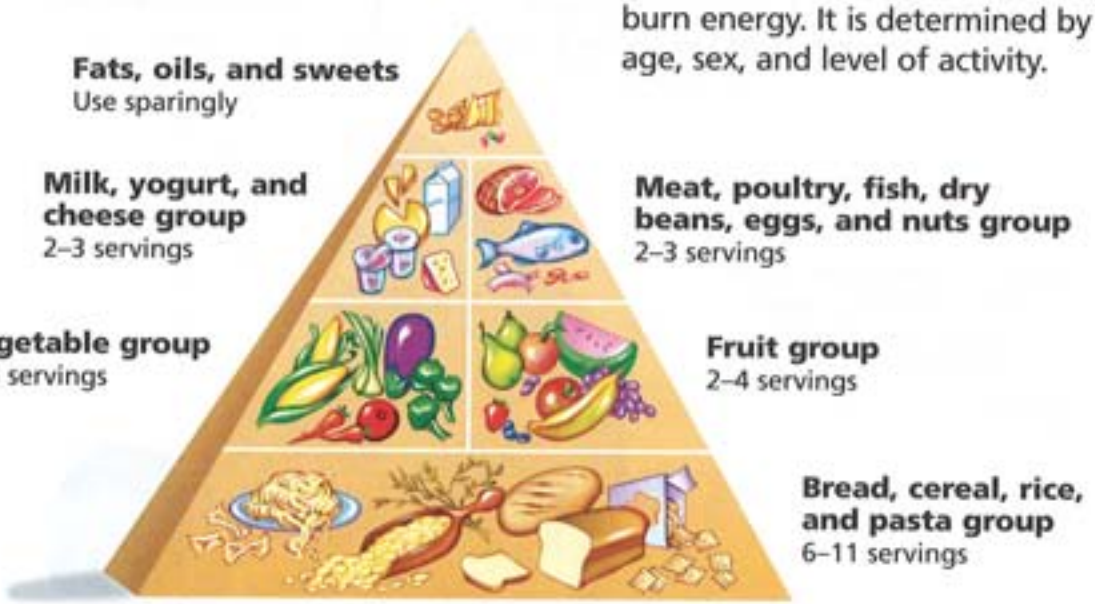
Activity Pyramid

CARE!

- **Stay active every day.**
- **Eat a balanced diet.**
- **Drink plenty of water—6 to 8 large glasses a day.**

There is more to fitness than exercise. To make sure your body gets all the nutrients you need, you should eat a balanced diet. *A balanced diet* includes all the major food groups.

A balanced diet provides the calories, or energy from food, that you need to stay healthy. The number of calories needed varies from person to person, depending on their metabolism. *Metabolism* is the rate at which you burn energy. It is determined by weight, age, sex, and level of activity.



Food Guide Pyramid

FOLDABLES™

by Dinah Zike

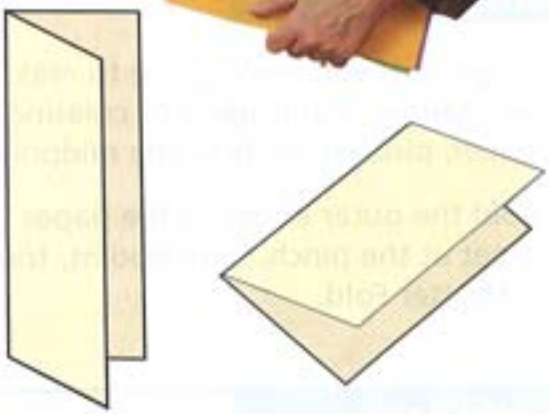
Folding Instructions

So how do you make a Foldables data organizer? The following pages offer step-by-step instructions—where and when to fold, where to cut—for making 11 basic Foldables data organizers. The instructions begin with the basic shapes, such as the hot dog fold, that were introduced on page xv.

Half-Book

Fold a sheet of paper ($8\frac{1}{2}$" x 11") in half.

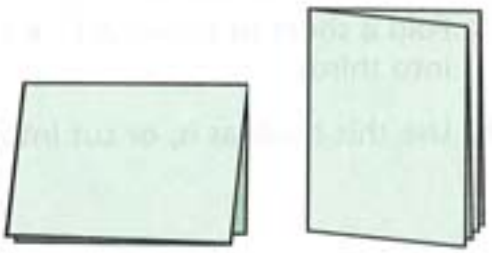
1. This book can be folded vertically like a hot dog or ...
2. ... it can be folded horizontally like a hamburger.



Folded Book

1. Make a Half-Book.
2. Fold in half again like a hamburger.

This makes a ready-made cover and two small pages inside for recording information.



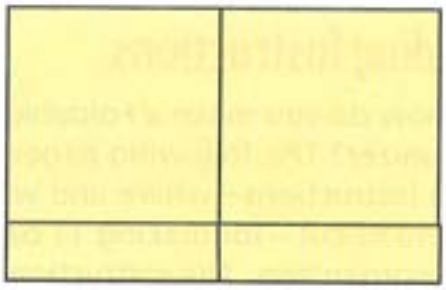
Two-Tab Book

Take a Folded Book and cut up the valley of the inside fold toward the mountain top.

This cut forms two large tabs that can be used front and back for writing and illustrations.

Pocket Book

1. Fold a sheet of paper ($8\frac{1}{2}$" x 11") in half like a hamburger.
2. Open the folded paper and fold one of the long sides up two inches to form a pocket. Refold along the hamburger fold so that the newly formed pockets are on the inside.
3. Glue the outer edges of the two-inch fold with a small amount of glue.

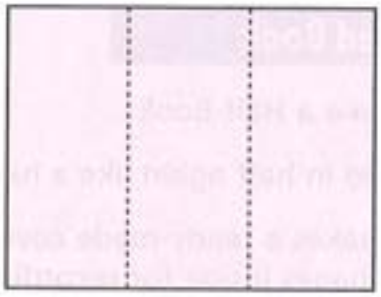


Shutter Fold

1. Begin as if you were going to make a hamburger, but instead of creasing the paper, pinch it to show the midpoint.
2. Fold the outer edges of the paper to meet at the pinch, or midpoint, forming a Shutter Fold.

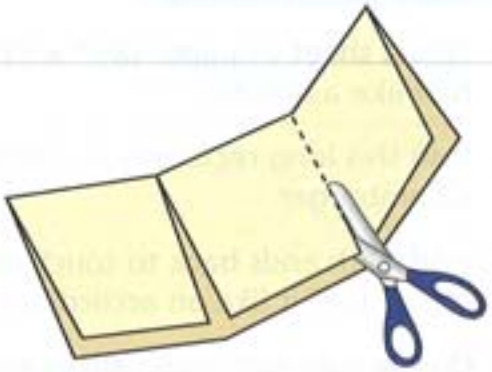
Trifold Book

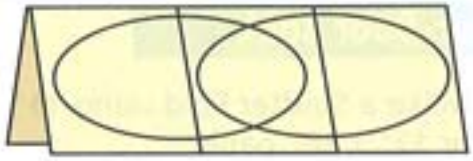
1. Fold a sheet of paper ($8\frac{1}{2}$" x 11") into thirds.
2. Use this book as is, or cut into shapes.



Three-Tab Book

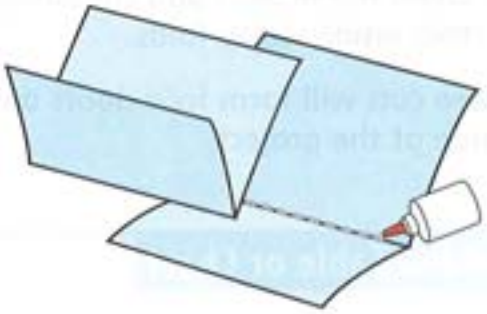
1. Fold a sheet of paper like a hot dog.
2. With the paper horizontal and the fold of the hot dog up, fold the right side toward the center, trying to cover one half of the paper.
3. Fold the left side over the right side to make a book with three folds.
4. Open the folded book. Place one hand between the two thicknesses of paper and cut up the two valleys on one side only. This will create three tabs.

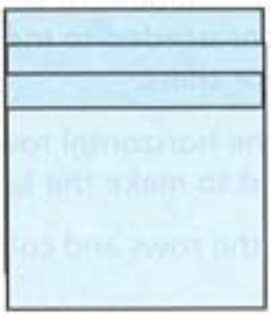




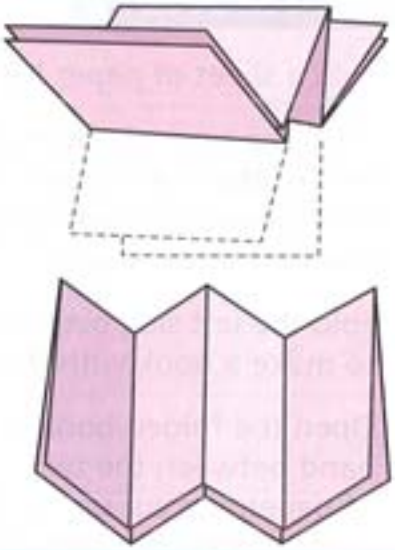
Layered-Look Book

1. Stack two sheets of paper ($8\frac{1}{2}$" x 11") so that the back sheet is one inch higher than the front sheet.
2. Bring the bottoms of both sheets upward and align the edges so that all of the layers or tabs are the same distance apart.
3. When all the tabs are an equal distance apart, fold the papers and crease well.
4. Open the papers and glue them together along the valley, or inner center fold, or staple them along the mountain.



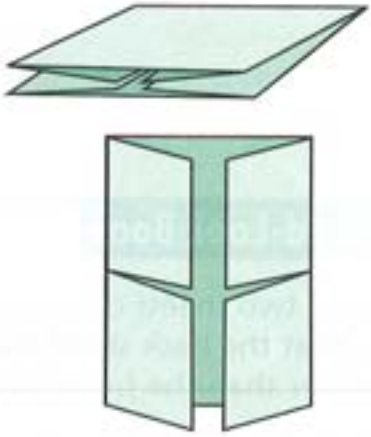


Four-Tab Book



1. Fold a sheet of paper ($8\frac{1}{2}$" x 11") in half like a hot dog.
2. Fold this long rectangle in half like a hamburger.
3. Fold both ends back to touch the mountain top or fold it like an accordion.
4. On the side with two valleys and one mountain top, make vertical cuts through one thickness of paper, forming four tabs.

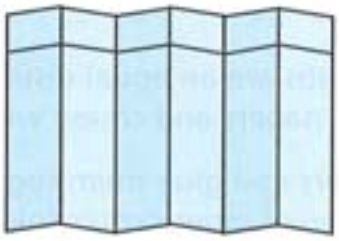
Four-Door Book



1. Make a Shutter Fold using 11" x 17" or 12" x 18" paper.
2. Fold the Shutter Fold in half like a hamburger. Crease well.
3. Open the project and cut along the two inside valley folds.

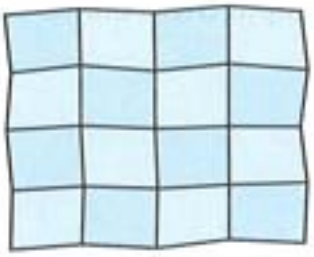
These cuts will form four doors on the inside of the project.

Folded Table or Chart



Chart

1. Fold the number of vertical columns needed to make the table or chart.
2. Fold the horizontal rows needed to make the table or chart.
3. Label the rows and columns.



Table

Glossary

This Glossary will help you to pronounce and understand the meanings of the Science Words introduced in this book. The page number at the end of the definition tells where the word appears.

A

abiotic factor (ā'bī ot'ik fak'tər) A nonliving part of an ecosystem. (p. B6)

absorption (əb sôrp'shən) The disappearance of a sound wave into a surface. (p. F66)

abyssal plain (ə bis'əl plān) The vast flat lands beyond the continental shelf that cover almost half of the deep ocean floor. (p. C90)

acceleration (ak sel'ə rā'shən) Change in velocity with respect to time. (pp. F13, F22)

acid (as'id) A substance that tastes sour and turns blue litmus paper red. (p. E82)

acid rain (as'id rān) Moisture that falls to Earth after being mixed with wastes from burned fossil fuels. (p. C65)

acidity (ə sid'ə tē) The strength of an acid. (p. E86)

action (ak'shən) The force one object applies to a second, as in Newton's third law of motion, which states, "For every action, there is an equal but opposite reaction." *See* **reaction**. (p. F24)

adaptation (ad'əp tā'shən) A characteristic that enables a living thing to survive in its environment. (pp. A46, A106)

aerial root (âr'ē əl rüt) A root that never touches the ground but can take in moisture from the air. (p. A31)

aerosol (ār'ə sōl') A type of colloid in which liquid drops or solid particles are spread throughout a gas. (p. E60)

air mass (âr mas) A large region of the atmosphere where the air has similar properties throughout. (p. D70)

air pressure (âr presh'ər) The force put on a given area by the weight of the air above it. (p. D33)

alkalinity (al'kə lin'i tē) The strength of a base. (p. E86)

alternative energy source (ōl tûr'nə tiv en'ər jē sôrs) A source of energy other than the burning of a fossil fuel. (p. C104)

amphibian (am fib'ē ən) A vertebrate that lives part of its life in water and part of its life on land. (p. A95)

anemometer (an'ə mom'i tər) A device that measures wind speed. (p. D64)

PRONUNCIATION KEY

The following symbols are used throughout the McGraw-Hill Science Glossaries.

a	at	e	end	o	hot	u	up	hw	white	ə	about
ā	ape	ē	me	ō	old	ū	use	ng	song		taken
ä	far	i	it	ôr	fork	ü	rule	th	thin		pencil
âr	care	ī	ice	oi	oil	ú	pull	th	this		lemon
ô	law	îr	pierce	ou	out	ûr	turn	zh	measure		circus

' = primary accent; shows which syllable takes the main stress, such as **kil** in **kilogram** (kil'ə gram').

, = secondary accent; shows which syllables take lighter stresses, such as **gram** in **kilogram**.

aneroid barometer (an'ə roid bə rom'i tər) A spring enclosed in a pleated metal can that expands or contracts to indicate changes in air pressure. (p. D34)

angiosperm (an'jē ə spûrm') A seed plant that produces flowers. *See* **gymnosperm.** (p. A68)

aquifer (ak'wə fər) An underground layer of rock or soil filled with water. (p. C75)

asexual reproduction (a sek'shū əl rē'prō duk'shən) The production of a new organism from only one cell. (p. A62)

asteroid (as'tə roid') "Minor planet." One of many small, rocky objects that orbit the Sun between the orbits of Mars and Jupiter. (p. D19)

asteroid belt (as'tə roid' belt) Region between Mars and Jupiter where most asteroids are found. (p. D19)

atmosphere (at'məs fir') The blanket of gases that surrounds Earth. (pp. C26, D32)

atom (at'əm) The smallest unit of an element that retains the properties of that element. *See* **molecule.** (p. E26)

aurora (ə rôr'ə) The northern or southern lights that appear in the night sky, especially in polar regions. (p. D32)

B

bacterium (bak tir'ē əm) *sing., n. pl.* **bacteria** (-ē ə) A member of either of two kingdoms of one-celled living things that have no nucleus, or center, in their cell body. (p. A19)

balanced forces (bal'ənst fôrs'əz) Forces that cancel each other out when acting together on a single object. (p. F21)

barometer (bə rom'i tər) A device for measuring air pressure. (p. D34)

base (bās) A substance that tastes bitter and turns red litmus paper blue. (p. E82)

basin (bās'in) The floor of an ocean, containing mountains, valleys, and plains. (p. C84)

bench mark (bench' märk') A plaque left by surveyors to tell the exact location and elevation of a place. (p. C6)

benthos (ben'thos) Organisms that live on the bottom in aquatic ecosystems. (p. B72)

bird (bûrd) A vertebrate that has both feathers and wings. (p. C95)

biomass (bi'ō mas') Energy from plant matter or animal waste. (p. C106)

biome (bi'ōm) One of Earth's large ecosystems, with its own kind of climate, soil, plants, and animals. (p. B64)

biotic factor (bi ot'ik fak'tər) A living part of an ecosystem. (p. B7)

boiling point (boil'ing point) The particular temperature for each substance at which it changes state from a liquid to a gas. (p. E37)

buoyancy (boi'ən sē) The upward push of a liquid on an object placed in it. (p. E12)

C

cambium (kam'bē əm) The layer in plants that separates the xylem from the phloem. (p. A31, A32)

camouflage (kam'ə fläzh') An adaptation in which an animal protects itself against predators by blending in with the environment. (p. A108)

carbon cycle (kär'bən si'kəl) The continuous exchange of carbon dioxide and oxygen among living things. (p. B53)

carnivore (kär'nə vôr') An animal that eats another animal. (p. B20)

carrying capacity (kar'ē ing kə pas'i tē) The maximum population size that an area can support. (p. B35)

cell (sel) The smallest unit of living matter. (p. A6)

chemical change (kem'i kəl chānj) A change of matter that occurs when atoms link together in a new way, creating a new substance different from the original substances. (p. E71)

chemical formula (kəm'i kəl fôr'myə lə) A way to write a compound's name using symbols. The letters tell what elements are in the compound, and the subscripts tell the number of particles in the compound. (p. E25)

chemical reaction (kem'i kəl rē ak'shən) Another name for chemical change. (p. E71)

chemosynthesis (kē'mō sin'thə sis) In tube worms the process by which bacteria create nutrients from hydrogen sulfide and oxygen, using chemical reactions rather than light. (p. C93)

chlorophyll (klôr'ə fil') A green chemical in plant cells that allows plants to use the Sun's energy for making food. (p. A6)

cirrus cloud (sir'əs kloud) A high-altitude cloud with a featherlike shape, made of ice crystals. (p. D44)

classification (klas'ə fi kā'shən) The science of finding patterns among living things. (p. A10)

cleavage (klē'vij) The tendency of a mineral to break along flat surfaces. (p. C34)

climate (kli'mit) The average weather pattern of a region. (p. D84)

climate zone (kli mat' zōn) A region that has similar weather patterns based on temperature, precipitation, wind, distance from a coast, mountain ranges, ocean currents, and vegetation. (p. D84)

climax community (kli'maks kə mū'ni tē) The final stage of succession in an area, unless a major change happens. (p. B84)

cold front (kōld frunt) A front where cold air moves in under a warm air mass. (p. D72)

colloid (kol'oid) A special type of mixture in which the particles of one material are scattered through another and block the passage of light without settling out. (pp. E54, E60)

comet (kom' it) A "dirty snowball" orbiting the Sun — a mixture of ices, frozen gases, rock, and dust left over from the formation of the solar system. (p. D19)

commensalism (kə men'sə liz'əm) A relationship between two kinds of organisms that benefits one without harming the other. (p. B27)

community (kə mū'ni tē) All the living things in an ecosystem. (p. B11)

complete flower (kəm plēt' flou'ər) A flower that has sepals, petals, stamens, and pistils. (p. A78)

compound (kom'pound) Any substance that is formed by the chemical combination of two or more elements and acts like a single substance. (p. E24)

compression (kəm presh'ən) **1.** The part of a sound wave where molecules are crowded together. (p. F51) **2.** A movement of plates that presses together or squeezes Earth's crust. (p. C8)

concave lens (kon kāv' lenz) A lens that is thicker at the edges than at the middle. As it curves inward, it spreads light rays apart, making images appear smaller. (p. F100)

concave mirror (kon kāv' mir'ər) A mirror that curves in on the shiny side. (p. F88)

condensation (kon'den sā'shən) *n.* The changing of a gas into a liquid. (pp. B50, D39) **—condense** (kən dens') *v.* (p. E37)

PRONUNCIATION KEY

a at; ā ape; ä far; âr care; ô law; e end; ē me; i it; ī ice; îr pierce; o hot; ō old; ôr fork; oi oil; ou out; u up; ū use; ü rule; ú pull; ûr turn; hw white; ng song; th thin; th this; zh measure; ə about, taken, pencil, lemon, circus

conduction (kən duk'shən) *n.* The passing of heat through a material while the material itself stays in place. (p. E97) —**conduct** (kən dukt') *v.* (p. E14)

conifer (kon'ə fər) Any of a group of gymnosperms that produce seeds in cones and have needlelike leaves. (p. A69)

conserve (kən'sûrv') To save, protect, or use resources wisely. (p. C39)

constellation (kon'stə lā'shən) Patterns formed by groups of stars in the night sky. (p. D12)

consumer (kən sū'mər) Any animal that eats plants or eats other plant-eating animals. (pp. B7, B20)

continental rise (kon'tə nen'təl riz) A buildup of sediment on the sea floor at the bottom of the continental slope. It is a zone of sand and mud that stretches from the slope down to the deep-sea floor. (p. C90)

continental shelf (kon'tə nen'təl shelf) The underwater edge of a continent. (p. C90)

continental slope (kon'tə nen'təl slōp) The steep slope leading down from the continental shelf toward the sea floor. (p. C90)

contour plowing (kon'tūr plou'ing) Preventing erosion by plowing across rather than up and down a slope. (p. C51)

contract (kən trakt') To shrink, as when a material gets colder. (p. E41)

convection (kən vek'shən) The flow of heat through a liquid or a gas, causing hot parts to rise and cooler parts to sink. (p. E97)

convection cell (kən vek'shən sel) A circular pattern of air rising, air sinking, and wind. (p. D55)

convex lens (kon veks' lenz) A lens that is thicker at the middle than at the edges. As it curves outward, it brings light together, making images appear larger. (p. F100)

convex mirror (kon veks' mir'ər) A mirror that curves out on the shiny side. (p. F88)

coquina (kō kē'nə) A sedimentary rock formed from seashell fragments. (p. C44)

Coriolis effect (kôr'ē ō'lis i fekt') The curving of the path of a moving object caused by Earth's rotation. (p. D57)

cortex (kôr'teks) The layer of tissue just inside the epidermis of a plant's roots and stems. (p. A30)

cotyledon (ko'tə lē'dən) A tiny leaflike structure, also called a seedleaf, inside the seed of an angiosperm. (p. A72)

crop rotation (krop rō tā'shən) Growing different crops each year so that the soil does not use up the same kinds of minerals year after year. (p. C51)

crossbreeding (krôs'brēd'ing) Producing offspring by mating individuals from two distinct breeds or varieties of the same species. (p. A112)

cross-pollination (krôs'pol'ə nā'shən) The transfer of pollen from one flower to another. (p. A80)

crust (krust) The rocky surface that makes up the top of the lithosphere and includes the continents and the ocean floor. (p. C7)

crystal (kris'təl) The geometric shape a mineral forms when its atoms and molecules get into fixed patterns. (p. C32)

cumulus cloud (kū'myə ləs kloud) A puffy cloud that appears to rise up from a flat bottom. (p. D44)

current (kûr'ənt) An ocean movement; a large stream of water that flows in the ocean. (p. C86)

cycad (si'kad) One of the evergreen gymnosperms that resemble palms and have seed-bearing cones. (p. A69)

D

decibel (dB) (des'ə bel') A unit that measures loudness. (p. F58)

deciduous (di sij'ü əs) Said of a plant that loses its leaves each fall. *See* **evergreen.** (pp. A69, B70)

deciduous forest (di si'jə wəs fôr'ist) A forest biome with many kinds of trees that lose their leaves each autumn. (p. B70)

decomposer (dē'kəm pōz'ər) Any of the fungi or bacteria that break down dead plants and animals into useful things like minerals and rich soil. (pp. B7, B21, B56)

delta (del'tə) Fan-shaped region formed by deposits of sediments found at the mouth of a river. (p. C21)

density (den'si tē) A measure of how tightly packed the matter in an object is. (pp. C35, E8)

deposition (dep'ə zish'ən) The dropping off of bits of eroded rock. (p. C13)

desalination (dē sal'ə nā'shən) Getting fresh water from seawater. (p. C73)

desert (dez'ərt) A sandy or rocky biome, with little precipitation and little plant life. (p. B69)

dicot (di'kot') An angiosperm with two cotyledons in each seed. *See* **monocot.** (p. A72)

dinoflagellate (din'ə flaj'ə lāt') A protist containing chlorophyll that has two flagella for motion. When they overreproduce, they can cause "red tides." (p. A14)

distillation (dis'tə lā'shən) The process of separating the parts of a mixture by evaporation and condensation. (p. E64)

diversity (di vûr'si tē) A wide variety of traits in individuals from the same population. (p. A114)

Doppler effect (dop'lər i fekt') The change in frequency (and pitch) as a source of sound moves toward or away from you. (p. F71)

downdraft (doun'draft') A downward rush of air caused by the falling of rain during a thunderstorm. (pp. D55, D76)

E

echo (e'kō) A reflected sound wave. (p. F68)

echolocation (ek'ō lō kā'shən) Finding an object by using reflected sound. (p. F70)

ecological succession (ek'ə loj'i kəl sək sesh'ən) The gradual replacement of one community by another. (p. B82)

ecology (ē kol'ə jē) The study of how living and nonliving things interact. (p. B11)

ecosystem (ek'ō sis'təm) All the living and nonliving things in an environment, including their interactions with each other. (p. B6)

effort arm (ef'ərt arm) The part of a lever that applies force to the resistance arm. (p. F26)

electromagnetic spectrum (i lek'trō mag net'ik spek'trəm) All the wavelengths of visible and invisible light in order, from short (gamma rays) to long (radio). (p. F119)

electromagnetism (i lek'trō mag'ni tiz'əm) The production of magnetism by electricity (and the production of electricity by magnets). (p. F118)

electron (i lek'tron) A particle in the space outside the nucleus of an atom that carries one unit of negative electric charge. (p. E27)

element (el'ə mənt) A pure substance that cannot be broken down into any simpler substances. (p. E22)

PRONUNCIATION KEY

a at; ā ape; ä far; âr care; ô law; e end; ē me; i it; ī ice; ir pierce; o hot; ō old; ôr fork; oi oil; ou out; u up; ū use; ü rule; u̇ pull; ûr turn; hw white; ng song; th thin; th this; zh measure; ə about, taken, pencil, lemon, circus

elevation (el'ə vā'shən) The height of a place above sea level. (p. C6)

embryo (em'brē ō') The immature plant inside a seed. (p. A82)

emulsion (i mul'shən) A type of colloid in which one liquid is spread throughout another. (p. E60)

endangered species (en dān'jərd spē'shēz) A species that is in danger of becoming extinct. (p. B36)

epidermis (ep'i dûr'mis) An outermost layer of such plant parts as roots and leaves. (pp. A30, A34)

erosion (i rō'zhən) The picking up and carrying away of pieces of rocks. (p. C10)

evaporation (i vap'ə rā'shən) The slow changing of a liquid into a gas. (pp. B50, D38, E38)

evergreen (ev'ər grēn') Said of a gymnosperm that keeps its leaves for at least a few years. *See* **deciduous.** (p. A69)

expand (ek spand') To spread out, as when a material gets hotter. (p. E41)

extinct (ek stingkt') A species that has died out completely. (p. B36)

F

fault (fôlt) A crack in Earth's crust whose sides show evidence of motion. (p. C6)

fault-block mountain (fôlt blok moun'tən) A mountain formed by blocks of Earth's crust moving along a fault. (p. C9)

fertilization (fûr'tə lə zā'shən) The joining of a sperm cell with an egg cell to make one new cell, a fertilized egg. (pp. A62, A81)

fertilizer (fûr'tə lī'zər) A substance used to add minerals to the soil. (p. B56)

fibrous root (fī'brəs rūt) One of the many hairy branching roots that some plants have. (p. A31)

filament (fil'ə mənt) The wire in a light bulb that gives off light and heat. (p. E92)

fish (fish) A vertebrate that lives its whole life in water. (p. A95)

flood plain (flud' plān') Land that is likely to be underwater during a flood. (p. C21)

foam (fōm) A type of colloid in which a gas is spread throughout a liquid. (p. E60)

fog (fôg) A cloud at ground level. (p. D44)

fold mountain (fōld moun'tən) A mountain made up mostly of rock layers folded by being squeezed together. (p. C8)

food chain (fūd chān) The path of the energy in food from one organism to another. (p. B18)

food web (fūd web) The overlapping food chains in an ecosystem. (p. B20)

force (fôrs) A push or pull exerted by one object on another, causing a change in motion. (p. F6)

fossil (fos'əl) Any remains or imprint of living things of the past. (p. C45)

fossil fuel (fos'əl fū'əl) A fuel formed from the decay of ancient forms of life. (p. C64)

fracture (frak'chər) The characteristic way some minerals break in uneven patterns. (p. C35)

freezing point (frēz'ing point) The temperature at which a substance changes state from a liquid to a solid. (p. E37)

frequency (frē'kwən sē) The number of times an object vibrates per second. (p. F57)

friction (frik' shen') A force that opposes the motion of one object moving past another. (p. F8)

frond (frond) The leaf of a fern. (p. A61)

front (frunt) A boundary between air masses with different temperatures. (p. D71)

fruit (frūt) The ripened ovary of a flowering seed plant. (p. A70)

fulcrum (fúl'krəm) The pivot point of a lever. (p. F26)

fundamental frequency (fun'də men'təl frē'kwən sē) The lowest frequency at which an object vibrates. (p. F72)

fungus (fung'gəs) *n.*, **fungi** (fun'ji) *pl.* Members of a kingdom that contains one-celled and many-celled living things that absorb food from their environment. (p. A17)

G

galaxy (gal'ək sē) A collection of billions of stars. Our Sun belongs to the Milky Way galaxy. (p. D20)

gas (gas) A form of matter that does not take up a definite amount of space and has no definite shape. (p. E36)

gel (jel) A type of colloid in which a solid is spread throughout a liquid. (p. E60)

gem (jem) A mineral valued for being rare and beautiful. (p. C38)

geologist (jē ol'ə jist) A scientist who studies rocks to tell how they formed and to predict when an earthquake may occur. (p. C16)

geothermal energy (jē'ō thûr'məl en'ər jē) Earth's internal energy. (p. C104)

germination (jûr'mə nā'shən) The sprouting of a seed into a new plant. (p. A83)

ginkgo (ging'kō) *n., pl.* **ginkgoes** A large gymnosperm with fan-shaped leaves. (p. A69)

gnetophyte (ne'tō fit') One of the gymnosperms that are closely related to flowering plants and live in both deserts and the tropics. (p. A69)

grassland (gras'land') A biome where grasses, not trees, are the main plant life. Prairies are one kind of grassland region. (p. B66)

gravitropism (grav'i trō'pi'zəm) The response of a plant to gravity. (p. A44)

gravity (grav'i tē) The force of attraction between any two objects due to their mass. (pp. D8, F35)

groundwater (ground wô'tər) Precipitation that seeps into the ground and is stored in tiny holes, or pores, in soil and rocks. (pp. B51, C74)

gymnosperm (jim'nə spûrm') A seed plant that does not produce flowers. *See* **angiosperm**. (p. A68)

H

habitat (hab'i tat) The place where a plant or animal naturally lives and grows. (p. B12)

hail (hāl) Pellets made of ice and snow. (p. D47)

hardness (härd'nis) How well a mineral resists scratching. (p. C34)

herbivore (hûr'bə vôr') An animal that eats plants, algae, and other producers. (p. B20)

heredity (hə red'i tē) The passing down of inherited traits from parents to offspring. (p. A110)

hertz (Hz) (hûrts) A unit for measuring frequency. One hertz equals a frequency of one vibration per second. (p. F57)

heterogeneous (het'ər ə jē'nē əs) Differing in kind or nature; dissimilar; not homogeneous. (p. E54)

high-pressure system (hi'presh'ər sis'təm) A pattern surrounding a high pressure center, from which winds blow outward. In the Northern Hemisphere these winds curve to the right in a clockwise pattern. (p. D59)

PRONUNCIATION KEY

a at; ā ape; ä far; âr care; ô law; e end; ē me; i it; ī ice; îr pierce; o hot; ō old; ôr fork; oi oil; ou out; u up; û use; ū rule; ù pull; ûr turn; hw white; ng song; th thin; th this; zh measure; ə about, taken, pencil, lemon, circus

host (hōst) The organism a parasite lives in or on and is harmed by. (p. B26)

humidity (hū mid'i tē) The amount of water vapor in the air. (p. D38)

humus (hū'məs) Decayed plant or animal material in soil. (pp. B9, C49)

hurricane (hûr'i kān') A very large, swirling storm with very low pressure at the center. (p. D78)

hybrid (hī'brid) An organism produced by the crossing of parents that have different forms of the same trait. (p. A112)

hydrocarbon (hī'drə kär'bən) Compound made only of hydrogen and carbon atoms. (p. E32)

hydroelectric plant (hī'drō i lek'trik plant) A factory where running or falling water spins a generator to make electricity. (p. C104)

hydrosphere (hī'drə sfîr') Earth's water, found in continents and oceans, including the fresh water in ice, lakes, rivers, and underground water. (p. C26)

hydrotropism (hi drot'rə piz'əm) The response of a plant to a nearby source of water. (p. A45)

hyperthermia (hī'pər thûr'mē ə) The overheating of the body that can be caused by overexposure in a hot, dry climate. (p. D90)

I

igneous rock (ig'nē əs rok) A rock formed when melted rock material cools and hardens (p. C43)

image (im'ij) A "picture" of the light source that light rays make in bouncing off a polished, shiny surface. (p. F89)

imperfect flower (im pûr'fikt flou'ər) A flower with either a stamen or a pistil, but not both. (p. A78)

incomplete flower (in'kəm plēt' flou'ər) A flower that lacks sepals, petals, stamens or pistils. (p. A78)

indicator (in'di kā'tər) A substance such as litmus paper whose color changes when it is mixed with an acid or a base. (p. E84)

inertia (i nûr'shə) The tendency of a moving object to keep moving in a straight line or of any object to resist a change in motion. (pp. D8, F7)

inexhaustible resource (in'eg zôs'tə bəl rē'sôrs') A resource that cannot be depleted or used up easily. (p. B58)

inherited trait (in her'i təd trāt) A characteristic that is passed from parents to offspring. (p. A110)

inner planet (in'ər plan'it) A planet between the Sun and the asteroid belt (Mercury, Venus, Earth, Mars). (p. D16)

insolation (in'sə lā'shən) The amount of the Sun's energy that reaches Earth at a given time and place. *Insolation* is short for *in*coming *sol*ar radi*ation*. (p. D30)

instinct (in'stingkt') An inherited behavior, one that is not learned but is done automatically. (p. A110)

insulate (in'sə lāt') To prevent heat from passing through. (p. E14)

intertidal zone (in'tər ti'dəl zōn) The shallowest section of the marine, or ocean, ecosystem, where the ocean floor is covered and uncovered as the tide goes in and out. (p. B73)

invertebrate (in vûr'tə brit) An animal that does not have a backbone. (p. A16)

ionized (i'ə nīzd') Electrically charged by radiation, as gas particles of auroras in the night sky. (p. D32)

isobar (i'sə bär') A line on a weather map connecting places with equal air pressure. (p. D59)

K

kinetic energy (ki net'ik en'ər jē) The energy of any moving object. (p. E95)

L

land breeze (land brēz) Wind that blows from land to sea. (p. D56)

laser (lā'zər) A device that produces a thin stream of light of just a few close wavelengths. (p. F122)

lava (lä'və) Magma that reaches Earth's surface. (pp. C9, C43)

law of reflection (lô uv ri flek'shən) The angle between an incoming light ray and a surface equals the angle between the reflected light ray and the surface. (p. F87)

lever (lev'ər) A simple machine made of a rigid bar and a fixed pivot point, called the fulcrum. (p. F26)

light ray (lit rā) A straight-line beam of light as it travels outward from its source. (p. F85)

lightning (lit'ning) One of the huge electric sparks that leap from clouds to the ground in thunderstorms. (p. D76)

limiting factor (lim'ə ting fak'tər) Anything that controls the growth or survival of a population. (p. B34)

liquid (lik'wid) A form of matter that takes up a definite amount of space and has no definite shape. (p. E36)

lithosphere (lith'ə sfir') The hard outer layer of Earth, about 100 km thick. (p. C26)

long-day plant (lông'dā plant) A plant that blooms when there is much more daylight than darkness. (p. A46)

low-pressure system (lō'presh'ər sis'təm) A pattern surrounding a low-pressure center, in which winds blow in toward the center. In the Northern Hemisphere, these winds blow to the right in a counterclockwise pattern. (p. D59)

luster (lus'tər) The way light bounces off a mineral's surface. (p. C33)

M

magma (mag'mə) Hot, molten rock deep below Earth's surface. (p. C9)

magnetic (mag net'ik) The property of a material like iron in which the particles line up pole to pole, causing it to be attracted or repelled by a magnet. (p. E15)

mammal (mam'əl) A vertebrate that feeds its young milk. (p. A95)

mare (mär'ā) *n., pl.* **maria** (mär'ē ə) Dark-colored land on the Moon that is dry and flat and is surrounded by mountains and ridges. (p. D10)

mass (mas) A measure of the amount of matter in an object. (p. E6)

matter (ma'tər) Anything that has mass and takes up space. (pp. E6, F51)

meander (mē an'dər) Bends or s-shaped curves in a river. (p. C21)

melting point (melt'ing point) The particular temperature for each substance at which it changes state from a solid to a liquid. (p. E37)

membrane (mem'brān) A thin envelope surrounding the nucleus of a cell. (p. A18)

metal (met'əl) Any of a group of elements found in the ground that conducts heat and electricity. (p. C38)

PRONUNCIATION KEY

a at; ā ape; ä far; âr care; ô law; e end; ē me; i it; ī ice; îr pierce; o hot; ō old; ôr fork; oi oil; ou out; u up; ū use; ü rule; u̇ pull; ûr turn; hw white; ng song; th thin; th this; zh measure; ə about, taken, pencil, lemon, circus

metamorphic rock (met'ə môr'fik rok) A rock formed under heat and pressure from another kind of rock. (p. C46)

meteor (mē' tē or) A chunk of rock from space that burns up as it travels through Earth's atmosphere. A "shooting star." (p. D19)

meteorite (mē'tē ə rit') A chunk of rock from space that strikes the surface of Earth or the Moon. (pp. C14, D19)

mid-ocean ridge (mid ō'shun rij) Chain of mountains that wind along all the world's major oceans. (p. C91)

mimicry (mim'i krē) An adaptation in which an animal is protected against predators by its resemblance to another, unpleasant animal. (p. A106)

mineral (min'ə rəl) A solid material of Earth's crust with a definite composition. (p. C32)

mixture (miks'chər) A physical combination of two or more substances that are blended together without forming new substances. (p. E52)

molecule (mol'ə kūl') A particle that contains more than one atom joined together. (p. E30) *See* **atom**. (p. E26)

monocot (mon'ə kot') An angiosperm with one cotyledon in each seed. *See* **dicot.** (p. A72)

mountain breeze (moun'tən brēz) A cool night wind that blows down a mountain slope to replace the warmer air in the valley. (p. D56)

mutualism (mū'chū ə liz'əm) A relationship between two kinds of organisms that benefits both. (p. B24)

N

neap tide (nēp tid) The slightest changes from high to low tide that occur when the Sun, the Moon, and Earth form a right angle or are perpendicular to each other. (p. C89)

nekton (nek'tən) Organisms that swim through the water in aquatic ecosystems. (p. B72)

neutral (nū'trəl) Neither acid nor base. (p. E82)

neutron (nū'tron) A particle in the nucleus of an atom that has no net electric charge. (p. E27)

newton (nū'tən) A basic unit measuring the amount of pull or push a force produces. (pp. E7, F20)

NEXRAD (neks'rad') A new form of Doppler radar that is used to track storms. The word stands for *NEXt generation of weather RADar.* (p. D81)

niche (nich) The role of an organism in a community. (p. B12)

nitrogen cycle (nī'trə jən sī'kəl) The continuous trapping of nitrogen gas into compounds in the soil and its return to the air. (p. B54)

nonrenewable resource (non'ri nū'ə bəl rē'sôrs') A resource that cannot be replaced within a short period of time or at all. (pp. B58, C64)

nonvascular (non vas'kyə lər) Containing no plant tissue through which water and food move. (p. A15)

nucleus (nū'klē əs) **1.** A dense structure inside the cell. (p. A18) **2.** One of the airborne dust particles around which water condenses as droplets or ice crystals before falling as precipitation. (p. D46) **3.** An atom's dense center, where most of its mass is. (p. E27)

O

omnivore (om'nə vôr') An animal that eats both plants and animals. (p. B21)

opaque (ō pāk') Completely blocking light from passing through it. (p. F96)

orbit (ôr'bit) The path of a planet traveling around a star. (p. D6)

ore (ôr) A mineral containing a useful substance. (p. C38)

organ (ôr'gən) A group of tissues that work together to do a certain job. (p. A9)

organism (ôr'gə niz'əm) Any living thing that can carry out its life on its own. (p. A6)

organ system (ôr'gən sis'təm) A group of organs that work together to do a certain job. (p. A9)

outer planet (out'er plan'it) One of the five planets beyond the asteroid belt (Jupiter, Saturn, Uranus, Neptune, Pluto). (p. D16)

ovary (ō'və rē) A structure containing egg cells; the base of a pistil in a flower. (p. A78)

overtone (ō'vər tōn') One of a series of pitches that blend to give a sound its quality. (p. F72)

ozone layer (ō'zōn lā'ər) A layer of ozone gas in the atmosphere that screens out much of the Sun's UV (ultraviolet) rays. (p. C63)

P

parasitism (par'ə si tiz'əm) A relationship in which one organism lives in or on another organism and benefits from that relationship while the other organism may be harmed by it. (p. B26) —**parasite** (par'ə sit') (pp. A71, B26)

perfect flower (pûr'fikt flou'ər) A flower with both male and female parts, that is, both a stamen and a pistil. (p. A78)

permafrost (pûr'mə frôst') A layer of permanently frozen soil found in arctic and antarctic regions. (p. B68)

pH (pē'aitch') The scale that tells how acidic or basic a solution is. (p. E86)

phloem (flō'em) The tissue through which food from the leaves moves down through the rest of a plant. (pp. A31, A32)

photon (fō'ton) The tiny bundles of energy by means of which light travels. (p. F119)

photoperiodism (fō'tō pîr'ē ə diz'əm) The flowering response of a plant to changing periods of daylight and darkness. (p. A46)

photosynthesis (fō'tə sin'thə sis) The food-making process in green plants that uses sunlight. (p. A36)

phototropism (fō tot'rə piz'əm) The response of a plant to changes in light. (p. A44)

phylum (fi'ləm) *n., pl.* **phyla** (-lə) One of the large groups in the animal kingdom. (p. A16)

physical change (fiz'i kəl chānj) A change of matter in size, shape, or state without any change in identity. (p. E70)

pioneer community (pī'ə nîr' kə mū'ni tē) The first community thriving in a once lifeless area. (p. B83)

pioneer species (pī'ə nîr' spē'shēz) The first species living in an otherwise lifeless area. (p. B83)

pitch (pich) How high or low a sound is. (p. F56)

planet (plan'it) Any of the nine major objects that travel around the Sun and shine by reflecting its light. (p. D6)

plankton (plangk'tən) Organisms that float on the water in aquatic ecosystems. (p. B72)

plate (plāt) One of the moving pieces of Earth's crust that has been broken by upward pressure from the mantle. (p. C7)

plate tectonics (plāt tek ton'iks) A scientific theory that Earth's crust is made of moving plates. (pp. B90, C7)

polarization (pō'lər ə zā'shən) Allowing light vibrations to pass through in only one direction. (p. F97)

pollen (pol'ən) Dustlike grains in the flower of a plant that contain its male sex cells. (pp. A70, A74, A84)

PRONUNCIATION KEY

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pollination (pol'ə nā'shən) The transfer of a pollen grain to the egg-producing part of a plant. (p. A74)

pollute (pə lūt') *v.* To add harmful substances to Earth's land, water, or air. (p. C50) —**pollutant** (pə lū'tənt) *n.* Something that pollutes. (p. C50) —**pollution** (pə lū'shən) *n.* A polluted condition. (p. C50)

population (pop'yə lā'shən) All the members of one species in an area. (p. B11)

potential energy (pə ten'shəl en'ər jē) Stored energy. (p. E95)

precipitation (pri sip'i tā'shən) Any form of water particles that falls from the atmosphere and reaches the ground. (pp. B51, D46)

predator (pred'ə tər) An animal that hunts other animals for food. (pp. A106, B21)

prey (prā) A living thing that is hunted for food. (p. B21)

primary color (prī'mer'ē kul'ər) Red, green, or blue. Mixing these colors can produce all the colors of the spectrum. (p. F110)

primary pigment (prī'mer'ē pig'mənt) Magenta, cyan, or yellow. Materials with any of these colors absorb one primary color of light and reflect the other two. (p. F112)

primary succession (prī'mer'ē sək sesh'ən) The beginning of a community where few, if any, living things exist, or where earlier communities were wiped out. (p. B82)

prism (priz'əm) A cut piece of clear glass (or plastic) with two opposite sides in the shape of a triangle or other geometric shape. (p. F108)

producer (prə dū'sər) Any of the plants and algae that produce oxygen and food that animals need. (pp. B7, B20)

product (prod'ukt) A new substance produced by a chemical change. (p. E71)

prop root (prop rūt) One of the roots that grow out of a plant's stemlike main roots and help prop up the plant. (p. A31)

property (prop'ər tē) A characteristic of matter that can be observed, such as mass, volume, weight, or density. (pp. E6, E24)

protective coloration (prə tek'tiv kul'ə rā'shən) A type of camouflage in which the color of an animal blends in with its background, protecting it against predators. (p. A109)

protein (prō'tēn) A substance rich in nitrogen that the body uses for growth and the repair of cells. (p. B54)

protist (prō'tist) A member of a kingdom that contains one-celled and many-celled living things, some that make food and some that hunt for food. (p. A18)

proton (prō'ton) A particle in the nucleus of an atom that carries one unit of positive electric charge. (p. E27)

Q

quality (kwol'i tē) The difference you hear between two sounds of the same loudness and pitch. (p. F72)

R

radar (rā'dār) A device for tracking the position and path of a distant moving object. (p. D80)

radiation (rā'dē a'shən) The transfer of heat through electromagnetic rays. (p. E97)

rarefaction (rār'ə fak'shən) The part of a sound wave where molecules are spread apart. (p. F51)

raw material (rô mə tîr'ē əl) Material not yet refined, manufactured, or processed. (p. B58)

reactant (rē ak'tənt) An original substance at the beginning of a chemical reaction. (p. E71)

reaction (rē ak'shən) The force with which an object responds to an action, as in Newton's third law of motion. (p. F24)

reflection (ri flek'shən) The bouncing of a sound wave off a surface. (p. F66)

refraction (ri frak'shən) The bending of light rays as they pass from one substance into another. (p. F98)

relative humidity (rel'ə tiv hū mid'i tē) A comparison between how much water vapor is in the air and how much the air could hold at a given temperature if it were full, or saturated. (p. D39)

renewable resource (ri nū'ə bəl rē'sôrs') A resource that can be replaced in a short period of time. (pp. B58, C62)

reservoir (rez'ər vwär') A storage area for fresh water supplies. (p. C75)

resistance arm (ri zis'təns arm) The part of a lever that applies force to the load the machine acts against. (p. F26)

resonance (rez'ə nəns) In an instrument or object, a unique blend of the fundamental frequency and its overtones. (p. F72)

resource (rē'sôrs') Any material that helps support life on Earth. (p. C26)

respiration (res'pə rā'shən) The release of energy in plants and animals from food (sugar). (p. A37)

response (ri spons') What a living thing does as a result of a stimulus. (p. A44)

reptile (rep'təl) An egg-laying vertebrate with thick, dry skin. (p. A95)

revolve (ri volv') To move around, or orbit, another object. (p. D10)

rhizoid (rī'zoid) One of the hairlike fibers that anchor a moss to the soil and take in water from the soil. (p. A58)

rhizome (rī'zōm) The underground stem of a fern. (p. A61)

rock (rok) A naturally formed solid in the crust made up of one or more minerals. (p. C42)

rock cycle (rok si'kəl) Rocks changing from one into another in a never-ending series of processes. (p. C52)

root cap (rūt kap) A thin covering made up of cells that protect the root tip of a plant as it grows into the soil. (p. A30)

root hair (rūt hâr) Any of the threadlike projections from a plant root that absorb water and dissolved minerals from the soil. (p. A30)

rotate (rō'tāt) To make a complete spin on an axis, causing one day on a planet. A day differs in length from planet to planet. (p. D9)

runoff (run'ôf) Precipitation that flows across the land's surface or falls into rivers and streams. (pp. B51, C20)

S

savanna (sə van'ə) A tropical grassland with some trees and shrubs. (p. B66)

scanning tunneling microscope (scan'ing tun'əl ing mī'krə skōp') A device that uses electric current flowing through a needle to trace the contours of atoms and magnify them as much as 30 million times. (p. E26)

scavenger (skav'ən jər) A meat-eating animal that feeds on the remains of dead animals. (p. B21)

sea breeze (sē brēz) Wind that blows from sea to land. (p. D56)

sea-floor vent (sē'flôr' vent) An opening in a mid-ocean ridge where mineral-saturated water boils up from the seafloor crust. (p. C93)

seamount (sē'mount') A huge underwater volcanic mountain that may emerge from the ocean surface as an island. (p. C90)

PRONUNCIATION KEY

a at; ā ape; ä far; âr care; ô law; e end; ē me; i it; ī ice; îr pierce; o hot; ō old; ôr fork; oi oil; ou out; u up; ū use; ü rule; u̇ pull; ûr turn; hw white; ng song; th thin; th this; zh measure; ə about, taken, pencil, lemon, circus

secondary succession (sek'ən der'ē sək sesh'ən) The beginning of a new community where an earlier community already exists. (p. B82)

sediment (sed'ə ment) Pieces of material carried and deposited by water or wind (p. C20)

sedimentary rock (sed'ə men'tə rē rok) A rock made of bits of matter joined together. (p. C44)

seed (sēd) An undeveloped plant with stored food sealed in a protective covering. (p. A68)

seed coat (sēd kōt) The outer covering of a seed. (p. A82)

seed dispersal (sēd di spûr'səl) The movement of a seed from the flower to a place where it can sprout. (p. A83)

self-pollination (self'pol'ə nā'shən) The transfer of pollen from an anther to a stigma in the same plant. (p. A80)

sexual reproduction (sek'shū əl rē'prō duk'shən) The production of a new organism from a female sex cell and a male sex cell. (pp. A62, A81)

shear (shîr) A movement of plates that twists, tears, or pushes one part of Earth's crust past another. (p. C8)

short-day plant (shôrt'dā plant) A plant that blooms when there is more darkness and less daylight. (p. A46)

simple machine (sim'pəl mə shēn') A machine with few moving parts, making it easier to do work. (p. F26)

smog (smog) A mixture of smoke and fog. (p. C64)

solar system (sō'lər sis'təm) The Sun and the objects that are traveling around it. (p. D6)

solid (sol'id) A form of matter that has a definite shape and takes up a definite amount of space. (p. E36)

solubility (sol'yə bil'i tē) The ability of a substance to be dissolved by another substance. (p. E58)

solute (sol'ūt) A substance that is dissolved by another substance to form a solution. (p. E57)

solution (sə lū'shən) A mixture of substances that are blended so completely that the mixture looks the same everywhere. (p. E54)

solvent (sol'vənt) A substance that dissolves one or more other substances to form a solution. (p. E57)

sound wave (sound wāv) A vibration that spreads away from a vibrating object. (p. F51)

spectrum (spek'trəm) A band of colors produced when light goes through a prism. (p. F108)

speed (spēd) How fast an object's position changes with time at any given moment. (p. F11)

spore (spôr) Cells in seedless plants that grow into new organisms. (p. A58)

spring (spring) A place where groundwater seeps out of the ground. (p. C75)

spring tide (spring tīd) The greatest changes from high to low tide that occur when the Sun, the Moon, and Earth are lined up. (p. C89)

state of matter (stāt uv mat'ər) One of the three forms that matter can take—solid, liquid, or gas. (p. E36)

stimulus (stim'yə ləs), *n., pl.* **stimuli (-lī)** Something in the environment that causes a living thing to react. (p. A44)

stomata (stō'mə tə) *pl. n., sing.* **stoma** Pores in the bottom of leaves that open and close to let in air or give off water vapor. (p. A34)

storm surge (stôrm sûrj) A great rise of the sea along a shore caused by low air pressure. (p. D79)

stratus cloud (strā'təs kloud) A cloud that forms in a blanketlike layer. (p. D44)

streak (strēk) The color of the powder left when a mineral is rubbed against a hard, rough surface. (p. C34)

strip farming (strip fär'ming) Trapping runoff by alternating tightly growing grasses with more widely spaced plants. (p. C51)

subscript (sub'skript') A number in a chemical formula that tells the number of atoms in the compound. (p. E25)

surveyor (sər vā'ər) A specialist who makes accurate measurements of Earth's crust. (p. C6)

suspension (sə spen'shən) A mixture in which suspended particles can easily be seen. (p. E59)

symbiosis (sim'bē ō'sis) A relationship between two kinds of organisms that lasts over time. (p. B24)

T

taiga (tī'gə) A cool forest biome of conifers in the upper Northern Hemisphere. (p. B67)

taproot (tap'rūt') A root that has few hairy branches and grows deep into the ground. (p. A31)

temperate (tem'pər it) Free from extremes of temperature. (p. B66)

tension (ten'shən) A movement of plates that stretches or pulls apart Earth's crust. (p. C8)

terracing (ter'is ing) Shaping hillsides into steps so that runoff and eroded soil get trapped on the steps. (p. C51)

texture (teks'chər) An identifying quality of a rock based on how coarse, fine, or glassy it is and on how angular or rounded it is. (p. C42)

threatened species (thret'ənd spē'shēz) A species that is in danger of becoming endangered. (p. D36)

thunder (thun'dər) The noise caused by lightning-heated air during a thunderstorm. (p. D76)

thunderhead (thun'dər hed') A cumulonimbus cloud in which a thunderstorm forms. (p. D76)

thunderstorm (thun'dər stôrm') The most common severe storm, formed in cumulonimbus clouds. (p. D76)

tissue (tish'ū) A group of similar cells that work together at the same job. (p. A8)

topsoil (top'soil') The dark, top layer of soil, rich in humus and minerals, in which many tiny organisms live and most plants grow. (p. B9)

tornado (tôr nā'dō) A violent, whirling wind that moves across the ground in a narrow path. (p. D77)

trade wind (trād wind) A belt of winds around Earth moving from high pressure zones toward the low pressure at the equator. (p. D58)

translucent (trans lū'sənt) Letting only some light through, so that objects on the other side appear blurry. (p. F96)

transparent (trans pâr'ənt) Letting all light through, so that objects on the other side can be seen clearly. (p. F96)

transpiration (tran'spə rā'shən) The loss of water through a plant's leaves. (pp. A35, A38, D39)

trench (trench) A deep valley in the sea floor. (p. C91)

tropical rain forest (trop'i kəl rān fôr'ist) A hot biome near the equator, with much rainfall and a wide variety of life. (p. B71)

tropism (trō'piz'əm) A response of a plant toward or away from a stimulus. (p. A44)

PRONUNCIATION KEY

a at; ā ape; ä far; âr care; ô law; e end; ē me; i it; ī ice; îr pierce; o hot; ō old; ôr fork; oi oil; ou out; u up; ū use; ü rule; u̇ pull; ûr turn; hw white; ng song; th thin; th this; zh measure; ə about, taken, pencil, lemon, circus

troposphere (trop'ə sfîr') The layer of the atmosphere closest to Earth's surface. (p. D32)

tube worm (tūb wûrm) Large wormlike animals that live near sea-floor vents and obtain their food through bacterial chemosynthesis. (p. C93)

tundra (tun'dra) Large, treeless plain in the arctic regions, where the ground is frozen all year. (p. B68)

U

ultrasonic (ul'trə son'ik) Said of a sound with a frequency too high to be heard by humans. (p. F57)

unbalanced forces (un bal'ənst fôrs'əz) Forces that do not cancel each other out when acting together on a single object. (p. F21)

updraft (up'draft') An upward rush of heated air during a thunderstorm. (pp. D55, D76)

V

vacuum (vak'ū əm) A space through which sound waves cannot travel because it contains no matter. (p. F116)

valley breeze (val'ē brēz) A cool wind that blows up a mountain slope and replaces the slope's rising Sun-warmed air. (p. D56)

variable (vâr'ē ə bəl) One of the changes in a situation that may affect the outcome of an experiment. (p. A48)

vascular (vas'kyə lər) Containing plant tissue through which water moves up and food moves down. (p. A15)

velocity (və los'i tē) The speed and direction of a moving object. (p. F12)

vertebrate (vûr'tə brit) An animal that has a backbone. (p. A16)

vibration (vī brā'shən) A back-and-forth motion. (p. F50)

volume (vol'ūm) **1.** A measure of how much space an object takes up. (p. E6) **2.** The loudness or softness of a sound. (p. F58)

W

warm front (wôrm frunt) A front where warm air moves in over a cold air mass. (p. D72)

water cycle (wô'tər sī'kəl) The continuous movement of water between Earth's surface and the air, changing from liquid to gas to liquid. (pp. B51, C74)

water table (wô'tər tā'bəl) The top of the water-filled spaces in the ground. (p. C75)

water vapor (wô'tər vā'pər) Water in the form of a gas. (pp. B50, D38)

watershed (wô'tər shed') Area from which water is drained; region that contributes water to a river or river system. (pp. C20, C68–C69)

weather (weth'ər) What the lower atmosphere is like at any given place and time. (p. D34)

weathering (weth'ər ing) Breaking down rocks into smaller pieces. (p. C10)

weight (wāt) The force of gravity between Earth and an object. (pp. E7, F36)

well (wel) A hole dug below the water table that water seeps into. (p. C75)

wind (wind) Air that moves horizontally. (p. D55)

work (wûrk) The use of force to move an object a certain distance. (p. F26)

X

xylem (zī'ləm) The tissue through which water and minerals move up through a plant. (pp. A30, A32)

Y

year (yîr) The time it takes a planet to orbit the Sun. A *year* is different from planet to planet. (p. D7)

Index

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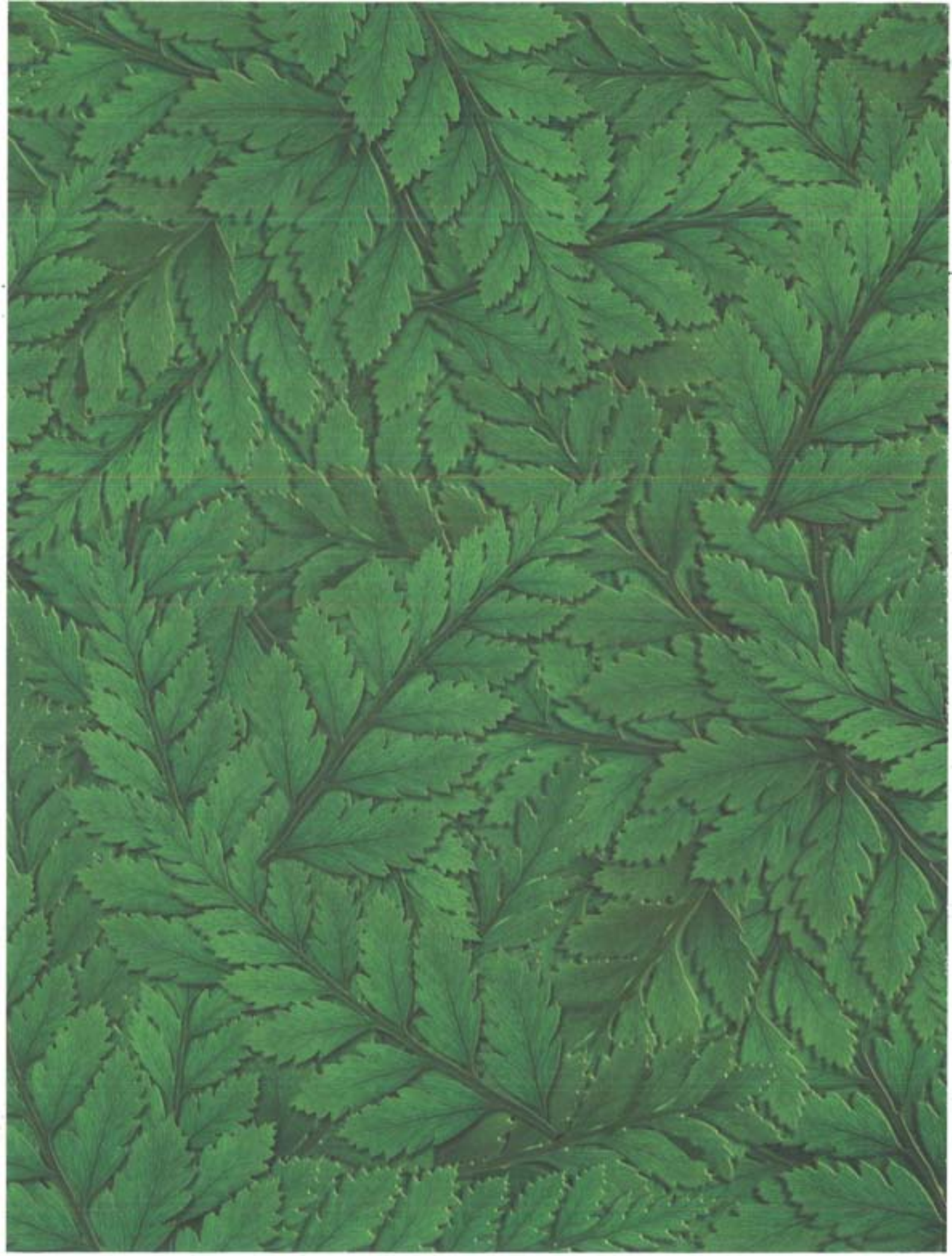

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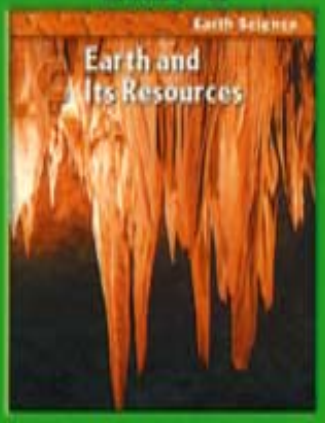

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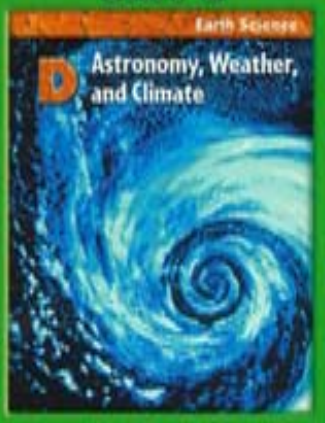

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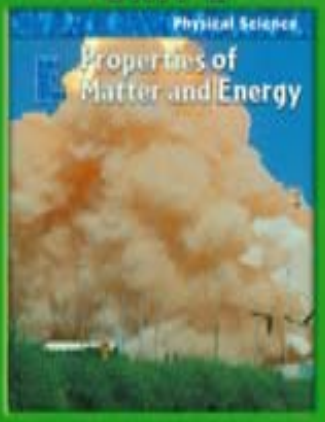

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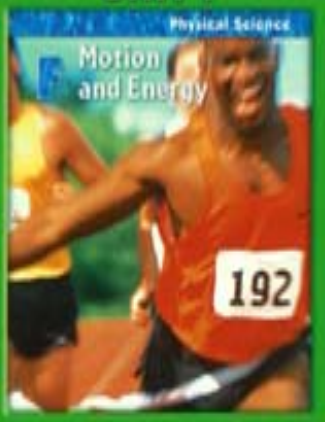

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