Understanding Food Chains

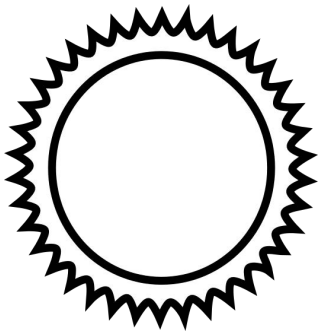
Our bodies need energy to grow and do things. We get energy from the food we eat. But where does our food get energy from? That's where the **food chain** comes in. Before we can understand what a food chain is, we have one more word we have to learn. **Ecosystem**.

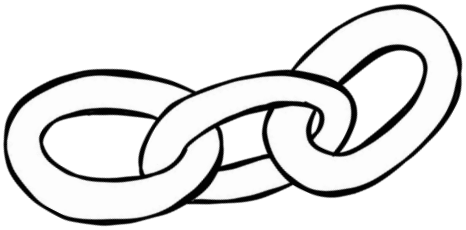
Ecosystem

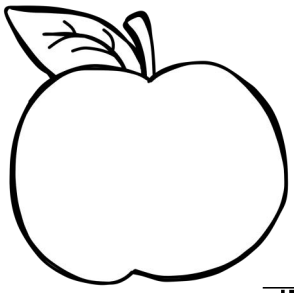
An ecosystem is made up of all the living and nonliving things in an area. A desert includes sunshine, cacti, scorpions, lizards, reptiles, and other plants and animals that live there. When we look at how all of those things work together and affect each other, we are studying an ecosystem.

A food chain is the way energy moves through an ecosystem. The food we eat got all of its energy from the sun, but we don't eat sunshine! The energy comes to us one step at a time, like links in a chain. At one end of the chain is the sun. At the other end of the chain is us and the food we eat.

Some food chains are made up of just the sun and plants. The sun gives an apple tree energy to grow, the tree produces apples, and we eat the apples. There aren't any animals involved. Some food chains involve animals. When one animal eats another animal, it is called a predator. When an animal is eaten, it is called prey. Let's look at some of the different food chains we can find all around the world.



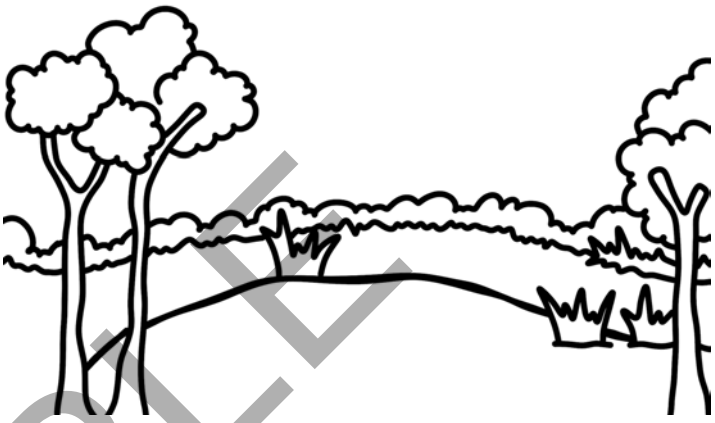




Food chain

AUSTRALIAN WOODLANDS

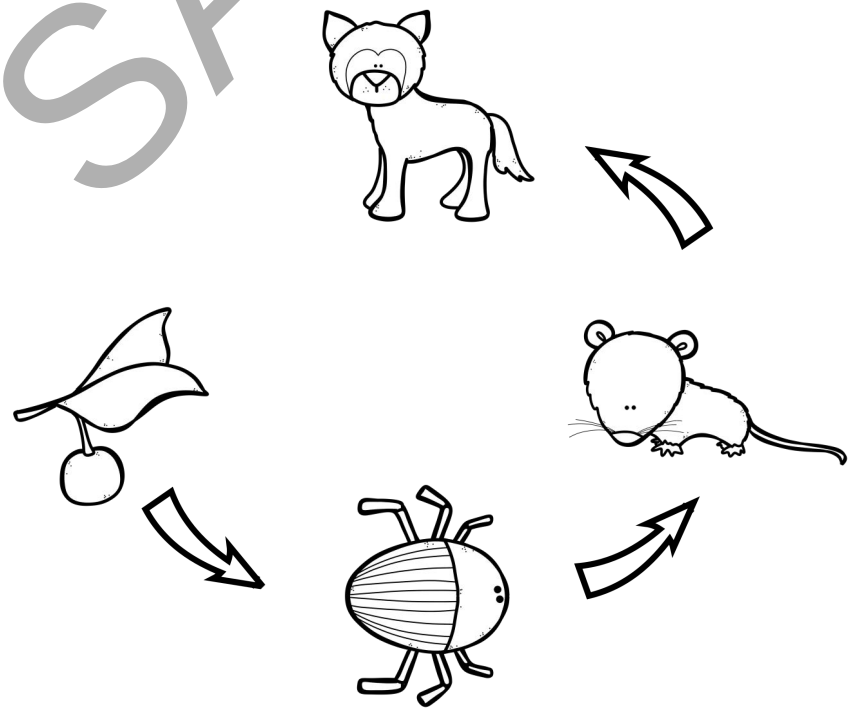
Australia is a country and a continent south of the Equator. It is surrounded by the Indian and Pacific Oceans. Its **woodland** areas are covered with trees and grass.



Beetles eat plants that got their energy from the sun. Small marsupials called possums are predators and eat the beetles and other insects. Wild dogs called dingoes are predators, and they eat the possums. The possum was a predator when it ate the beetle, but then it became prey for the dingo.

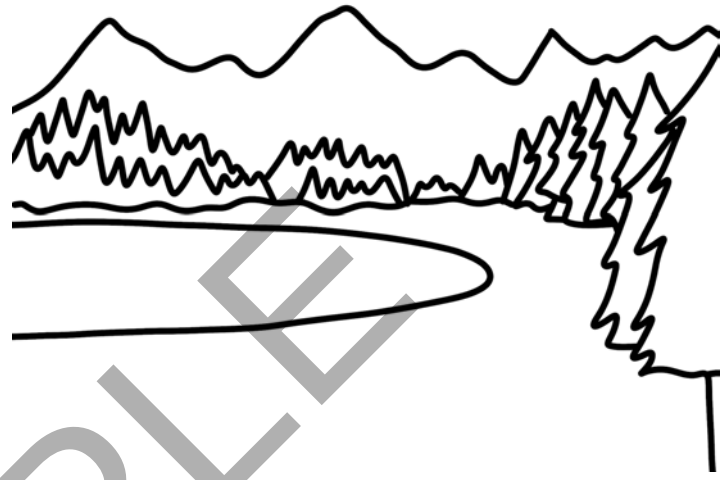
Add the sun and an arrow to complete this food chain.

Australian woodlands



BOREAL FOREST

The **boreal forest**, or taiga as it is sometimes called, is an evergreen forest that sits like a giant hat on the Northern Hemisphere. It covers part of Canada in North America and part of Scandinavia in Europe and Russia.

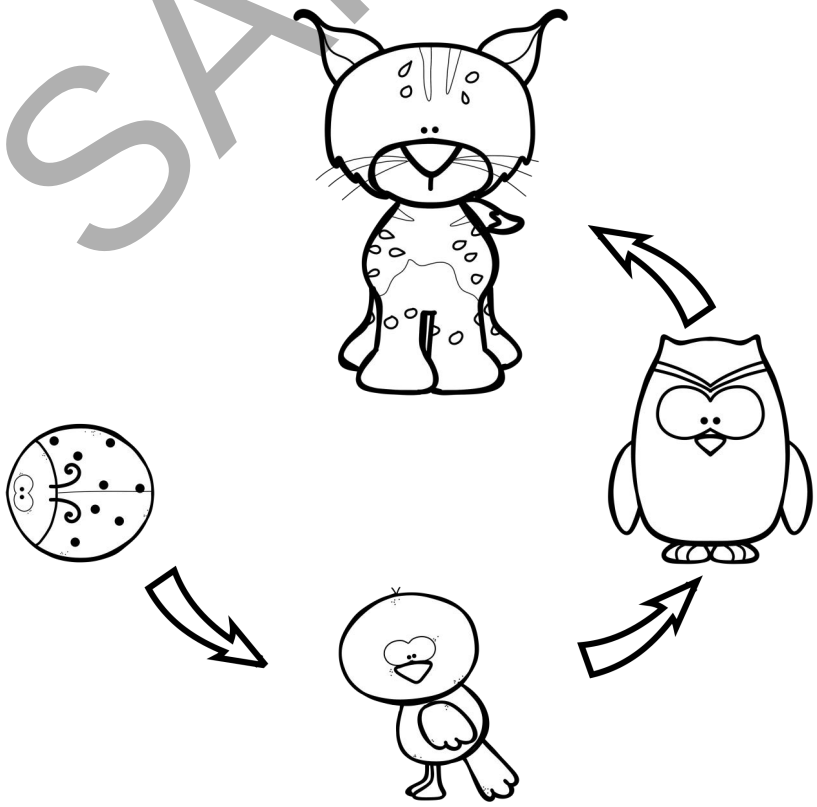


Aphids are tiny bugs that eat plants. Ladybugs eat small bugs like aphids for energy. Songbirds eat the ladybugs. Great horned owls sometimes eat the songbirds, and the lynx eats the owls. The ladybugs, songbirds, and owls are both predators and prey.

Boreal

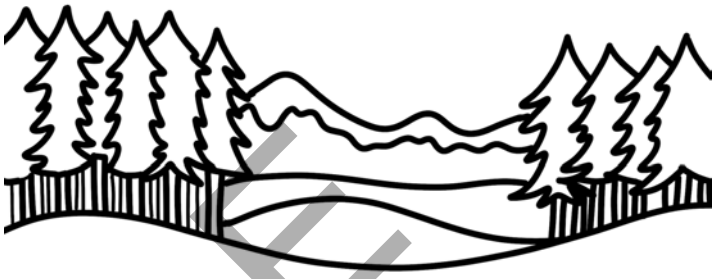
forest

Add the sun, plants, aphids (just tiny little dots), and arrows to complete this food chain.



CONIFEROUS FOREST

Temperate **coniferous forests** are evergreen forests that are not as far north as the taiga.

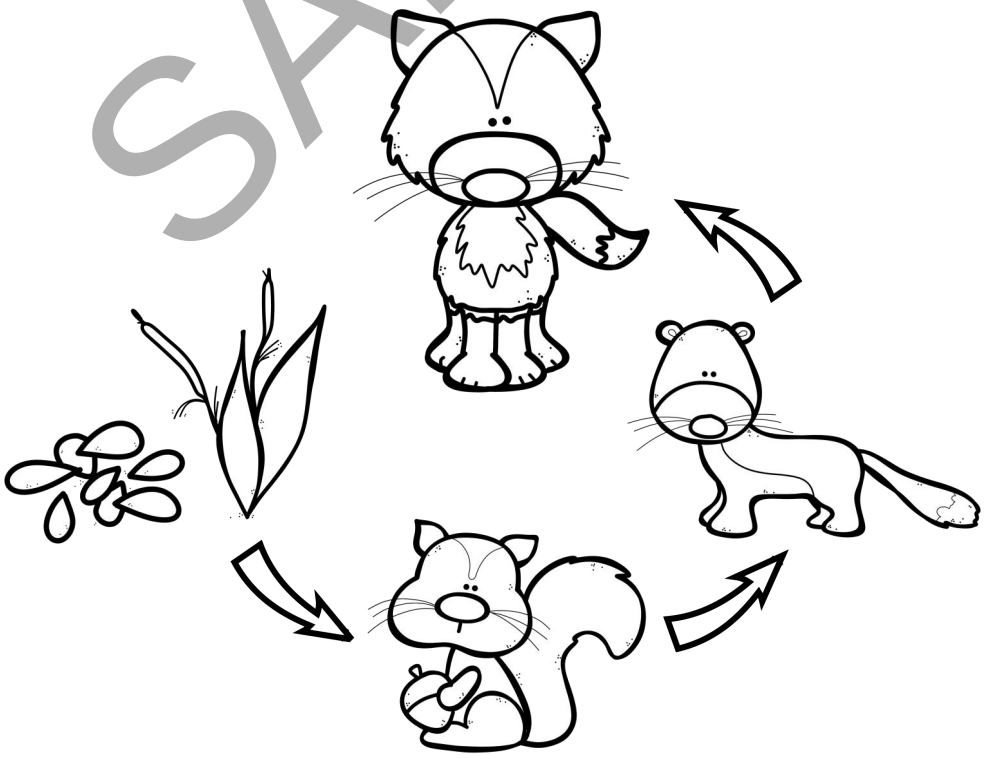


Squirrels eat the seeds plants produce. Weasels eat squirrels, and foxes eat weasels. The weasels are predators because they eat squirrels, but they are also prey because the foxes eat them.

Add the sun and an arrow to complete this food chain.

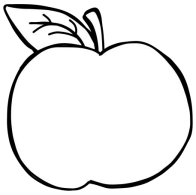
coniferous

forest

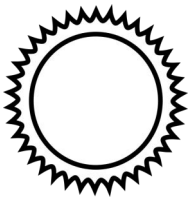


Review

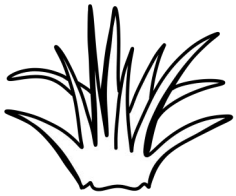
What is the first thing in every food chain? Draw a circle around it.



Apple



Sun



Grass

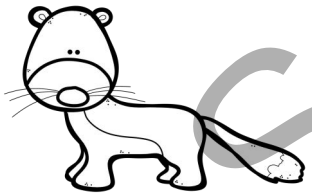
In the food chains we studied, which animal was not at the top of its food chain? Draw an X through it.

Frog

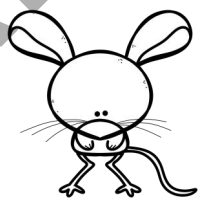
Mountain lion

Hawk

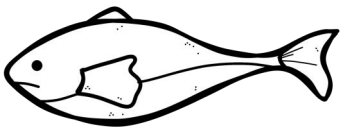
Which animal eats copepods? Draw a circle around it.



Weasel

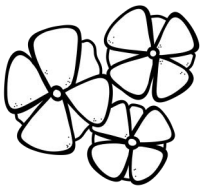


Jerboa

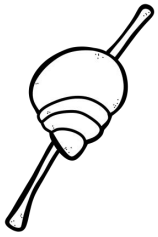


Arctic cod

Which of the following does not get its energy directly from the sun? Draw an X through it.



Flowers



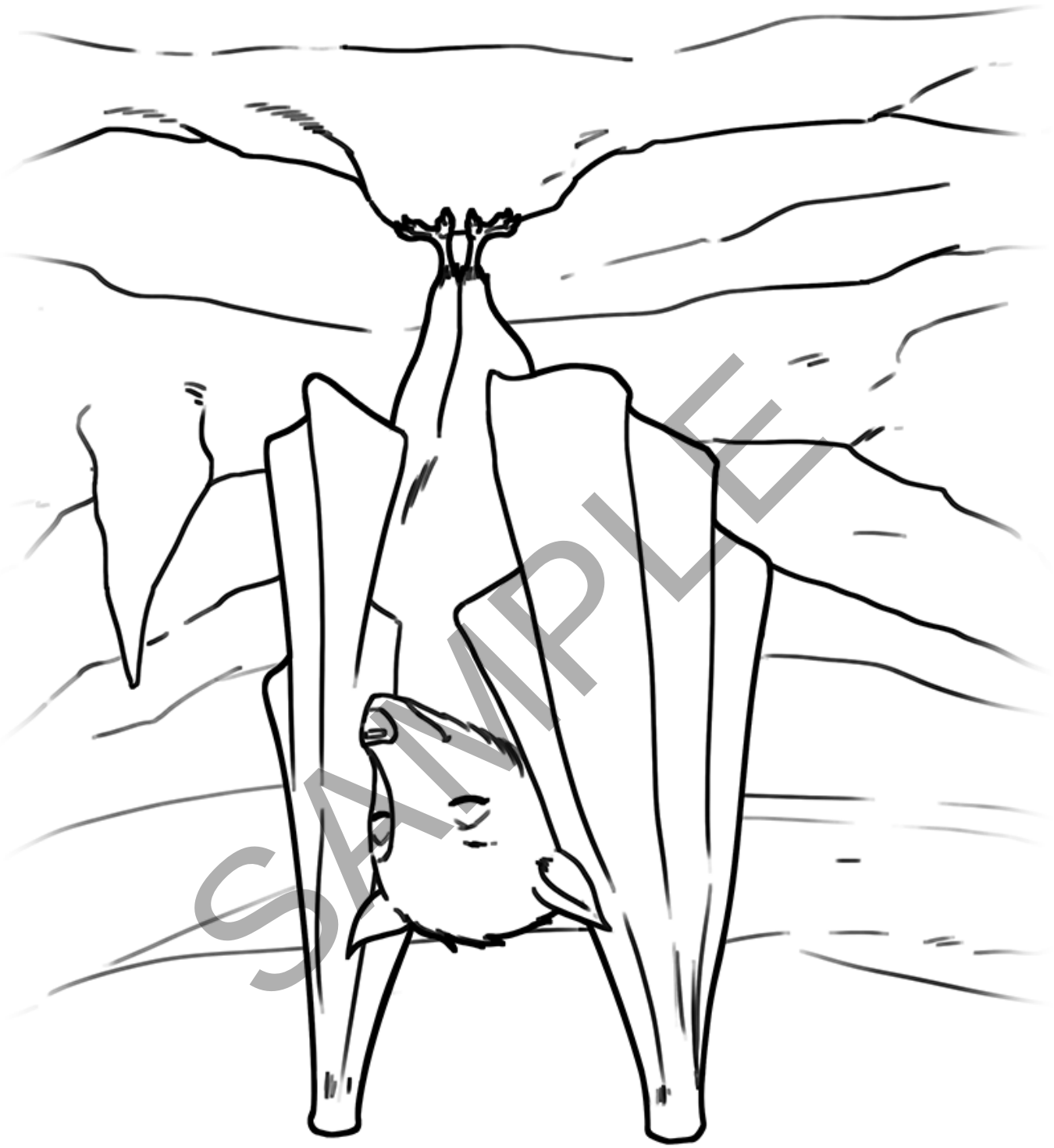
Snail

Algae

Bats are very unique mammals, and most bats do a very important job. Bats are the only mammals that can fly. Their job is to eat insects all day long. While that may sound gross, can you imagine how many bugs there would be if animals like bats didn't help keep their numbers down? Just one mosquito can lay between 50 and 200 eggs at one time. During her lifetime, a mother mosquito can lay up to 1,000 eggs. If everyone of those mosquitos lived and went on to lay 1,000 eggs of its own, we would very quickly find ourselves in big trouble! One bat can eat a lot of insects. Some can eat enough insects to equal the entire weight of the bat! That means if a bat weights 1 pound (453 grams), it can eat 1 pound (453 grams) of insects every single day!

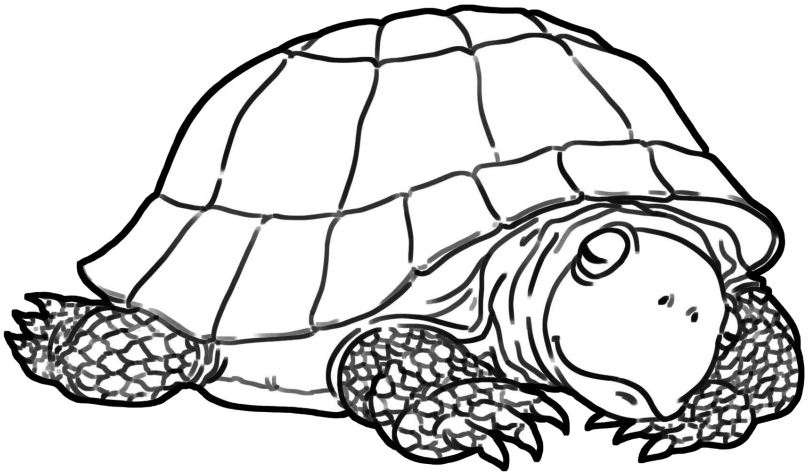
A bat needs a lot of energy to fly. It rests during the day, often hanging upside down in a place like a cave, and flies during the night. When the weather gets too cold, some bats migrate and move to warmer places for the winter. Other bats hibernate because when it gets colder, there aren't enough insects around to eat. Bats aren't able to store food for the winter, and it takes a lot of energy for them to wake up. They try to eat enough during the warmer months to store up energy in their body fat so they can hibernate all winter long. If something happens and they have to wake up when they should be hibernating, it can be very dangerous for them. They may run out of energy before it's time to be done hibernating.

What are some problems we could have if bats didn't eat insects?



Bat

Like snakes, **turtles** are reptiles. There are about 300 different types of turtles in the world. They mostly live in places that are not terribly cold because they are cold-blooded. Turtles who do live in places that have cold winters must hibernate.



Like snakes, turtles come in all sizes. Common bog turtles are only about 4 inches (10 centimeters) long and weigh only 4 ounces (110 grams). The largest type of turtle, a turtle called a leatherback, lives in the sea and can be up to 4-8 feet (1.2-2.4 meters) long and weigh up to 2,000 pounds (900 kilograms).

Turtles are known for their strong shells, which act like a coat of armor that protects them. Most can tuck their head, legs, and tail inside their shell, making it extremely difficult for other animals to eat them.

Turtles can't store food for the winter months either, so they have to find a safe place to hibernate and wait for temperatures to grow warm again. Freshwater turtles that need to hibernate often find a nice muddy place where they can squish down in the mud to stay warm.

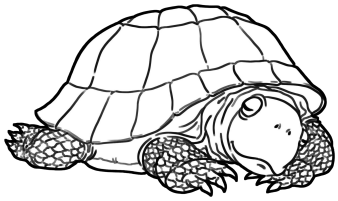
What do you think it would be like to have to sleep all winter long?

turtle

Review Answer Key

This animal gives birth to cubs while hibernating. Draw a circle around it.

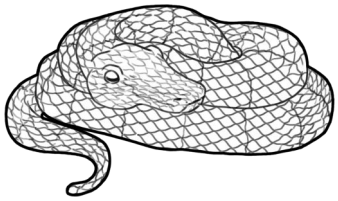
Hedgehog



Turtle

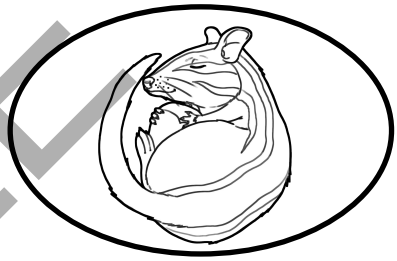
Bear

This animal is a small mammal in the rodent family. Draw a circle around it.



Snake

Frog



Chipmunk

This animal likes to dig mazes of burrows that have different rooms and many ways in and out. Draw a circle around it.

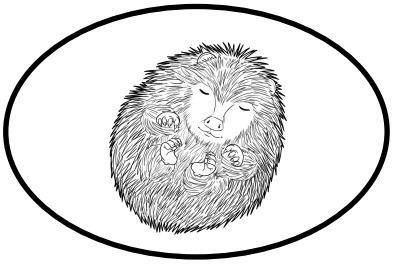
Beaver

Bat

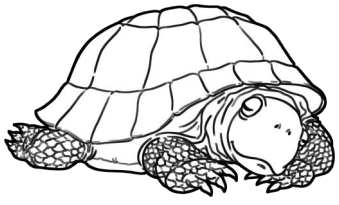
Groundhog

This animal has big eyes but cannot see very well. Draw a circle around it.

Bear



Hedgehog

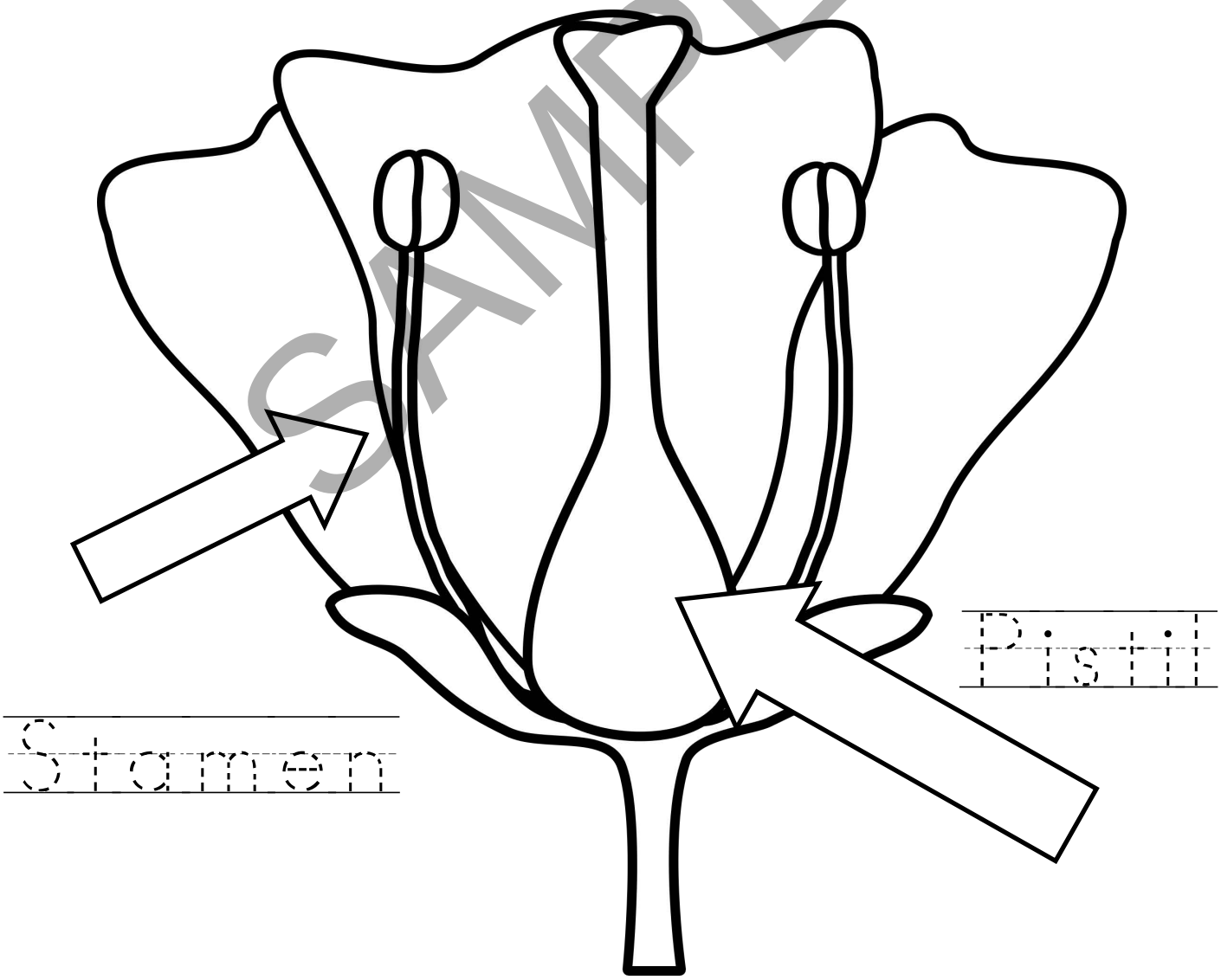


Turtle

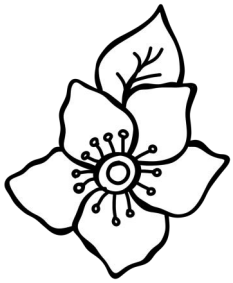
Plants: How They Grow and How They Help Us

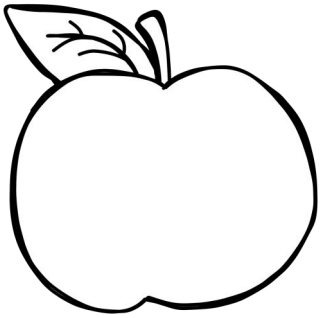
Plants are a very important part of our world. Without them, we wouldn't have the air we need to breathe or many of the foods we eat. Animals would starve with no plants to eat, and the soil would all wash away with no plant roots to hold onto it. Have you ever wondered how plants make more of themselves? They can't get up and move from place to place. They don't have cubs or kits like some animals do, and they can't lay eggs the way fish and birds do. So how does one plant reproduce and make more of itself? Many plants use a process called pollination.

Most plants are seed plants. They make seeds that can grow into new plants. In order for a plant to make a seed, pollen from one part of the plant has to reach another special part of the plant. In flowering plants, the pollen is made in the **stamen** and must travel to the **pistil**. Pollen uses many different ways to travel, including the wind, insects, and birds.



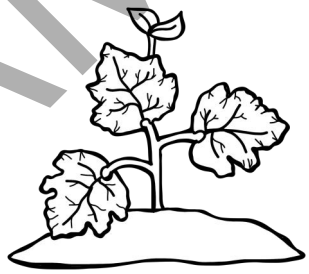
Let's look at an **apple** tree. When the weather is warm enough, the tree begins to bud. The buds open into flowers. After the flowers blossom, insects carry the pollen from the stamen of one flower to the pistil of another flower. The flower produces seeds, and the seeds grow into an apple.

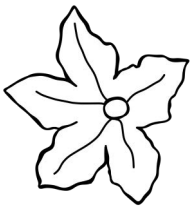
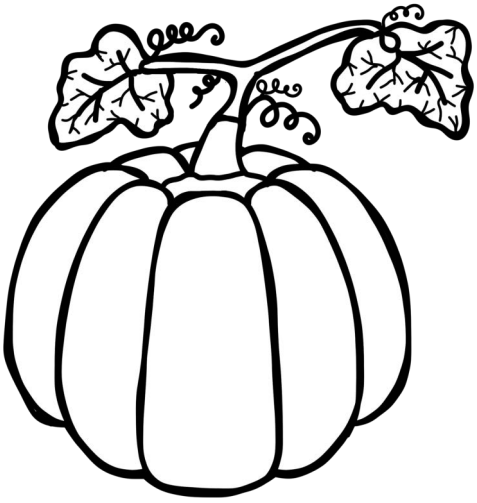


Apple

Pumpkins are another flowering plant. After a pumpkin seed sprouts, it grows into a plant. The plant grows into a vine, which produces many flowers. Only certain flowers can grow into pumpkins. Once the flowers are pollinated, a small pumpkin begins to grow. Most pumpkins grow to weigh between 5 and 30 pounds (2.3-14 kilograms), but some have been known to weigh more than 1,000 pounds (450 kilograms). The pumpkins have more seeds inside of them, which can sometimes be planted to start the cycle over again.

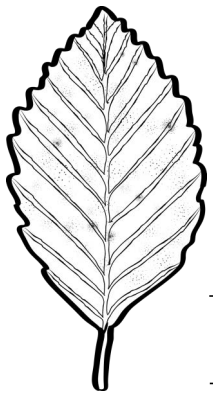





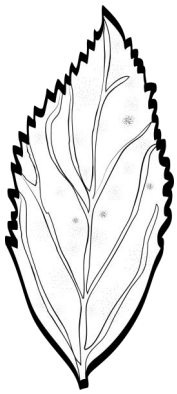
Pumpkin

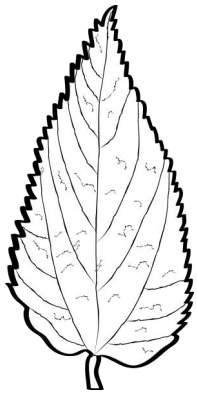
Not only are there many different types of flowers, there are many different types of leaves. Often, you can tell what kind of tree a leaf is from just by its shape. Look closely and see how many differences you can spot between the leaves from these trees.



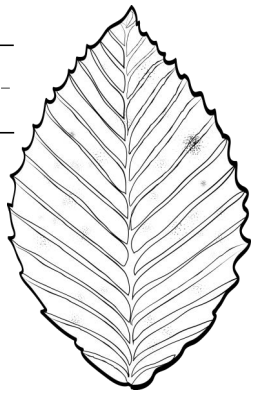
Alder

Ash

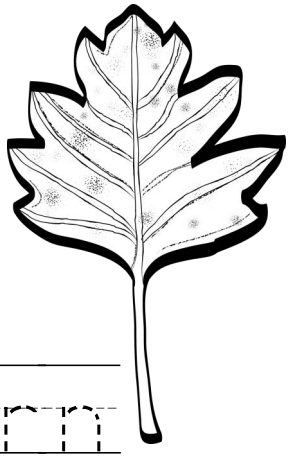




Beech



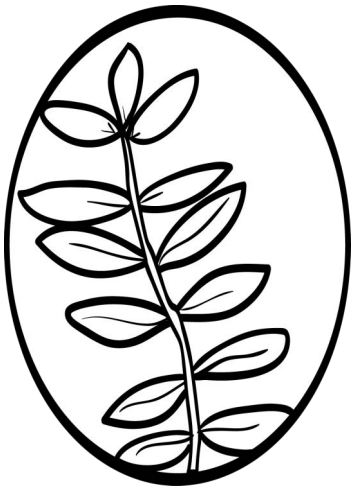
Hackberry

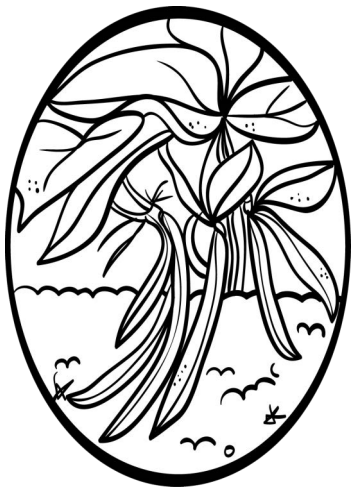


Hawthorn

Red maple

Some plants give us special kinds of seeds called pulses. Most of the common pulses we eat are types of beans, like **lentils**, **navy beans**, and **pinto beans**.





Lentils, navy beans,

and pinto beans

Some plants have roots that are healthy food for us to eat, like **carrots**, **radishes**, and **turnips**. These foods all have important vitamins and other substances our bodies need to stay healthy.

Carrots, radishes,

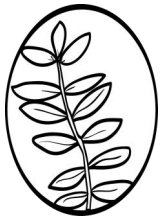
and turnips

Review

Which of the following is not a cereal grain? Draw an X through it.

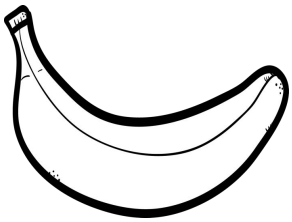
Barley

Corn



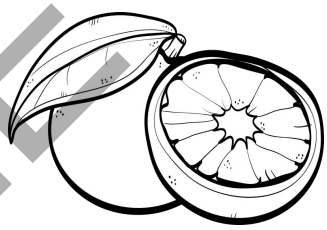
Lentil

Which of the following is not a fruit? Draw an X through it.



Banana

Spinach

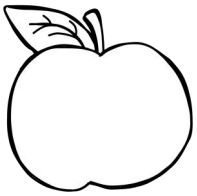


Orange

Which plant that we learned about grows on a vine and can weigh more than 1,000 pounds (450 kilograms)? Draw a circle around it.

Pumpkin

Cacao beans



Apple

Which of the following is not the root of a plant? Draw an X through it.

Carrots

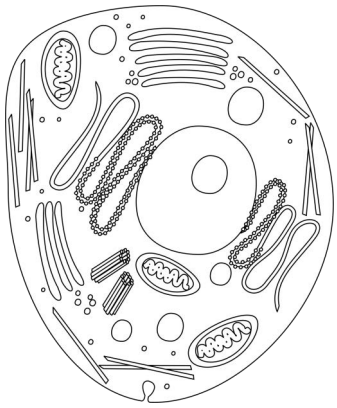
Celery

Radishes

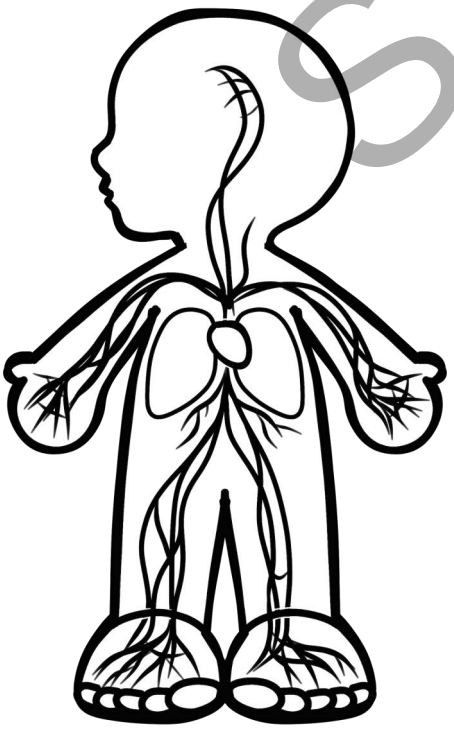
A Closer Look at Body Systems

Do you know what one trillion is? Think of it this way. Picture one piece of breakfast cereal. Now think of how many pieces it takes to fill one bowl. 100? 200? Let's pretend it takes 250 pieces of cereal to fill your bowl. Now imagine 40 bowls of cereal. Is your table getting full? If each bowl has 250 pieces of cereal in it, now you have 10,000 pieces of cereal. Now here's where it gets amazing. Imagine you had 1,000 bowls of cereal! You would have 250,000 pieces of cereal. We're still a long way from one trillion! How about 1,000,000 (1 million) bowls of cereal? That makes 250,000,000 (250 million) pieces of cereal. What if we had 4,000,000 (4 million) bowls of cereal? Now we're up to 1,000,000,000 (1 billion) pieces of cereal. Hold onto your hats for this next one. If we multiply our 4 million bowls of cereal by 1,000, we would get 4,000,000,000 (4 billion) bowls of cereal. THAT would finally give us 1,000,000,000,000 (1 trillion) pieces of cereal.

Now that we know what 1 trillion looks like, imagine this. Your body has more than 10 trillion **cells** in it! Thankfully, your cells are a lot smaller than a piece of cereal. As a matter of fact, cells are so tiny you can only see them through a microscope. Every one of those cells is made up of even smaller parts that let the cell "breathe," take in food, and get rid of waste.



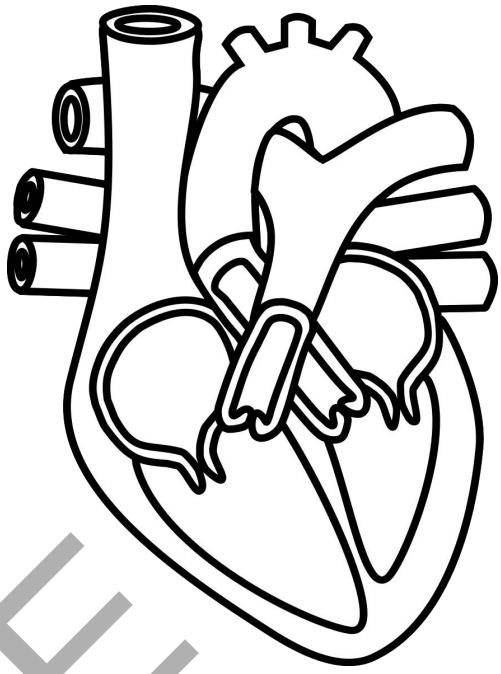
When a group of cells work together to do one type of job, we call them a tissue. When groups of tissues work together, we call it an organ. Your body has many important organs such as your heart, brain, lungs, and kidneys. When a group of organs work together, we call it a system.



Let's look at a few of your body's amazing systems. We'll start with the circulatory system. Your cells need oxygen and nutrients to stay alive and do their jobs. The **circulatory system** is the way your body delivers these things to your cells. It has to reach every single corner of your body, from the top of your head to the bottom of your feet.

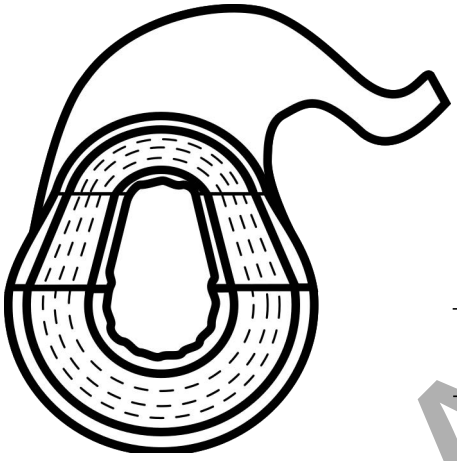
Circulatory system

Your body uses blood to deliver oxygen and nutrients throughout your body, but something has to keep that blood moving. That's where your **heart** comes in. Your heart is the main organ in your circulatory system. It works like a pump to keep the blood moving in a cycle through your body. Your blood delivers oxygen and nutrients to the cells using a long system of blood vessels. The blood vessels act like a system of roads, transporting the blood everywhere it needs to go. The blood drops off oxygen and nutrients and takes away waste the cells don't need anymore.



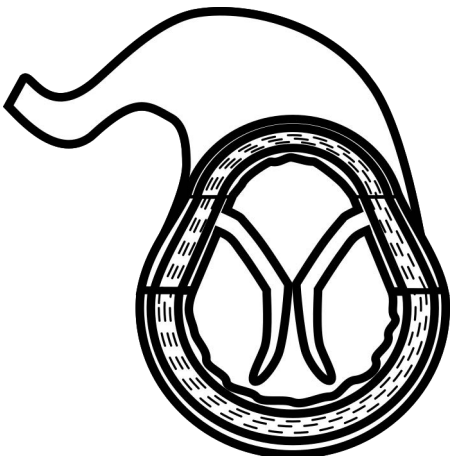
You have three types of blood vessels in your body, and just like the cells, each type has a different job to do.

heart



Artery

Arteries have the job of carrying blood from the heart. The blood they carry is full of oxygen, so it looks very red. **Veins** carry blood back to the heart. The blood our veins carry has already delivered most of its oxygen to the cells, so it appears much darker.

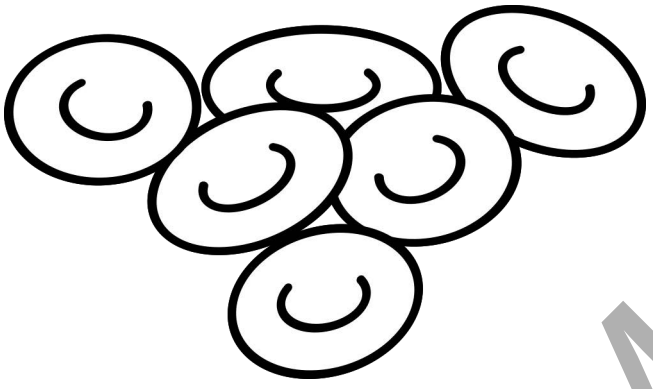


Vein

Capillaries have the special job of connecting our arteries and veins together.

Capillary

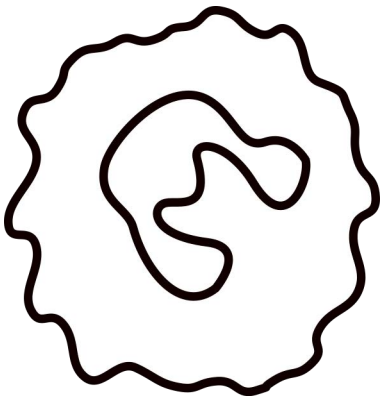
Now that we know how blood travels through the body, let's take a closer look at what makes up your blood. Your blood is made up of a watery-type of liquid called plasma. The plasma carries your blood cells. You have three types of blood cells—**red blood cells**, **white blood cells**, and **platelets**. And just like I'm sure you realize by now, each of those different types of cells has a different job to do.



Red blood cells carry oxygen to all the parts of your body. They are extremely small, as we've already discussed, and they are also very pliable. Pliable means they can bend and stretch a lot, and that comes in very handy when they have to squeeze through tight spaces in blood vessels.

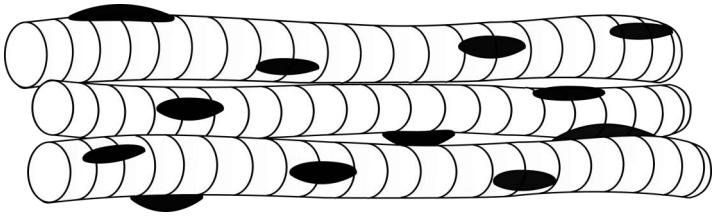
Red blood cells

White blood cells are your body's defenders. Whenever something invades your body that should not be there, like a virus or bacteria for example, the white blood cells go to work. Some of them release chemicals to fight off the attackers, and some of them just swallow the invaders! Your white blood cells multiply and build more of themselves when they have a big job to do, just as if they had called for reinforcements.



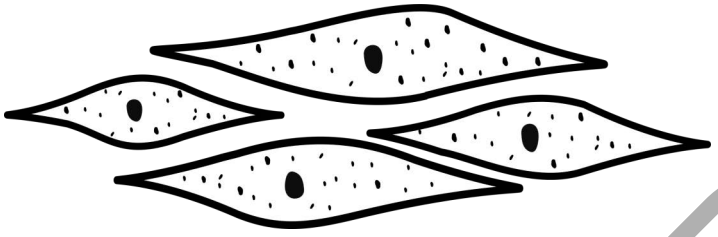
White blood cells

Skeletal muscles are the muscles that you probably think of first when you think about a muscle's job. These are the muscles that let you lift your arm, take a step, or move your mouth to talk. They are attached to your bones with strong tissues called tendons. Skeletal muscles are voluntary muscles, which means you can move them—or not—whenever you want. You can take a step or stand still. You can pick up a pencil or put it back down. You can talk or not talk. It's up to you!



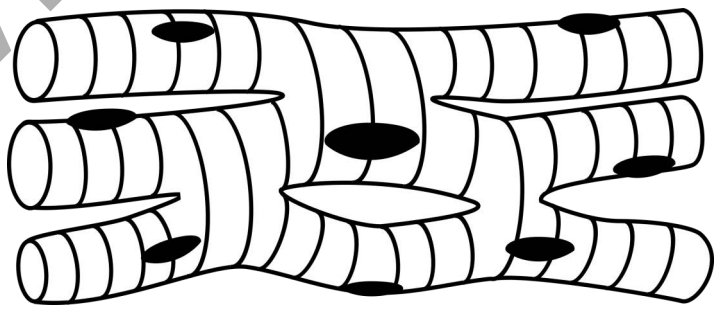
Skeletal muscle cell

Smooth muscles are the muscles in most of our internal organs. They are the ones that push the food through your esophagus and other parts of your digestive system.



Smooth muscle cell

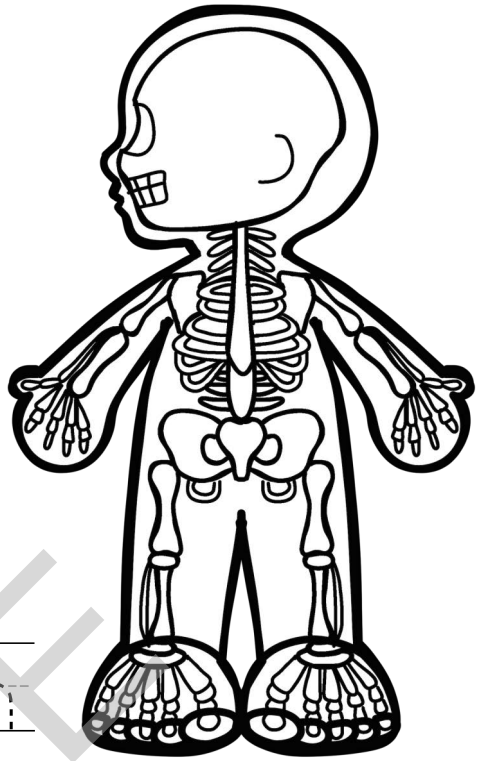
Cardiac muscles are the ones that make up the walls of your heart. These are special muscles that can work constantly without ever getting tired. They keep your heart pumping and everything else in your body working.



Cardiac muscle cell

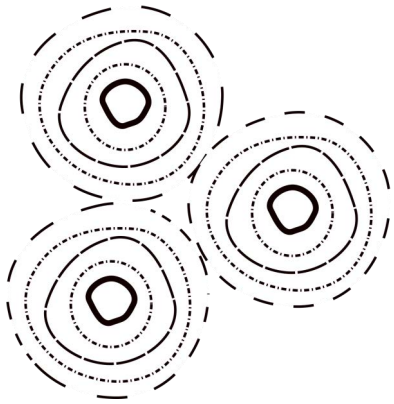
Smooth muscles and cardiac muscles are involuntary muscles. This means you don't control when they work and when they don't. It's a VERY good thing that these muscles are involuntary. If they weren't, you'd have to remember to tell them to work day in and day out. You wouldn't get much of anything else done, including sleep! Thankfully, these muscles keep working whether you are awake or asleep and whether you remember they are even there or not.

The last system we're going to talk about is the **skeletal system**. We usually only think about our bones when we break one, but your bones are busy every day doing their own amazing jobs. One of their most important jobs is giving your body its shape. They hold you up. They also protect some of your most important organs. Your skull protects your brain, and your rib cage protects your heart and lungs.



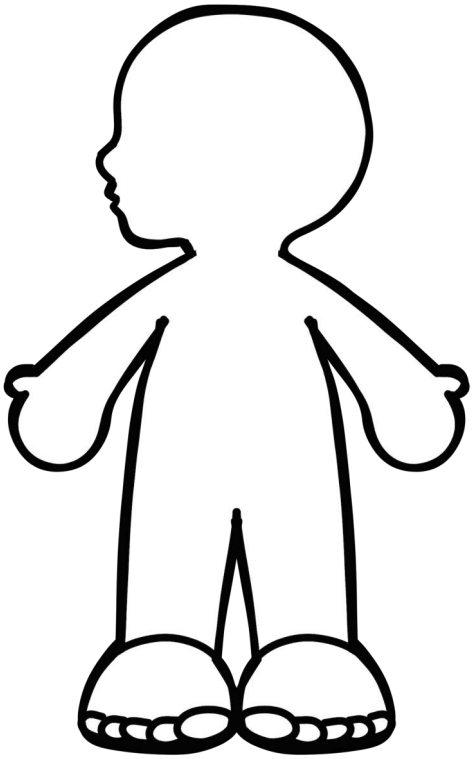
Your skeleton also includes a smooth tissue called cartilage that keeps bones from rubbing together, and a strong, stretchy material called ligaments that hold your bones in place.

Skeletal system



Bones

Bones may seem hard and dead, but they are actually quite alive! Most bones are hard on the outside and have softer bone on the inside. They are also home to two types of bone marrow, which is sort of a jellylike material. Yellow bone marrow is mostly fat, but red bone marrow has a terribly important job to do. It manufactures blood cells. Our red blood cells, for example, only live about 30 days, so without a way to make more of them, we'd quickly run out. Thanks to red bone marrow, we have a never-ending supply of them. Red blood cells are a critical part of the very first system we learned about, the circulatory system. Now you can see we've come all the way back to the beginning!

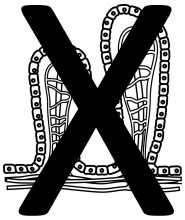


More than 10 trillion cells, 600 muscles, and 200 bones are all working together to make the one and only YOU!

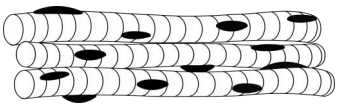
you

Review Answer Key

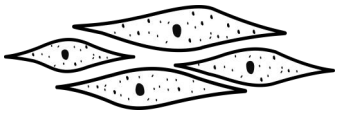
This is not a type of muscle tissue. Draw an X through it.



Villi



Cardiac

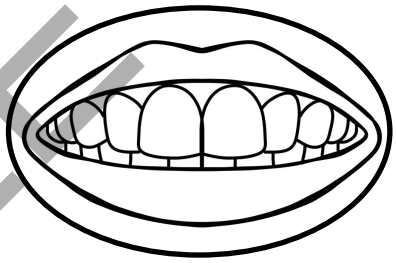


Smooth

This is where the digestive system starts. Draw a circle around it.

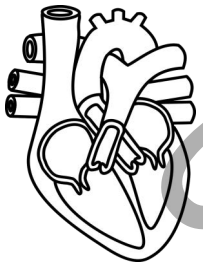
Artery

Air sacs

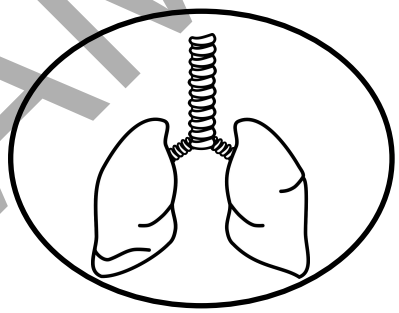


Mouth

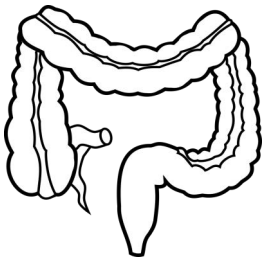
This is the main organ of the respiratory system. Draw a circle around it.



Heart

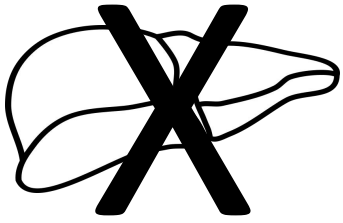


Lungs

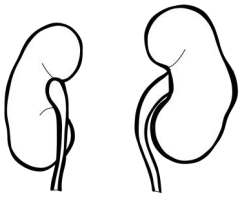


Large intestine

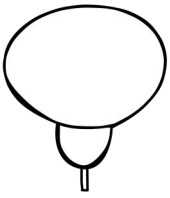
This organ is not a part of the urinary system. Draw an X through it.



Liver



Kidneys



Bladder

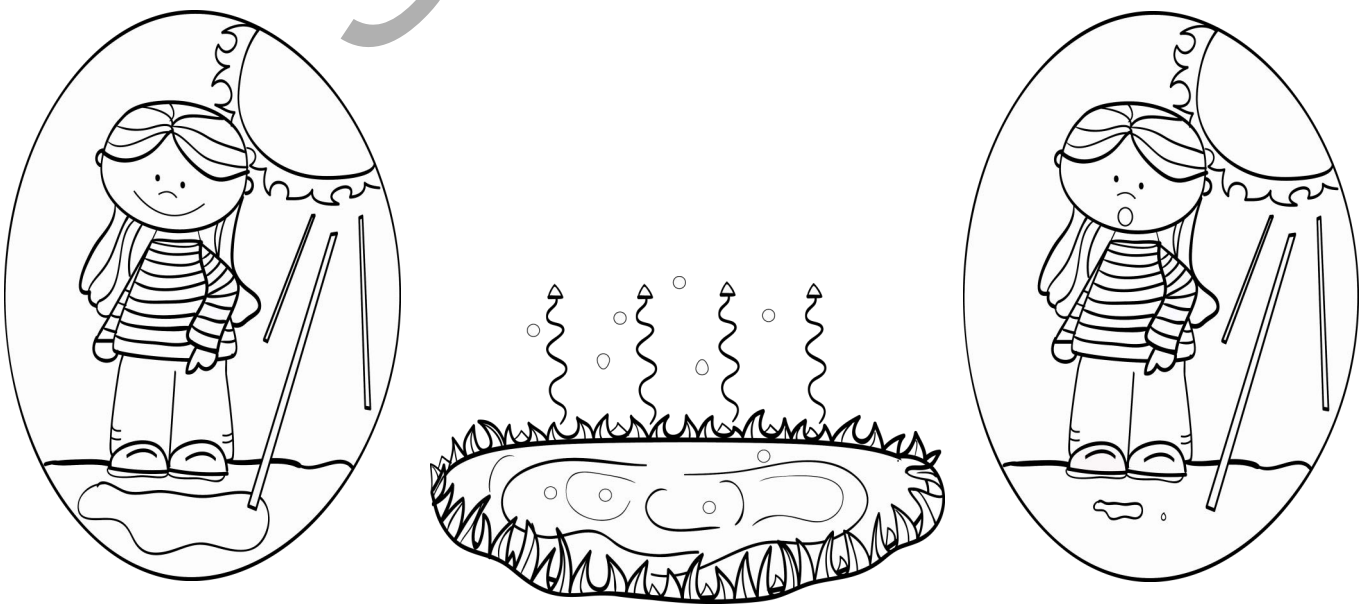
Evaporation

The water cycle starts with the sun. I know, that might sound strange (after all, what does the sun in the sky have to do with the water we drink?), but the sun plays a very important part. When the heat and energy from the sun reach the ocean, they warm the water. When the water gets warm enough, it turns into a gas called water vapor. The water vapor rises into the air. This process is called **evaporation**.

Think of what happens when someone boils a pan of water on the stove. As the water heats up, it starts to evaporate. It turns into water vapor and disappears into the air around us.

Evaporation is also why a puddle of water on the sidewalk does not stay a puddle forever. Even if there's nowhere else for the water to go, eventually, it will evaporate back into the air.

Evaporation

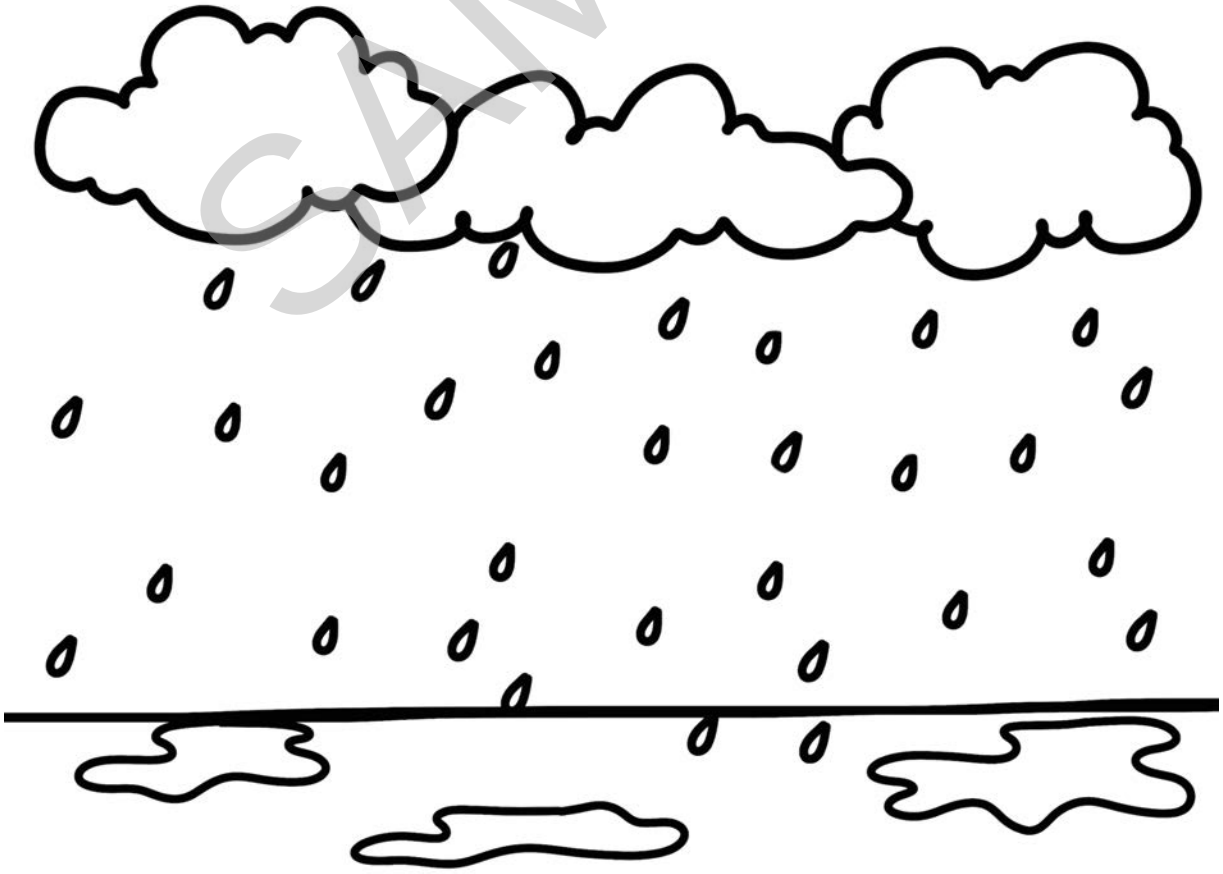


Infiltration

When the rain, snow, or other precipitation reaches the ground, some of it soaks into the ground through a process called **infiltration**. Now the precipitation becomes ground water.

Some of the water will quickly find its way to rivers and run off into them. The water that doesn't find its way to a river could end up being collected and stored in the ground in a place called an aquifer. An aquifer is made up of soil and rocks and can hold the water until the environment needs it.

Infiltration



Clouds

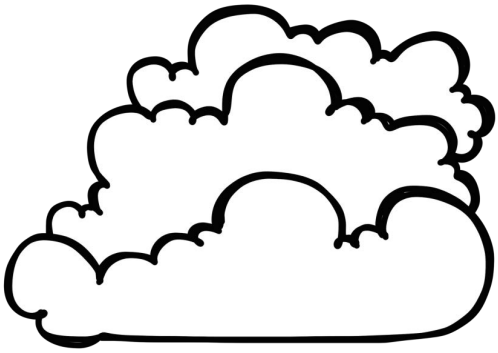
Scientists give **clouds** some very strange-sounding names, but their names aren't really hard to understand if you break them down. Cloud names describe their shape and sometimes how high above the earth they are.

Look at a word you know like *wise*. *Wise* means knowing what is right and making good decisions. If we add the prefix *un–* to *wise* we get *unwise*. *Un–* means *not*, so *unwise* is the same as *not wise*.

It works the same way with clouds. If we use the prefix *strato–* it means *layerlike* or *sheetlike*. We call these types of clouds stratus clouds.

If we use the prefix *cumulo-*, it means *pile* or *heap*. Cumulus clouds are the big, white puffy kind.

If we use the prefix *cirro*, it means *curl.* Cirrus clouds look curly.

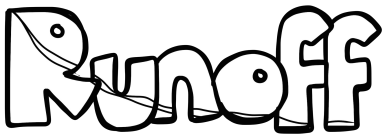


Clouds

Review

This is the process of water vapor returning to the air from plants. Draw a circle around it.

Infiltration



Runoff

Transpiration

This is the process of water turning into water vapor and rising into the air. Draw a circle around it.

Evaporation

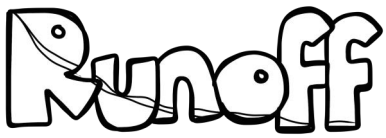
Condensation

Precipitation

This is the name for water that returns directly to the seas and oceans after falling from the clouds. Draw a circle around it.

Precipitation

Infiltration



Runoff

This is the process of water coming down to earth from the clouds. Draw a circle around it.

Transpiration

Precipitation

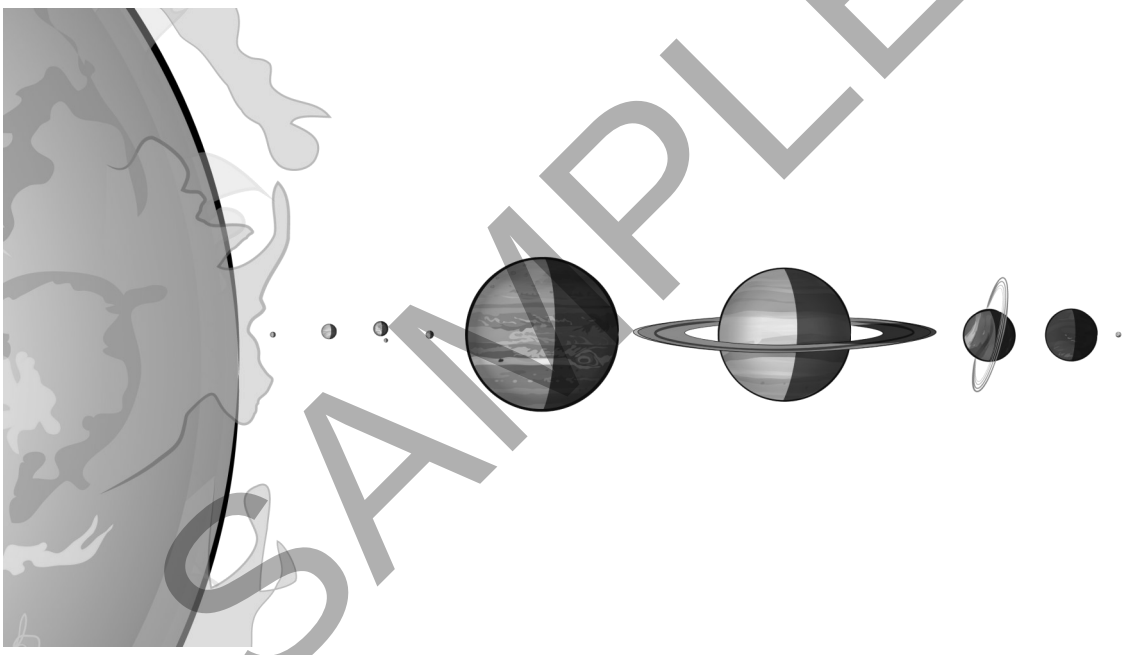
Condensation

The Solar System: Planets, Earth's Moon, and Constellations

Think about your home where you live. Picture your neighbors or the area close by your house. Now imagine you could see your home from higher, like a bird's eye view. Now you can see your home and neighbors and your town. If you go even higher, maybe in an airplane, you can see your town and the towns and cities close by. If you went even higher, maybe in a space shuttle, you could see whole countries and even continents.

That's what we're going to do now to get a big picture of what our universe looks like, only you'll have to use your imagination because there's no one spot a human being can stand or fly to that lets them see the entire universe.

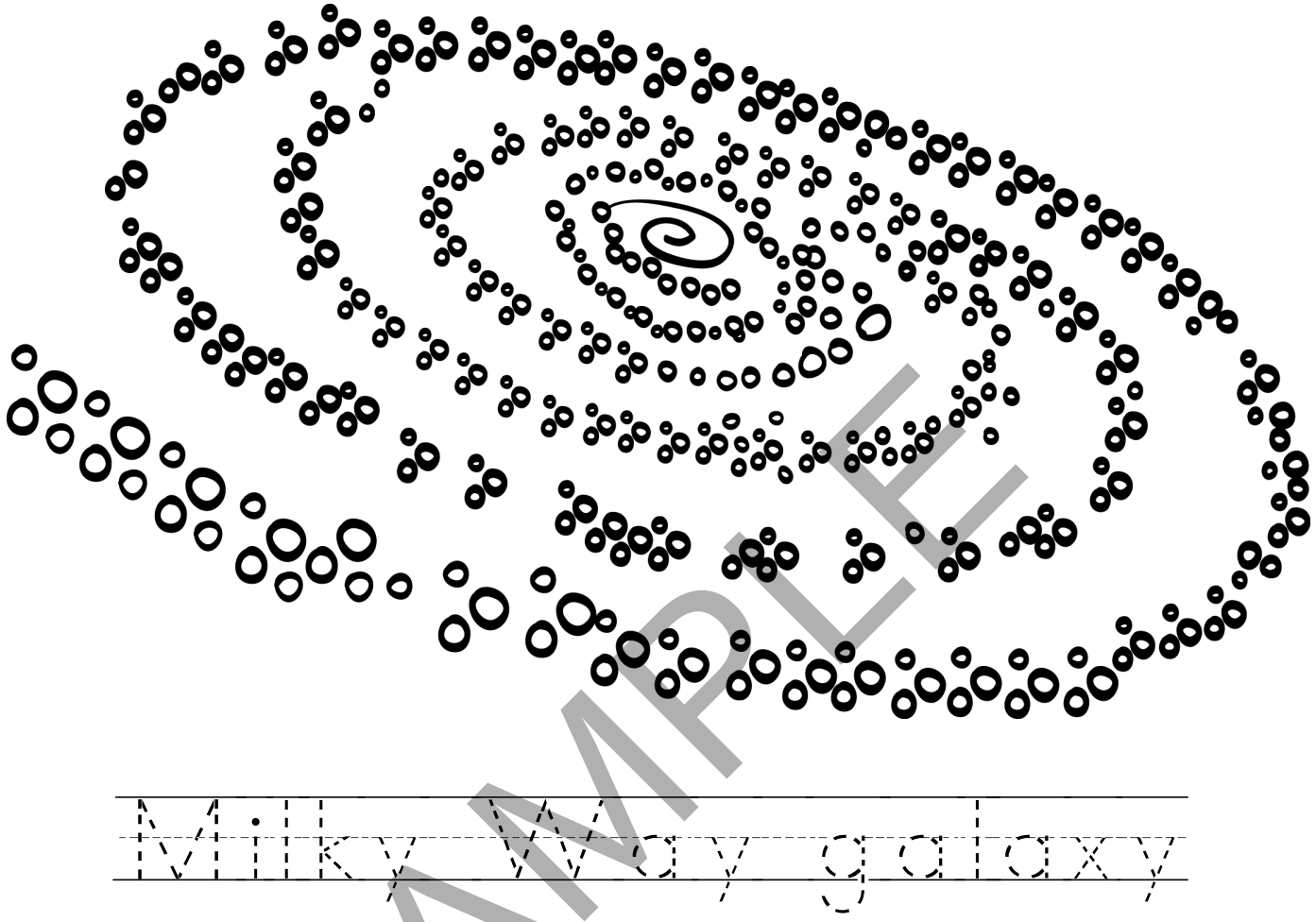
We live on planet Earth. Earth's neighborhood is made up of our sun, planets, their moons, dwarf planets, asteroids, and comets.



solar system

If we back up further, we would see that our **solar system** is part of a larger system called a galaxy. Scientists classify galaxies by their shape. There are elliptical galaxies, spiral galaxies, and irregular galaxies. Elliptical galaxies are the largest type, and they have the same shape as an egg. Spiral galaxies are next in size, and they look something like a pinwheel with arms twisting around. Irregular galaxies are the smallest, and they can be all sorts of different shapes.

Our solar system is part of a spiral **galaxy** called the **Milky Way**. The Milky Way contains not only our solar system but hundreds of billions of other stars plus clouds of gas and dust.

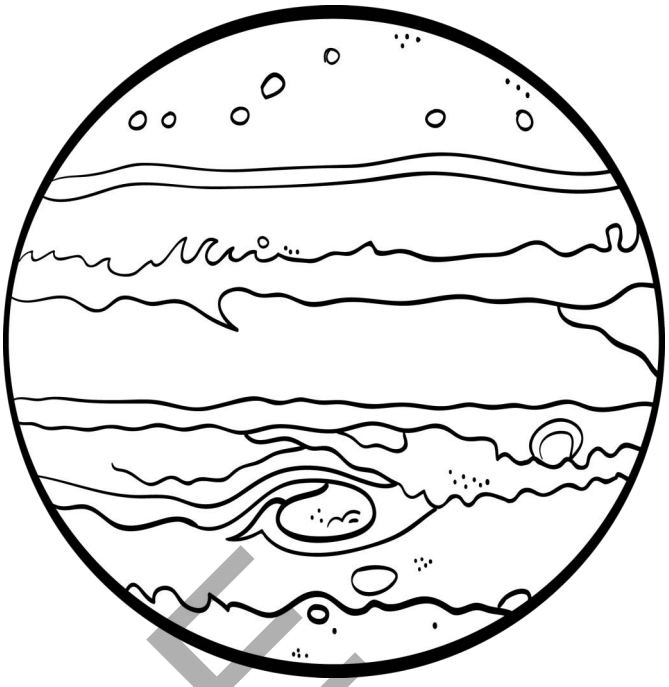


Milky Way galaxy

You know gravity is the force that makes your pencil fall to the floor when you drop it, but did you know gravity doesn't stop when you leave Earth? Gravity is also the force that holds all our planets in the shape of our solar system. It also holds the solar system and all those other stars together in the Milky Way. If you were to step back even further, you would see that the Milky Way galaxy and all the other galaxies are also held together by gravity, and all together, these galaxies and stars and other objects make up the universe.

We don't have time to talk about every star in the universe in this book. As a matter of fact, there is a whole lot scientists don't know about most of those stars, and there are stars and probably whole galaxies scientists haven't even discovered yet! So for this book, we're just going to talk about the planets and some of the most important stars and other objects in our solar system. Are you ready? Let's start at the center of the solar system, at the star we call the sun.

The last four planets in our solar system are known as the outer planets. They are made mostly of gases and liquids. **Jupiter** is the fifth planet from the sun, and it is the largest planet in our solar system. You could fit more than 1,000 Earths inside Jupiter.

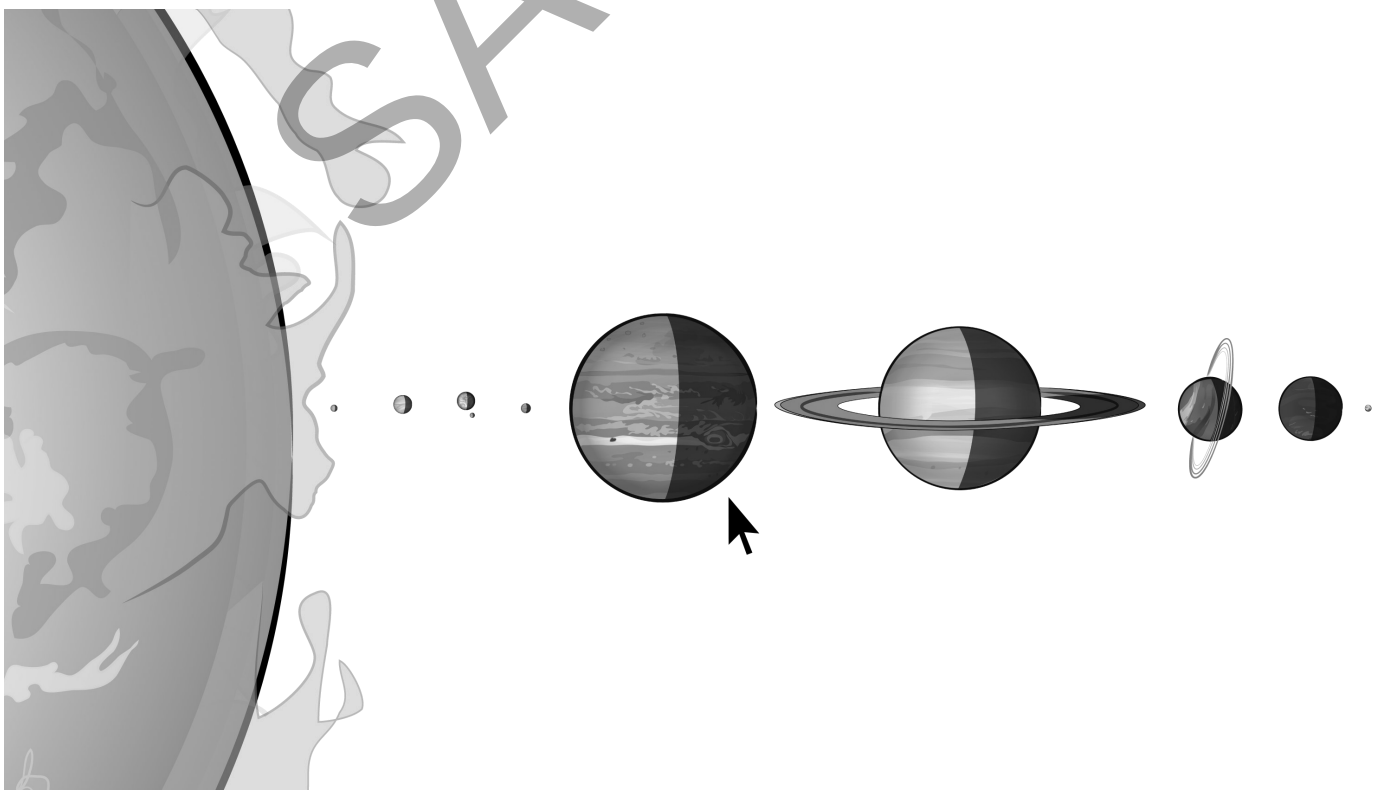


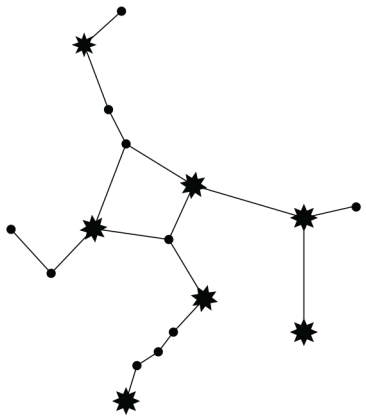
Jupiter

Because Jupiter is so much farther from the sun, it takes it about 12 of our years to make one orbit.

Jupiter doesn't have a rocky crust like the inner planets. Its atmosphere, the gases surrounding the planet, is actually the part we can see and study. We think the temperature in the hottest part of the atmosphere is about 1500 °F (800 °C). It also has very thin rings that are not as large as the rings around its neighbor Saturn.

Jupiter has at least 63 moons that we've found so far. Its biggest moon, Ganymede, is bigger than the planet Mercury!

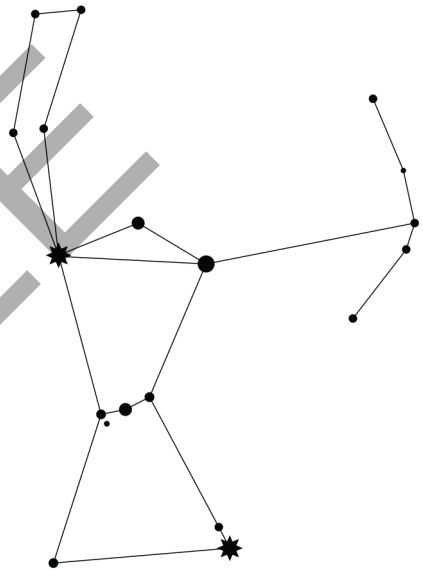




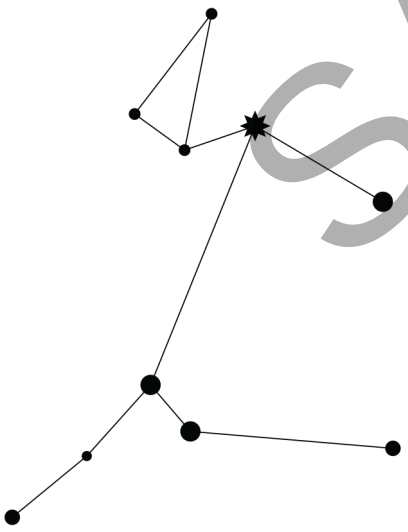
Let's see if we can see shapes in any other stars. What about this constellation? Can you see a body with two legs and two arms? He looks awfully strong to me. That's why he got the name **Hercules**, the name of a very strong man in the stories of the ancient Greeks.

Hercules

This next one looks like a person pulling an arrow back in a bow. In the myths of the ancient Greeks, there was a mighty hunter named **Orion**. When people saw this group of stars looked like a hunter with a bow and arrow, they named it Orion.



Orion



This group of stars looks a lot like a dog! That's how it got the name **Canis Major**. The word *canis* means *dog* in Latin, and the word *major* means *greater.* There is another smaller constellation that looks a little bit like a dog that is called Canis Minor. The star at the dog's shoulder in Canis Major is a very bright star named Sirius, the Dog Star!

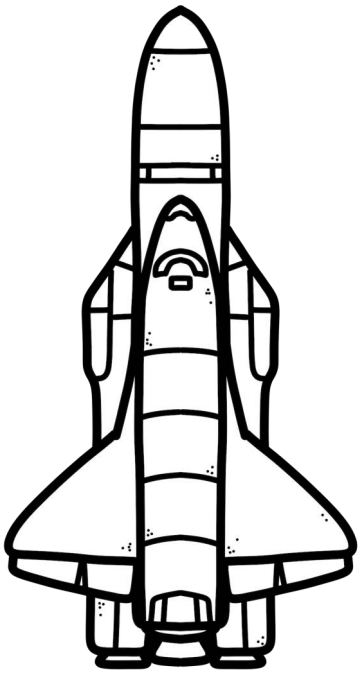
Canis Major

Galileo was an Italian astronomer who designed many different types of scientific instruments. He made improvements to a device called a refracting telescope and used it to learn much about the solar system. He discovered that the moon has craters and that Jupiter has moons. He discovered that Venus passes through phases, much like the phases of the moon, and learned new things about sunspots and Saturn.

Galileo

People from many different places have made important discoveries about space. Some have studied it from Earth; others have gone up into space. Let's look at just a few of the important events that have happened in the modern exploration of space.

1930: Pluto is discovered
1957: *Sputnik 1*, the first artificial satellite, is launched
1961: Yuri Gagarin becomes the first person to travel in space
1962: *Mariner 2* is sent to explore Venus
1963: Valentina Tereshkova becomes the first woman in space
1969: *Apollo 11* lands on the moon, and Neil Armstrong becomes the first person to walk on the moon
1971: *Salyut 1* becomes the first orbiting space station to have a crew
1976: *Viking 1* and *Viking 2* land on Mars
1981: The space shuttle program begins with space shuttle *Columbia*
1984: Kathryn D. Sullivan becomes the first American woman to walk in space
1992: Mae Jameson becomes the first African American woman in space
1995: Spacecraft *Galileo* reaches Jupiter
2004: The *Cassini* spacecraft reaches Saturn
2004: A private company launches a person into space for the first time
2011: *Atlantis* makes the final space shuttle mission

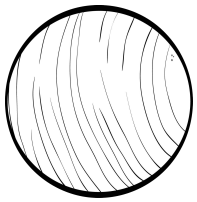


Review Answer Key

This planet does not have any moons. Draw an X through it.

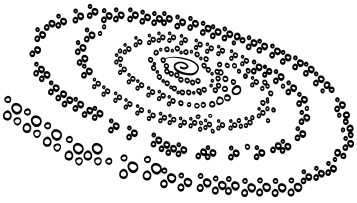
Mercury

Earth

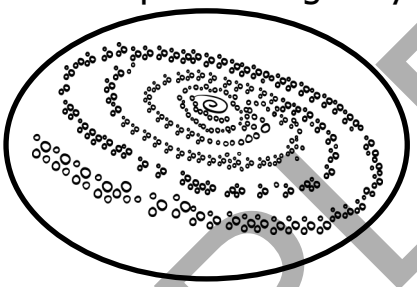


Uranus

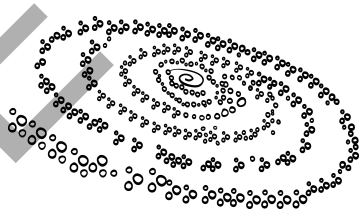
Which of these is the name of the shape of our galaxy? Draw a circle around it.



Elliptical

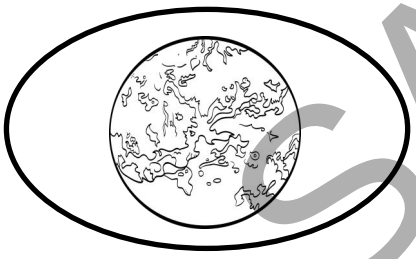


Spiral

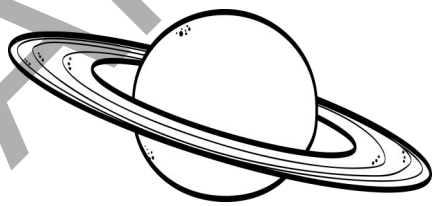


Irregular

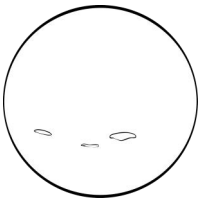
This planet was explored by *Mariner 2*. Draw a circle around it.



Venus



Saturn



Neptune

This person was not a famous scientist. Draw an X through him.

Sir Isaac Newton

Galileo

Michelangelo

In science, a **force** is either a push or a pull. A scientist named Isaac Newton studied the way things work, and he discovered three laws related to motion. The first one says that an object at rest stays at rest, or an object in motion stays in motion, unless it's acted on by an outside force. That means if you have a ball sitting on the floor, it will never move unless it is acted on by an outside force. It also means if you roll a ball, it will continue rolling forever or until it's acted on by an outside force.

Force

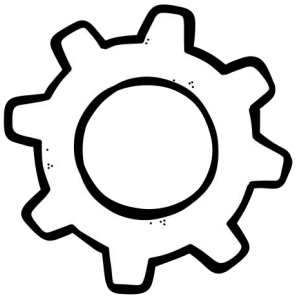
That may not seem true, because we all know that if you roll a ball across the floor, even if the floor is clear and nothing is in the ball's way, it will eventually slow down and come to a stop. Or, if you have a ball on a slanted floor, it can roll down the slant even if no one touches it. So how can Newton's law be true?

Newton's law is true because of two forces that we can't see but that affect everything in the world we live in. These two forces are **friction** and **gravity**.

Friction happens when two objects rub against each other. When you roll a ball on the floor, the surface of the ball rubs against the surface of the floor. The friction between them slows the ball down until it eventually stops. Think of it this way. If you have to push a big, heavy box across the floor, it's very hard. You know it would be hard to lift the box because it's heavy, but why is it hard to simply push the box? The answer is friction. The friction between the box and the floor makes it harder for you to make the box move.

Friction

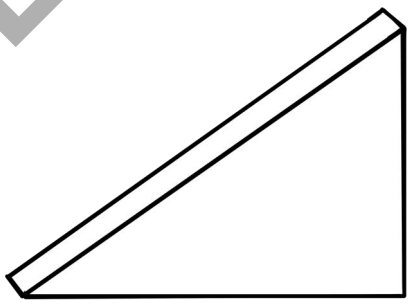
You can probably think of lots more machines, but let's think about what they are made up of. I don't mean just the gears and hinges and things like that. Those are parts of a machine. I mean the principles the machine uses to get the job done. What do I mean by principles? Let's find out!



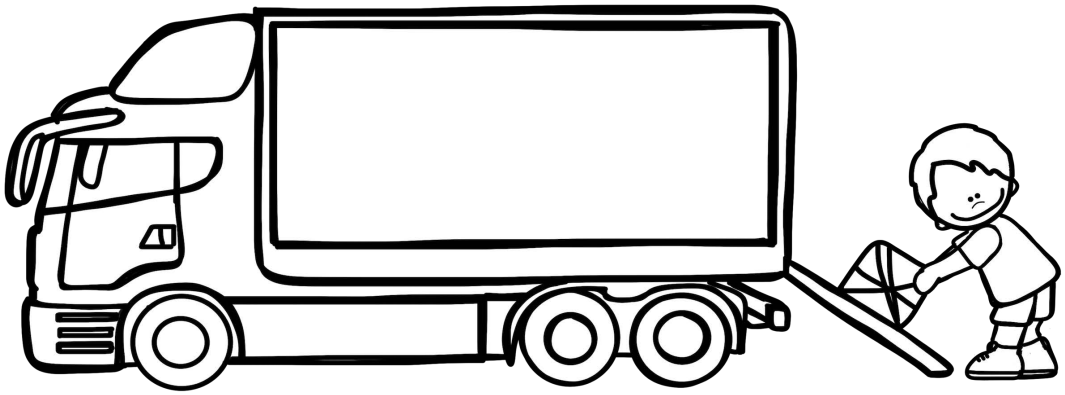
Most of the machines we use every day are called complex machines. A complex machine is made up of one or more **simple machines**. The simple machines are what I mean by the principles of how complex machines work. There are six different types of simple machines. They are the inclined plane, the wheel and axle, the lever, the wedge, the pulley, and the screw. We'll start with the inclined plane.

Simple machines

An **inclined plane** is a ramp. It doesn't look like a machine that does something, but it can make moving things a LOT easier! Imagine you had a really heavy box you have to put in the back of a big truck. There's no way you can lift it high enough to get it in the truck. How can you get it there?

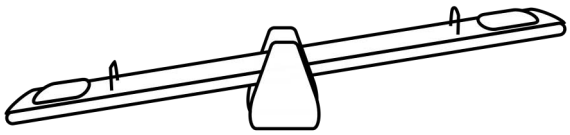


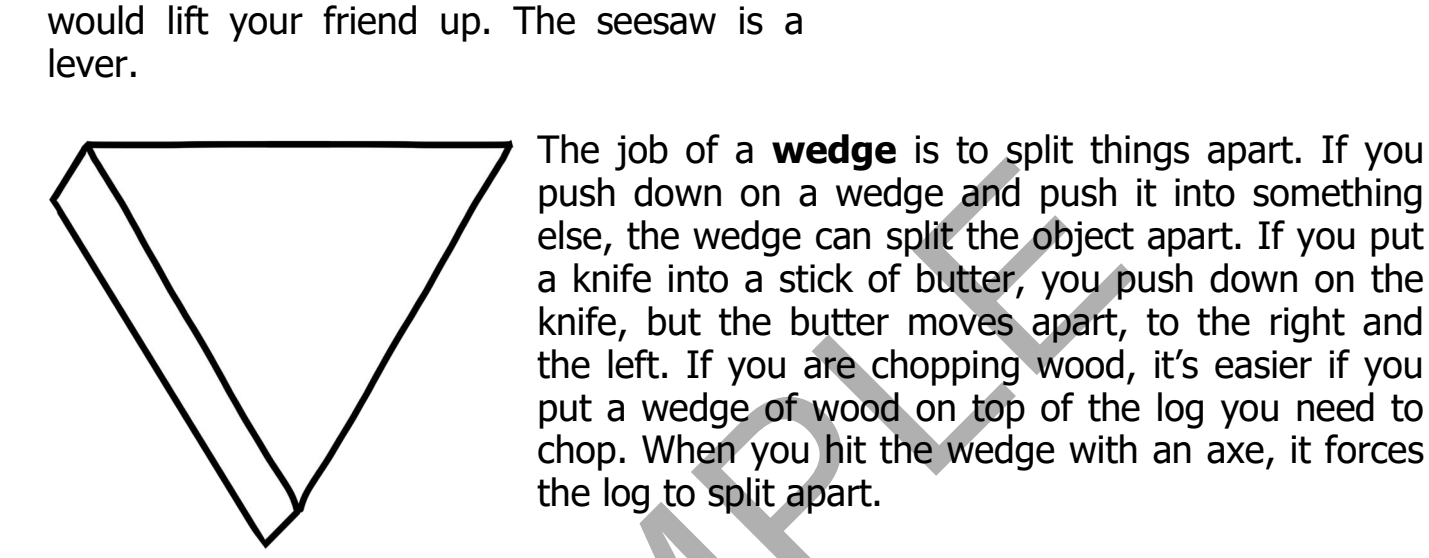
If you use an inclined plane, you could slide the box up into the truck. You would have to move the box farther, but it would be easier to do because the inclined plane is helping you do the job.



Inclined plane

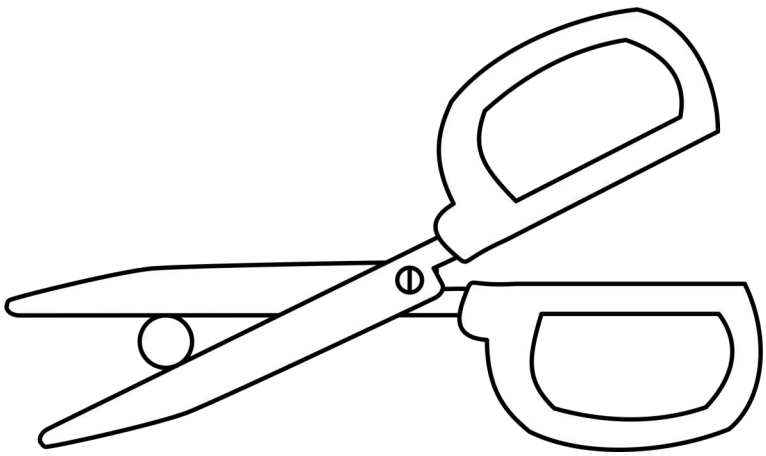
A **lever** is another kind of simple machine. We use it when we want to turn downward force into upward force. If you want to lift your friend, you probably can't just pick him or her up (and it's not a good idea to try, because one or both of you could get hurt!). But if your friend was sitting on one end of a seesaw, and you sat down on the other end, the force of you pushing the seesaw down would lift your friend up. The seesaw is a lever.





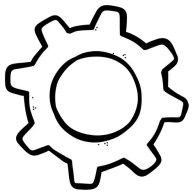
The job of a **wedge** is to split things apart. If you push down on a wedge and push it into something else, the wedge can split the object apart. If you put a knife into a stick of butter, you push down on the knife, but the butter moves apart, to the right and the left. If you are chopping wood, it's easier if you put a wedge of wood on top of the log you need to chop. When you hit the wedge with an axe, it forces the log to split apart.

A pair of scissors are levers and wedges working together. The wedges are the blades of the scissors. When you cut into a piece of paper, the blades move up and down, but the wedges push the paper apart to the left and right. Pushing down on one handle moves one blade up, and pushing up on the other handle pulls the other blade down, because they are levers. By working together, these simple machines make a more complex machine that makes our lives easier.



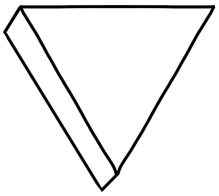
Review

Which simple machine has the job of splitting things apart? Draw a circle around it.



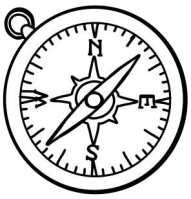
Gear

Pulley



Wedge

What word describes the way an object is going? Draw a circle around it.

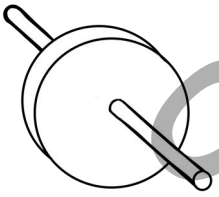


Direction

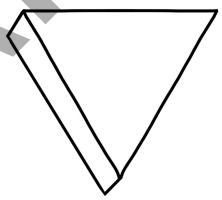
Force

Gravity

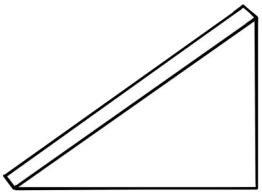
Which of the following is the simple machine that has the job of splitting things apart? Draw a circle around it.



Wheel and Axle

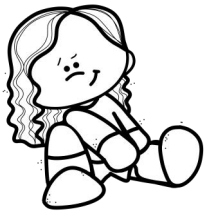


Wedge

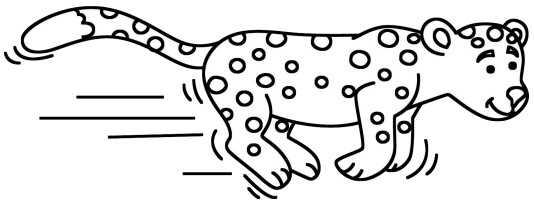


Inclined Plane

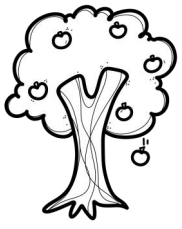
What is the name of the force that causes things to fall to earth? Draw a circle around it.



Pull



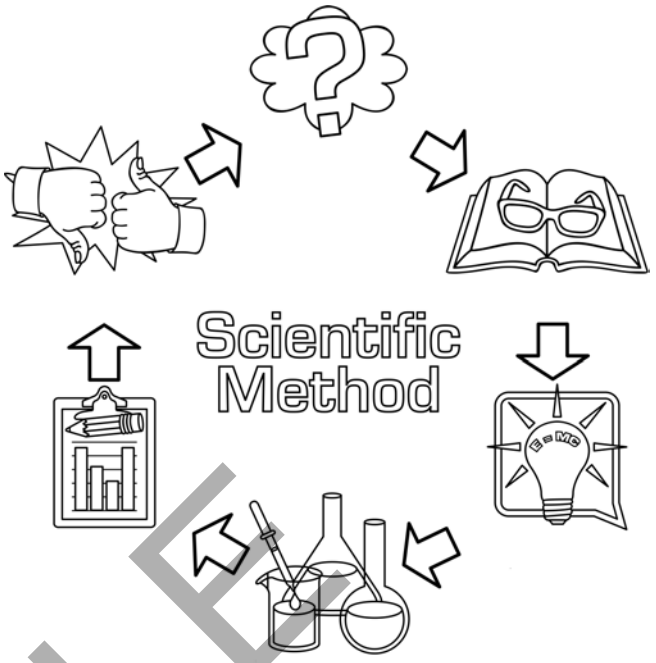
Speed



Gravity

Scientists and the Scientific Method

If you are reading this book, you are learning about science, but have you ever wondered just what exactly science is? Science is the study of why and how things happen, and a scientist is a person who studies science. There are different types, or branches, of science that we'll look at, but they all use a form of the **scientific method**. What is the scientific method? I'm glad you asked, because that is the first step!

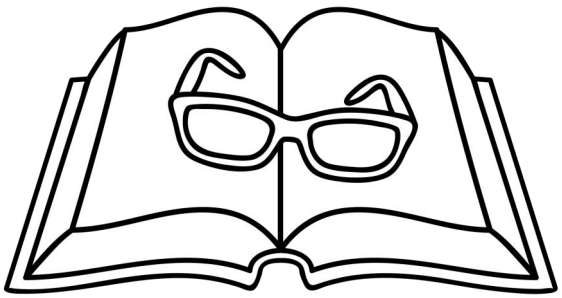


Scientific Method

The scientific method starts by **asking** a question because that's what science is about—asking questions about how and why things work and then trying to find the answers.

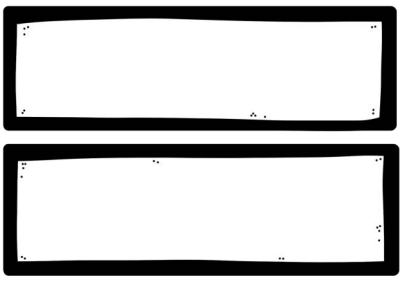
Ask

Once you know what you want to understand, the next step is **researching** and learning all you can about it. What can you learn from what other scientists have done?



Research

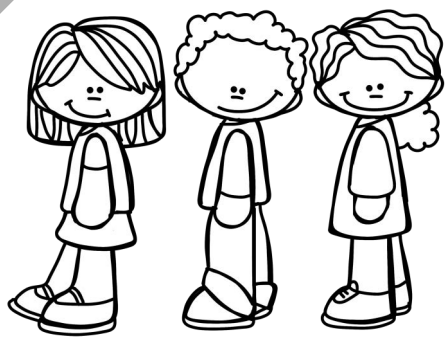
Now that we know more about what science is and what scientists do, let's look at the different types of sciences. We can break all the sciences down into four different groups—**mathematics**, **physical sciences**, **life sciences**, and **social sciences**.



Math might not sound like a science to you, but without math, scientists couldn't do their jobs. They rely on the absolutes in math to conduct their experiments. If 1 + 1 didn't always equal 2, then there would be no way to get data from experiments that meant anything. Scientists also need math in order to communicate what they've learned to other people. If you couldn't use math or numbers to describe your problem 1 + 1 = 2, how could you possibly explain it? Math also helps scientists predict patterns, analyze data, measure results, and just about everything else you can think of.

Mathematics

Social sciences are sciences that study people and why they do certain things. These scientists study things like how people buy and sell things they need, how people get along or don't get along, how a community changes over time, why they live where they do, how they feel about certain things, and other ways people behave.



Social sciences

Physical sciences study our world and the forces that affect it. These scientists study things like friction, gravity, chemicals, the stars and solar system, the rocks, what the earth is made of, how the oceans work, volcanoes, and much more.

Physical sciences

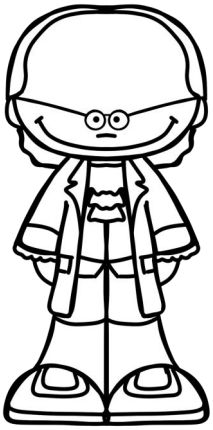
Galileo (1564-1642) was an Italian astronomer who discovered new things about the planets. He discovered craters on Earth's moon and that the planet Jupiter has moons. He also discovered that Venus passes through phases, much like the phases of the Earth's moon.

Galileo

Isaac Newton (1642-1727) was an English scientist who learned that sunlight actually has all the colors of light mixed together. He invented a new kind of math and discovered that the same force of gravity that holds us to the Earth also keeps the moon traveling around the Earth and the planets orbiting the sun.

Isaac Newton

Benjamin Franklin (1706-1790) was an American scientist who was also a statesman, inventor, writer, publisher, and speaker. He is the scientist who proved lightning is actually electricity.



Benjamin Franklin

Benjamin Banneker (1731-1806) was an American astronomer, farmer, mathematician, and surveyor. He hand-carved a clock made completely out of wood, and he was so good at astronomy that he wrote a yearly almanac that predicted the weather based on what he observed.

Benjamin Banneker

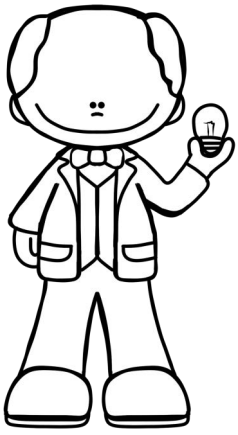
Caroline Herschel (1750-1848) was born in Germany and later moved to England. She was an astronomer who discovered several comets, which look like small stars with tails. She also kept very detailed records of what her brother, who was also an astronomer, observed in space. These records helped future astronomers learn and discover new things.

Caroline Herschel

Mary Somerville (1780-1872) was a British scientist who is best remembered for the special way she wrote about science. She studied many sciences, including mathematics, astronomy, botany, and geology. She became famous for being able to write about science clearly in a way other people could understand.

Mary Somerville

Thomas Alva Edison (1847-1931) was an American scientist and one of the most famous inventors of all time. He studied many things, including electricity, sound, chemistry, and mechanics. He invented the electric lightbulb and the phonograph (the first machine that could record and playback sound), and he improved inventions such as the telephone and motion pictures.

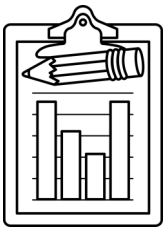


Thomas Alva

Edison

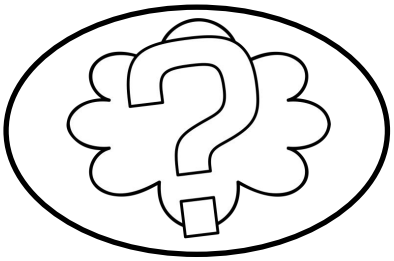
Review Answer Key

What is the first step in the scientific method? Draw a circle around it.



Analyze

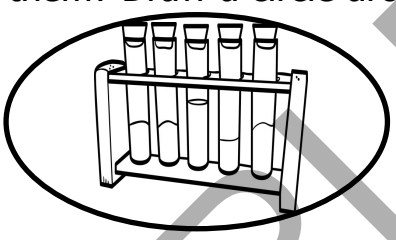
Experiment



Ask

What is the name for a scientist who studies chemicals, how they interact, and how to make new things with them? Draw a circle around it.

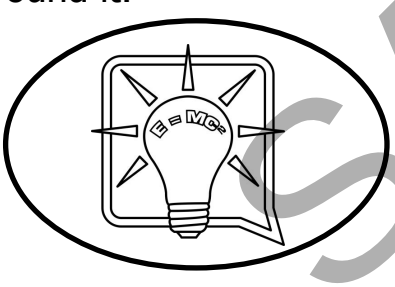
Physicist



Chemist

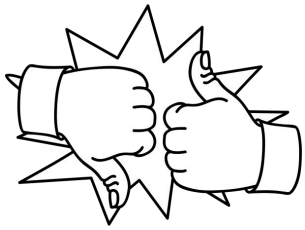
Geneticist

What is the name of the idea or opinion that you need to test? Draw a circle around it.



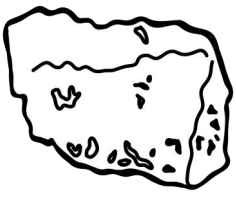
Hypothesis

Research

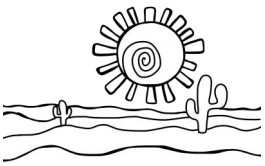


Conclusion

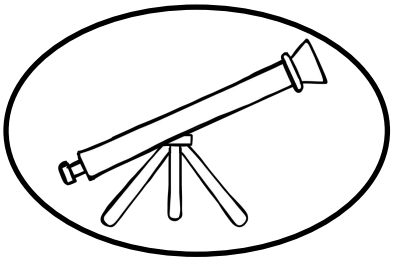
What is the name for a scientist who studies the universe and everything that is in? Draw a circle around it.



Geologist



Ecologist



Astronomer