SOAR Units 1-4 Student Texts

Unit 1 Students Texts

- The Loma Prieta Earthquake
- Earthquakes
- The Tohoku Tsunami
- Life After the Tsunami
- The Mossy Grove Tornado
- Tornado Alley and Storm Chasers
- Mount St. Helens Volcano
- Volcanoes

Key words

The Loma Prieta Earthquake

Main idea notes

On a beautiful October afternoon in 1989, I was driving home when my car started to wobble. I thought I had a flat tire, but when I got out I realized that the ground was swaying like the deck of a small boat. I was confused as I heard what sounded like a gigantic roar coming from the south. Later I realized this was all of the houses, buildings, concrete, and earth cracking as an earthquake approached.

Within seconds, the ground was moving in waves that seemed to be 6 feet tall. I tried walking to a nearby tree but kept falling. The quake's **tremors** caused underground pipes to burst and spray water into the air. I looked over at a school building swaying back and forth on the brink of collapse. After what seemed like forever, the shaking stopped, although utility poles continued to wave back and forth.

I drove to our apartment building and found water from the large in-ground pool covering the parking lot. My wife had ridden out the quake braced in the doorway of our apartment. Kitchen drawers had been knocked open and their contents had scattered everywhere. One wall in the kitchen was beginning to collapse, so we gathered our terrified cats and drove to a Red Cross shelter.

Six months before the earthquake, we had lived in a house on the edge of a cliff on Loma Prieta Mountain. We returned several years later to find that the house was now gone, having fallen off the cliff during the earthquake. Oddly, the home next to ours had survived. Being on Loma Prieta Mountain years after the quake made me grateful to be alive.

Key words

Earthquakes

Main idea notes

Earthquakes are set off by the movement of tectonic **plates**, the enormous pieces of Earth's shell that fit together like pieces of a jigsaw puzzle. Tectonic plates are always in motion, moving between 1 and 6 inches per year. Usually they glide smoothly, but sometimes the edges catch against each other and **pressure** gradually builds up. When the pressure becomes too strong and the huge plates suddenly shift, waves of energy are released, like the waves in a pond if you throw a stone into the water. This is an earthquake.

Seismology is the study of earthquakes and a seismologist is the scientist who studies them. A seismograph is an instrument that measures an earthquake's waves using a special pen and paper that are mounted on a moving cylinder. When an earthquake occurs, the pen jumps back and forth on the paper, creating lines that show the intensity of the earthquake. Seismograph stations are located all over the world and can record **tremors** from quakes thousands of miles away.

Earthquakes can cause tremendous destruction and loss of life. The ground under buildings can become loose, causing buildings to collapse or sink. **Tremors** might trigger landslides, mudslides, and avalanches on steep hills or mountains. Broken gas and power lines, or tipped-over wood or coal stoves can start fires. Fires can be especially serious if water lines that feed the fire hydrants have also been damaged.

Seismologists have tried lots of different ways of predicting earthquakes, but none have been successful. They have a pretty good idea of *where* an earthquake is most likely to hit, but they still can't tell exactly *when* it will happen. There is no obvious sign to indicate that an earthquake is coming very soon. Vibrations can be detected just before an earthquake occurs, but this doesn't give enough time for people to escape.

Key words

The Tohoku Tsunami

Main idea notes

You may have heard of tsunamis, the enormous waves that crash into the coastline and flood entire cities. The <u>2011 Tohoku Tsunami</u> slammed into Japan and caused billions of dollars worth of <u>damage</u>. <u>Thousands</u> of lives were lost. It even caused the core of a nuclear power plant to overheat and release **contamination** into the environment.

Tsunamis are usually caused by underwater <u>earthquakes</u>. An undersea earthquake causes the <u>**plates**</u> on ocean floor to be pushed forcefully upwards by as much as 15 feet. As the **plates** rise, the ocean above it is <u>**displaced**</u> and also rises. This causes a huge wave that can become a tsunami.

The size of a tsunami depends on the <u>strength</u> of the earthquake's **tremors**. It also depends on the depth of the water where it occurs. A tsunami will be larger when a strong earthquake occurs in deep ocean water.

In the case of <u>Tohoku</u>, it was classified as an undersea megathrust <u>earthquake</u>. This was the biggest earthquake to ever hit Japan. In fact, it was the fifth-largest earthquake ever measured on earth since humans began tracking the size of earthquakes in 1900. The waves produced during the Tohoku tsunami were, quite simply, huge. The tallest may have reached a height of 133 feet, scientists believe. In certain areas, these waves traveled as far as six miles inland, wiping out nearly everything in their path.

Key words

Life After the Tsunami

Main idea notes

"My wife and grandson are still missing," Mr. Sato, a Tohoku fisherman, explained to a news reporter in November 2012. "The tsunami was estimated to be 20 feet tall, so my wife, my three brothers and I ran to a place that was 50 feet high. The tsunami was actually 65 feet high," said Sato. "All I remember is holding on as the waves washed over me again and again. When it was all over, my wife was missing. That night, I walked to my wife's hometown, but I could not find her."

Not all tsunamis are formed by undersea earthquakes. Explosions, underwater landslides, and volcanic eruptions can also trigger them. A tsunami could even be generated by a giant meteor splashing into the ocean from outer space. That will cause a gigantic amount of water to be **displaced**, and can often result in a tsunami.

How can people know if a tsunami is coming? Sometimes roaring sounds from the ocean are heard before a tsunami strikes. The most threatening sign is when water that covers the shoreline begins to recede, or pull back. Some people from Tohoku said that the ocean receded and exposed the ocean floor before coming back in huge waves traveled as far as six miles inland, wiping out nearly everything in their path.

In spite of Sato's tragedy, he has taken a leadership role in relief and recovery efforts in his community. Sato has been working to restore the local fishing industry, which provided jobs for 205 families in the area before the disaster. The fishing community faces many problems, including lack of equipment and money, and fears of food **contaminated** by the Fukushima nuclear disaster. Living **conditions** for the survivors are slowly improving thanks to the efforts of Sato and other volunteers.

Key words

The Mossy Grove Tornado

Main idea notes

A **tornado** is a very dangerous part of some thunderstorms. Weather **conditions** have to be just right for a tornado to **form**. First, layers of wind in a storm need to blow at different speeds and in different directions. This causes a tube of wind to form between the layers. It rolls horizontally like a log. Next, upward and downward air currents tip it on its end. The tube is now a vertical column of spinning air called a **funnel cloud**. A tornado occurs when the lower end of the funnel cloud touches the ground. Winds inside a tornado can blow at hundreds of miles per hour, destroying houses, ripping the bark off trees, and even uprooting trees!

November 10, 2002 was an unusually hot and muggy day in Mossy Grove, Tennessee when my aunt called to warn us that tornadoes were headed our way. My parents didn't take her warnings seriously at first. My mother said I could hide under a mattress if I was scared. When I turned on the TV and saw the tornado warning, I shouted that we needed to get out now. My dad rushed us to a neighbor's house where we huddled together under the steps in the basement.

Moments after hiding under the steps, the tornado struck. It lasted only a couple of minutes, but it seemed to stretch on forever. The wind was pulling the whole house up and I thought my head was going to explode from the heavy air pressure. The top part of the house caved in, then the brick wall beside me collapsed. When the tornado lifted my little brother into the air I thought he was going to get sucked away, but my mom grabbed his arm and lay on top of him. I cradled my dog, Chipper, and we all held on to each other.

When I saw my house the next day, it was totally destroyed. I only found one thing of mine left behind. It was the first doll that I ever had. It was lying there, totally undamaged. That felt so good, just being able to find something. When we found my brother's bed, it was like somebody had twisted it into a pretzel. We also found the mattress I was going to hide under. It was on the other side of the road. If I had stayed at home, the tornado would have killed me.

Key words

Tornado Alley and Storm Chasers

Main idea notes

Tornadoes in the United States often form when a warm wind converges with a cold wind. In the US, many tornadoes occur in a part of the Great Plains known as "Tornado Alley." This area includes parts of Texas, Oklahoma, Kansas, and Nebraska. In the Great Plains, the cold, dry air from Canada converges with the warm, moist air from the Gulf of Mexico. Most tornadoes form along the front, or boundary, between these two air masses.

Keeping residents of Tornado Alley safe is a priority for weather scientists, emergency responders, and community members. While it may be difficult to protect houses and other buildings, keeping the public aware of weather **conditions** helps people protect themselves and their families in cases of severe weather. The National Weather service provides timely warnings, and local TV and radio stations broadcast these warnings so that people in the tornado's path can seek shelter. Towns also set off warning sirens that **conditions** exist for a tornado to form.

Some scientists actually want to get close to tornadoes to learn about them. These scientists use special equipment and instruments to measure what is happening in and around a tornado. One special instrument these scientists use is called a tornado probe. This instrument is about six inches tall and looks like a short, orange construction cone. Inside the tornado probe, there are sensors to measure wind speed, temperature, pressure, and direction. Some even have cameras, so scientists can see and understand what it's like to be in a tornado.

Scientists will try to guess where the tornado will go next. Then they drive to that location and put down the probes. If they are right about the direction of the tornado, then the tornado will go near or even right over the equipment. Then they take all of the measurements from the equipment and use them to predict where future tornadoes will form and travel. The work of storm scientists is very important and has saved lives by giving people enough warning and time to get out of the way of a destructive tornado.

Key words

Mount St. Helens Volcano

Main idea notes

Mount St. Helens volcano is part of the Cascade Mountains in the state of Washington. On March 27, 1980, there were signs of volcanic activity when a steam explosion blasted a 200-foot wide crater through the summit's ice cap. For the next few weeks steam and ash periodically vented out of the growing crater on top. A bulge on the mountain's north side grew larger and larger so that by mid-May the north side of Mount St. Helens bulged out 300 feet. This rapidly growing bulge was evidence that **pressure** from molten rock (magma) was increasing inside the volcano.

On May 18, 1980 at 8:32 a.m., an earthquake's tremors rumbled underneath Mount St. Helens. At the same time as the earthquake, the volcano's northern bulge and peak slid away in a huge landslide—the largest debris avalanche on Earth in recorded history. The landslide released pressure from the volcano's magma-filled bulge and triggered powerful eruptions that blasted laterally (sideways). Everything within eight miles of the blast was destroyed almost instantly. The landslide flowed down the mountain and into surrounding areas at over 90 miles per hour, sweeping away everything in its path.

At the same time the earthquake caused the landslide and volcanic eruption, a column of ash rose thousands of feet skyward and drifted downwind, turning day into night as dark, gray ash fell over eastern Washington and beyond. Within 10 miles of the mountain, one foot of ash accumulated on the ground. The ash cloud spread across the U.S. in three days, and circled the Earth in 15 days. Although the ash eruption lasted 9 hours, it only took moments for Mount St. Helens and the surrounding landscape to change dramatically. A vast, gray landscape lay where the forested slopes of Mount St. Helens once grew.

In terms of human impact, the Mount St. Helens eruption was the most destructive in U.S. history. Fifty-seven people are known to have died. Hundreds of people were displaced when over than 200 homes were destroyed. More than 185 miles of roads and 15 miles of railways were damaged. Ash clogged sewage systems, damaged cars and buildings, and temporarily shut down air traffic over the Northwest.

Key words

Volcanoes

Main idea notes

There are three types of volcanoes, each with different shapes and types of eruptions. Shield volcanoes are low and flat and have small, flowing eruptions. Cone volcanoes are the tallest and largest volcanoes, and have very explosive eruptions. Composite volcanoes are a midway between shield volcanoes and cone volcanoes, with explosive eruptions. Although volcanoes can look different, they're all created when magma from beneath the Earth reaches the surface and erupts as lava, ash, rock, and gas.

Volcanoes are a natural way that the Earth cools off and releases internal heat and **pressure**. To understand how volcanoes erupt, you have to consider the structure of the Earth. You're standing on the Earth's crust, which is a relatively small part of the total volume of the Earth. It's around 18 miles thick beneath the continents, and can be less than 6 miles thick beneath the ocean floor. Underneath the crust is the Earth's mantle, a vast region where it is almost 2000 degrees Fahrenheit.

Although the Earth's mantle is solid rock, the extremely high temperatures cause rock to melt and squeeze out of cracks in the rock. The liquefied rock, or magma, collects in vast chambers beneath the Earth's crust. Since this magma is less dense than the surrounding rock, it "floats" up to the surface, seeking out cracks and weaknesses in the rock. When it finally reaches the surface, we see this as a volcanic eruption.

When it's underneath the surface, the molten rock is called magma. When it reaches the surface, it erupts as lava, ash, volcanic rock, and gas. With each eruption, rocks, lava and ash build up around the volcanic vent where the materials erupted. The nature of the eruption depends on viscosity of the magma. When the lava flows easily, it can travel far and creates wide shield volcanoes. When the lava is thick, it creates a more familiar cone volcano shape. And when the lava is extremely thick, it can build up in the volcano and explode. This is what happened with Mount St. Helens in 1980.

Unit 2 Student Texts

- Living Together on Earth
- Food Chain or Food Web?
- Protecting the Bats
- Predator-Prey Relationships
- Rainforest Ecosystem
- All the Pieces Matter
- Desert Life
- What Does a Conservationist Do?

Key words

Living Together on Earth

Main idea notes

Even if it doesn't look like it, all **organisms** **<u>interact</u>** with their environment. For instance, every time you breathe in, you get oxygen from the air. 

When you breathe back out, you release carbon dioxide into the air. Both oxygen and carbon dioxide are vital gases that different organisms use. Humans need the oxygen for energy. They also need to get rid of the carbon dioxide because it is waste matter.

Just like humans, all other **organisms** take something from their environment while putting waste back into it. When several kinds of **organisms interact** in one particular area, it's called an <u>ecosystem</u>. Depending on where they are on Earth, ecosystems can look and work differently. For example, in a forest ecosystem, living things such as plants, animals, insects, fungi and bacteria **interact** with each other. The living things also **interact** with nonliving things like soil, water, air, temperature, and sunlight. A different ecosystem, such as a desert area, would have different types of nonliving things and animals than the forest ecosystem.

Organisms in an ecosystem depend on their environment to meet their needs. Nonliving things help living things—**organisms**—meet their needs. Think for a minute about the importance of <u>water</u> in an ecosystem. All organisms need water to survive! The amount of water in an ecosystem determines the kinds of **organisms** that can live there. For example, a desert ecosystem, which has much less water than other ecosystems, contains **species** of plants and animals that require very little water.

Each ecosystem has its own set of <u>nonliving</u> <u>things</u> that includes soil, water, air, temperature, and sunlight. These conditions determine the types of **organisms** that are able to survive in that ecosystem. An organism can survive only where its needs are met. For example, the spider monkey lives in the trees of the rainforest. The rainforest provides all the food, water, and shelter the monkey needs. Each **organism** depends on each other, as well as the nonliving things, to survive.

Key words

Food Chain or Food Web?

Main idea notes

Have you ever heard of a food chain? While many people call it a "chain," the term "food web" is more accurate. Food web is a more accurate term since every organism is involved with several other organisms. For example, cows might be food for humans, bacteria, or flies. There are dozens of connections for every organism. In every ecosystem, **organisms** can be classified by their role in the system. The categories are producer, consumer, and decomposer.

At the beginning of the food web are producers. Producers are **organisms** that make their own energy out of nonliving things like oxygen and water. All energy comes from the Sun, so plants use a process called photosynthesis to make their own food. Plants also make loads of other nutrients for other organisms to eat. Plants like fruits, vegetables, trees, and grasses are then eaten by consumers.

Consumers get energy by eating other living things. Consumers who only eat plants are called herbivores, and those that eat meat are called carnivores. A third type of consumers are called omnivores, since they eat both plants and other animals. Humans are a great example of omnivores, since they can eat both plants and animals. The last links in the chain are the decomposers. Decomposers eat animals' waste as well as dead **organisms**. Decomposers break down nutrients in the dead "stuff" and return the nutrients to the soil.

To understand how the food web works, think about this example. A deer dies in the forest and its body falls on the ground. Bacteria "eat" and break down the deer's body, helping it decompose and return to the soil. The remains of the deer give energy back to the environment, making the soil richer. This rich soil, combined with water and sunlight, then allows grasses, trees, and flowers to grow. The plants can then use the nutrients and elements once they're back in the soil, and the whole cycle begins again.

Protecting the Bats

Key words

Main idea notes

The following is an interview between a reporter and a scientist who studies bats and the ecosystem.

MARIO RITTER: I'm Mario Ritter and I'm here talking to Barbara Klein. Today, we learn about the environmental and agricultural importance of bat populations.

BARBARA KLEIN: The United Nations has declared 2011-2012 the Year of the Bat. The campaign was launched last year as a way to strengthen efforts for protecting the world's only flying mammal. These creatures can be found in many parts of the world. Bats live in cities, deserts, grasslands and forests. There are over one thousand two hundred bat species.

MARIO RITTER: Most bats eat insects, but many feed on fruit or nectar from flowers. Many people think bats are blind, but this is not true. Many species have very good sight. Most bats communicate and find their way by making "echolocation" noises. They produce high-frequency noises and can estimate the distance of an object by using the sound echoes that bounce back to them. So, while bats may travel in total darkness, they "see" using sound.

BARBARA KLEIN: Sadly, bats are widely feared and misunderstood. Most bats come out of their shelters only at nightfall. Three bat species feed on blood. Because of these qualities, bats have long been linked in many cultures to death, darkness and vampires. Yet bats are important for agriculture and our environment. They help pollinate plants and spread seeds. They also help control insects. Bats eat huge numbers of insects, including kinds that damage crops.

MARIO RITTER: For example, a brown bat can eat more than one thousand insects the size of a mosquito in one hour. One report says bats save American farmers billions of dollars every year by reducing crop damage and limiting the need for chemicals that kill insects.

BARBARA KLEIN: Over one-fifth of all bat species are under threat. They face disease and the human destruction of their natural environments. In the eastern United States, a disease called white-nose syndrome has greatly damaged bat populations over the past five years. The organization Bat Conservation International says white-nose syndrome has

Key words

killed more than a million bats since it was discovered in a New York cave in 2006. In some areas, the disease has killed nearly one hundred percent of bat populations.

MARIO RITTER: Leslie Sturges is doing what she can to save bats. She is the director of Bat World NOVA, a bat protection group in the Washington, D.C. area. She cares for injured bats in the basement of her home. When the bats are healthy, she moves them to a closed off area next to her home so they can learn once more how to fly. Then she releases them back into the wild.

Main idea notes

Key words

Predator-Prey Relationship

Main idea notes

A **predator** is an organism that consumes another **organism**. The **prey** is the **organism** that the **predator** consumes. Some examples of **predator** and **prey** are lion and zebra, bear and fish, and fox and rabbit. Many **predators** live on land, but they can be found in many different habitats, such as swamps, deserts, oceans, coral reefs, and even your home or backyard. The words "**predator**" and "**prey**" are almost always used to refer to only animals that eat other animals, but the same concept also applies to plants: Bear and berry, rabbit and lettuce, grasshopper and leaf. STOP

In a given territory, **predators** compete with each other for the **prey** animals available. **Prey** animals are constantly aware of the possibility of being attacked, and experience fear of the **predator** or signs of its presence. Many animals are both **predators** and **prey** animals. This means that while an animal is hunting for its food (another animal), it can become **prey** at any time if a larger **predator** attacks it. For **prey**, an encounter with a **predator** means life or death. But for a **predator**, the only thing that is at stake is a meal!

When a **predator** is in close range of **prey**, it will approach as quietly as possible and try not to be detected. Many **predators** use special body language, such as crouching and scurrying, as they stalk their **prey** and try to find the best way to make the final attack. Camouflage is another characteristic that helps **predator** and **prey**. Here's how camouflage works: an animal's natural appearance—the colors of its fur or feathers, as well as its patterns and markings—help the animal to blend with its surroundings. As the **predator** comes closer, the **prey** animal won't notice. The reverse is true also: Camouflage can prevent a **predator** from detecting **prey**.

A **predator** might attempt to capture **prey**, but fail. It might wound the **prey** animal, making the wounded animal even easier to catch and kill next time. If the **predator** doesn't capture **prey**, the **predator** might starve. If the **prey** animal's wound is severe enough, it might weaken and die. **Predators** keep populations of animals in balance. Many animals, such as rabbits, breed very quickly, and their numbers can become very high. If there were no **predators** to eat other animals, there would be too many animals in the world.

Rainforest Ecosystem

Key words | Main idea notes

Where can you find more animal **species** than anywhere else in the world? It's not a zoo or the circus. It's a very special type of ecosystem called a tropical rainforest, and most tropical rainforests can be found in the Southern Hemisphere.

Why do tropical rainforests exist only in certain regions of the Earth? Let's start with geography. The Southern Hemisphere starts just below the equator and ends at the South Pole in Antarctica. The Southern Hemisphere has fewer landmasses and more water, so the overall climate in the Earth's southern half is milder than in the northern half. The climate near the equator is humid, warm, and rainy, which is why 57% of all tropical rainforests are found near the equator in Latin America.

Because there are high amounts of precipitation and the temperature stays at about 75-85 degrees Fahrenheit year round, rainforests in tropical climates have optimal conditions for many animal **species**. Rainforest animals don't have to worry about freezing during the winter or finding shade in the summer. Plus, because it rains almost every day, animals rarely have to search for water. This makes tropical rainforests a suitable home for diverse **species**, from massive gorillas to tiny ants.

In addition to their tropical climates, another reason why rainforests are home to so many different types of animals is because they are some of the oldest ecosystems on earth. Some scientists believe that certain rainforests have been around since dinosaurs roamed the earth at least 100 million years ago. Other scientists theorize that a large portion of the earth was completely frozen during the last Ice Age, causing many animal **species** to become extinct. But the massive freeze didn't affect certain places in tropical rainforests and their ecosystems continued to evolve.

The Amazon rainforest in Brazil, the biggest rainforest in the world, is home to jaguars, toucans, parrots, gorillas, and tarantulas. Yet this is only a small sample of rainforest animals. Many other rare and often endangered animals can be found in rainforests, like the okapi. This beautiful creature has striped hindquarters and front legs like a zebra, and tall perky ears, like a giraffe. There are so many different types of animals in

Key words

tropical rainforests that we haven't been able to name all the **species** yet.

The Amazon and other tropical rainforests are also home to some animals you might want to avoid, like flying snakes (although their name is actually a misnomer since they can only glide and not gain altitude) and spiders that eat birds. Other rainforest animals, like the coral snake and the poison arrow frog, produce natural poison that protects them from harm. Get too close, and they could easily harm you with poison. Many of these species are endemic to tropical rainforests, meaning that rainforests are the only place they live on Earth.

Another way animals **adapt** to life in the rainforest is by camouflaging themselves to hide from predators. An insect called the "walking stick" lives in the palm tree. It blends in so well with the tree that it's practically unnoticeable unless it moves. When some butterflies close their wings, they look identical to leaves, which masks them from predators.
Some species have had to **<u>adapt</u>** to their surroundings in the rainforest in order to survive. For example, toucans and parrots both have very large, strong beaks. These powerful beaks make it easy for them to crack open the tough shells of nuts that grow on many rainforest trees. Birds with small beaks, like robins and sparrows living in the Northern Hemisphere, probably would not be able <u>survive</u> in the rainforest without being able to crack open hard nuts.

Main idea notes

All the Pieces Matter

Key words

Main idea notes

Jason stared at the whiteboard at the front of the classroom, trying to make sense of what he saw there. Mr. Freamon had drawn a complicated diagram of all the creatures living in the nearby Ho Tep Wildlife Reserve. Every type of living thing, from trees and insects to mammals and birds, was written down and circled on the board. Arrows snaked around the board, connecting the circles, showing which creatures depended on which other creatures to survive.

Though he had been hiking out in the reserve plenty of times, Jason had never given much thought to the animals and wildlife he had seen out there. He'd never thought about how the amount of rainfall affected the amount of moisture in the soil, which affected how well plants could grow, which affected the ability of the animals that ate those plants to survive.

Mr. Freamon could tell that the drawing on the board confused his students.

"Relax," Mr. Freamon said. "You don't need to memorize what's on the board. If you're going to learn one thing from this lesson, let it be this: All the pieces matter. Every ecosystem on earth depends on a delicate balance among all of the different forms of life within it."

Mr. Freamon continued. "In any ecosystem, all of the creatures within it are competing for the same resources: food, water and shelter—the basic needs of every living thing. There's only so much to go around, so creatures have to compete with other creatures to get what they need. And since they all go about it in a unique way, all of the creatures in an ecosystem end up depending on one another. Let me give you an example. Remember that video about **predator** and **prey** that we watched last week? With the wolves killing the elk at Yellowstone National Park?"

Everyone nodded.

"And how many of you thought that the wolves were mean for killing those elk?"

About half the students raised their hands.

Key words

“Consider this, then,” Mr. Freamon continued. “Without the wolves in the park to keep the elk population in check, the elk would have eaten all of the aspen and willow in the park. Not only would those plants be gone, but the other animals that depend on them to survive, would have been out of luck too. All the pieces matter.”

Main idea notes

After class that day, Jason went home and found information about different ecosystems that had changed rapidly because one of the pieces had been taken out of the puzzle, as Mr. Freamon would have put it. For example, along some coasts, human activity had reduced the sea otter population. The sea otters ate sea urchins that ate kelp from huge kelp forests. Without the sea otters to keep sea urchins in check, the kelp started to disappear.

The whole idea was starting to make sense to Jason. It was basically like dominoes—all the pieces lined up, and if you knocked one down, it would knock down the next one, which would knock down the one after that, until they all went down. Of course, it was a lot more complicated than that, but that was the basic idea.

Jason thought about the wildlife on the reserve. A robin built its nest near the top of an oak tree. He imagined the robin catching insects to bring back to the nest to feed her chicks. He thought about how the roots of the tree reached way down into the soil to drink the moisture there. It really was fascinating how everything fit together.

The next day at school, Mr. Freamon shared a surprising piece of information with his students.

“Ho Tep Wildlife Reserve hasn’t always been a forest. It used to be a desert—a totally different ecosystem. But over time, things changed, like the weather patterns,” Mr. Freamon said. “There wasn’t a lot of rain falling on that area for a long time. But as that changed, there was more moisture in the soil. Enough for flowering plants to begin to take root, and eventually trees,”

“And once there are trees, there’s shelter for birds and other animals,” Jason said.

Key words

“Exactly right,” Mr. Freamon said. “Nature has a way of changing itself, but it takes a very long time. Ecosystems fall apart and then eventually find a new way to rebuild.”

“Can people change an ecosystem?” Jason asked.

Mr. Freamon smiled. “We’ve changed plenty of ecosystems! Except when humans change an ecosystem, it’s usually accidental. Usually it’s because clearing out land to build things drives out other creatures.”

“Well, it’s like you always say: humans are a part of nature too, right?”

“Exactly right, Jason,” Mr. Freamon said. “That’s exactly right.”

Main idea notes

Desert Life

Key words

Main idea notes

People often use the adjectives "hot," "dry," and "empty" to describe deserts, but these words do not tell the whole story. Although some deserts are very hot, with daytime temperatures as high as 130°F, other deserts have cold winters or are cold year-round. And most deserts, far from being empty and lifeless, are home to a variety of plants, animals, and other **organisms**. One thing all deserts have in common is that they are arid, or dry. There is little water available for plants and other **organisms**.

Some desert plants, such as cactuses, have shallow, wide-spreading root systems. The plants soak up water quickly and store it in their cells. Saguaro cactuses, which live in Arizona and northern Mexico, expand like accordions to store water in the cells of their trunks and branches. Other desert plants, like the mesquite tree, have very deep roots that can reach water more than 100 feet underground. Mesquites, saguaros, and many other desert plants have also **adapted** by having thorns to protect them from grazing animals.

Animals that have **adapted** to a desert environment are called xerocoles (ZER uh coles). Some xerocoles escape the heat in cool burrows they dig in the ground. Most xerocoles are nocturnal, so they sleep through the hot days and do their hunting and foraging at night. Some xerocoles have bodies that help them handle the heat. For example, a desert tortoise's thick shell insulates the animal and reduces water loss.

Many desert animals have developed ingenious ways of getting the water they need. The thorny devil, a lizard that lives in the Australian Outback, has a system of tiny grooves and channels on its body that lead to its mouth. The lizard catches rain and dew in these grooves and sucks them into its mouth by gulping. The humps on a camel's back store fat. Hydrogen molecules in the fat combine with oxygen to form water. During a shortage of food or water, camels draw upon this fat for nutrition and moisture.

What Does a Conservationist Do?

Dr. Osvel Hinojosa Huerta is an award-winning conservationist. He works with environmental organizations, governments, businesses, and citizen groups to save the delta of the Colorado River. Restoring the wetlands near the Gulf of California in Mexico will contribute to the area's biodiversity as well as its economy.

Key words -- Main idea notes

HOW DID YOU GET STARTED?
Despite growing up in the large urban area of San Luis Colorado, Sonora, Mexico, Osvel managed to find an instant connection with the natural world at a young age. "There was always this connection with nature," he says. "But at the same time, I will also have to say that television had a big affect on me. The nature documentaries were very influential with connecting with nature." Osvel quickly discovered his passion: to restore the ecosystem of the Colorado River Delta.

Millions of American and Mexican consumers depend on the freshwater of the Colorado River for drinking, hygiene, irrigation, and industry. The river's flow is very controlled, and dams have reduced the extent of the delta wetlands by more than 90 percent in the last century. For more than 15 years, Osvel has been working with communities along the river's drainage basin to restore water back to the delta. "It takes time," says Osvel. "But once you find common ground and make it clear that everyone is working toward a common goal, which is to improve conditions for everyone, then it's easier to make progress, but it takes time."

WHAT IS THE MOST EXCITING PART OF YOUR WORK?
"The hope that we can restore nature, seeing the results, and enjoying the results. Going back to a place that has been protected or restored and looking at how it thrives again and how the wildlife thrives, it's amazing."

WHAT IS MOST DEMANDING PART OF YOUR WORK?
"The main challenge we have is that we haven't been setting aside water for nature, just for people. So, we are changing that and that is the main challenge. We have failed to recognize that nature needs water also, not just using it for our farming industry. We need to dedicate water to connect the rivers to the seas."

Key words

Main idea notes

GEO-CONNECTION

"Wetlands provide a lot of services to the world," Osvel says. "They are great representatives of biodiversity. Many species live in wetlands. In many ways, they are the kidneys of the world. They clean the water and also provide protection against floods, storms, and hurricanes. They are very important."

Osvel and his team use different techniques to understand the Colorado River Delta. By mapping wetland areas that have been lost, as well as those that remain, they are able to understand the important connection we have with freshwater. "By using techniques like mapping and remote sensing, we started to learn what the areas could look like, and it has been very important," he says. "It also links to the political geography, which means how different places deal with the water in the basin. By understanding how and why different cities and places use the water, we can understand where the solutions can come from."

HOW CAN I BECOME A CONSERVATIONIST?

Osvel encourages students to learn all they can about water, because many times it is taken for granted. "We turn on our tap, but we don't know where the water comes from and how much it really costs to bring that water to our houses," he says. "So, learn about your watershed, where the water is produced, where the system goes, what are the important environmental values of your watershed and what are the conservation concerns of that area."

HOW CAN I GET INVOLVED?

"Learn. Go out and get engaged with the groups that are out there doing great work. There are many water-keepers around to learn from. There are also many grass roots organizations that deal with the health of rivers and water, especially in the U.S. There are plenty of these organizations. Try to learn from them and support their causes," he says.

Unit 3 Student Texts

- Cells in Your Body
- Movement in the Human Body
- The Human Heart
- The Largest Organ in Your Body
- Cardiac Arrest
- Tornado Alley and Storm Chasers
- The Digestive System
- The Nervous System

Key words

Cells in Your Body

Main idea notes

Your body is composed of more than 75 trillion cells, all working together to help your body grow and sustain itself. A cell is the smallest unit of an organism. Each cell is a living unit that is capable of taking in food, getting rid of waste, and reproducing. Although all cells consist of the same basic parts, not all cells in your body have the same job. Many different jobs must be performed to keep the body in balance, so certain cells are responsible for certain jobs.

Cells that do the same job in the body are organized into specific groups known as **tissues**. Muscle **tissue**, for example, consists of cells that can contract and relax. Nerve **tissue** is made of cells that can carry messages from one cell to another. When **tissues** work together in a group to perform a specific function, they become an **organ**. Some examples of **organs** are the heart, lungs, skin, and stomach. **Organs** are part of **organ systems**, such as the muscular and skeletal **systems**. All the body's **systems** work together and depend on each other to keep the body working. STOP

An Example

1-year old Lily is a baby girl who is growing and will keep growing into adulthood. She is growing because she is what scientists call a multicellular organism—a living thing that is made from many cells. One of the most important **function**s of a cell is a process called mitosis. Mitosis occurs when a cell makes an exact copy of itself and splits into two identical, new cells. The original cell is called the mother cell and the two new cells are called daughter cells.

By the time Lily is in middle school, hundreds of her cells have split into two, then split into two again, then split into two again, until there are thousands and thousands of cells. As time passes and Lily continues growing, mitosis also continues. Her cells continue splitting over and over, eventually becoming the trillions of cells that form the adult human body. An adult needs this many cells in order to have different **tissues** and **organs** for different purposes.

Growth

Think about how tall you are now. How tall were you a year ago? How tall were you when you were five years old? Human cells grow and mature until adulthood. Girls grow and develop until around age 17, but boys can grow until they are 22.

Mitosis makes it possible for an organism to grow from a baby to an adult. The cells in Lily's body are splitting all the time to help her grow. When she needs bigger shoes, it's because mitosis is causing the bone cells in her foot to make copies of themselves. This makes her toes longer and the sole of her foot wider. When she needs a haircut, it's because mitosis is causing the cells in her hair to multiply, resulting in longer hair. When she needs bigger muscles to support and move her growing body, mitosis produces more muscle cells.

Healing

Think about a time when you hurt yourself. Was it a scrape or cut? Did you break a bone? Each time you get injured or sick, the cells in your body work together to heal. Mitosis also helps the body heal. Mitosis is crucial for healing damaged cells. When Lily scrapes her knee on the playground, two weeks later her knee is completely healed. Thanks to mitosis, the skin cells in her knee multiplied to replace the damaged cells. If she breaks a bone, the cells along the edges of the break go through mitosis to repair it. Once Lily is an adult, however, some types of cells do not split and multiply. For instance, nerve cells and muscle cells don't regrow once they are mature.

Replacement

Certain **organs** constantly lose cells that need to be replaced by new cells. The skin is one example. Millions of skin cells die per day and are replaced through mitosis. The inner lining of the small intestine is another example. The small intestine is a tube that food travels through during digestion. Cells are knocked off as food passes through, and are replaced through mitosis.

Key words

Movement in the Human Body

Main idea notes

There are more than 600 muscles in the body. Muscle sizes vary from tiny, such as the muscles that move the eyeballs in their sockets, to very large, such as some muscles in the thighs. Muscles do everything from pumping blood throughout your body to helping you lift your heavy backpack. You consciously control some of your muscles, while others, like your heart, do their jobs automatically. There are three kinds of muscle **tissue**: skeletal, smooth, and cardiac.

Skeletal muscles **contract** to produce body movement as a result of nerve signals sent from the brain and spinal cord. Although these movements are under our conscious control, the brain can learn patterns of movements so that we can perform certain tasks, such as walking, without thinking. Unlike skeletal muscle, smooth and cardiac muscles are not under our conscious control — they **function** automatically. Smooth muscle is found in the walls of many **organs**, such as the stomach, where it **contracts** and relaxes to propel food along. Cardiac muscle, located only in the heart, pumps blood from the heart to the lungs and around the body.

Muscle and Bone Work Together

The 206 bones in our skeleton work with muscles to make the body move. Joints are formed where two bones meet. Joints make the skeleton flexible; without them, movement would be impossible. Skeletal muscles are the masses of tough, elastic **tissue** that pull our bones when we move. Together, our bones, muscles, and joints — along with tendons, ligaments, and cartilage — form our musculoskeletal **system** and enable us to do everyday physical activities.

Your skeletal muscles, which always work in pairs, connect to different sides of your bones near a joint. For instance, your biceps muscle and triceps muscle are connected near your elbow joint. When you bend your elbow, the biceps **contracts** and the triceps relaxes. When you straighten your arm, the opposite happens: The triceps **contracts** and the biceps relaxes.

What else to muscles do?
It may come as a surprise to you to find out that your muscles also help maintain the <u>temperature</u> in your body. When muscles contract, they release heat. Without this heat from muscle contraction, the body could not maintain its normal temperature. You may have noticed the way your muscles affect your body temperature when you shiver. The quick muscle contractions that occur when you shiver release heat and raise your body temperature.

Muscles also work closely together with the bones to keep you standing or sitting up standing. Have you ever noticed that you stand up straight without thinking about it? Most muscles in your body are always a little bit contracted. This tension, or muscle tone, is present even when you are sleeping. The muscles that maintain <u>posture</u> relax completely only when you are unconscious (passed out).

The Function of Bones
Without your <u>skeleton</u> you'd be just a puddle of skin and guts on the floor. From our head to our toes, our bones provide support for our bodies and help form our shape. The skull <u>protects</u> the brain and forms the shape of our face. The spinal cord, a pathway for messages between the brain and the body, is protected by the set of ring-shaped bones called vertebrae that make up the spine. The ribs form a cage that shelters internal **organs** such as the heart and lungs. And the pelvis helps protect the bladder, intestines, and in girls, the reproductive **organs**. Although they're very light, bones are strong enough to support our entire weight.

Because <u>bones</u> are made of living **cells**, when a bone is broken it will produce lots of new **cells** to rebuild the bone. These **cells** cover both ends of the broken part of the bone and close up the break. Calcium is an important mineral that bone **cells** need to repair themselves and stay strong, so make sure you eat a balanced diet!

Key words

The Human Heart

Main idea notes

Have you ever wondered what your doctor is actually listening for when he or she uses a stethoscope to check your heart? Listening closely to your heart can give your doctor a wealth of information—for example, how hard or frequently it is beating and how your heart valves sound when they open and close. Your heart valves are flaps that control the flow of blood within and out of the heart. The normal heartbeat is said to make a "lubb-dupp" sound as your heart valves close. But sometimes doctors can hear an extra sound. This unusual swishing or whooshing sound is called a heart murmur. More often than not, heart murmurs are harmless and don't require any treatment.

The circulatory system is one of the most important **systems** in the body. Made up of the heart, blood and blood vessels, the circulatory **system** is your body's delivery **system**. STOP Blood that travels away from the heart delivers oxygen and nutrients to every part of the body. On the return trip toward the heart, blood picks up waste products so that your body can get rid of them. There are three types of blood vessels in your circulatory **system**. Blood is pumped *away* from the heart by vessels called arteries, and is carried *toward* the heart by veins. The smallest blood vessels are capillaries. These vessels are so thin that oxygen and nutrients can pass right through their walls and into body **tissues**.

Your heart is a muscle about the size of your fist when it's clenched. It **contracts** and relaxes about 70 times a minute at rest — more if you are exercising — and pumps blood through its chambers to all parts of the body. The heart is divided into two sections. Both sides, which are called ventricles, pump at the same time. Veins throughout the body carry blood to the ventricle on the right side. The heart then sends the blood to the lungs, where it collects oxygen. The oxygen-rich blood then flows to the left ventricle of the heart. After moving through there, the oxygen-rich blood flows throughout the body and the whole process begins again.

Your blood has several different parts. Most of it is a colorless liquid called plasma, which contains red blood cells, white blood cells, and platelets. Red blood cells give the blood its red color and transport oxygen and carbon dioxide to and from the body's cells. White blood cells are part of your body's defense against pathogens. (A pathogen is an organism that causes disease.) Some white blood cells attack and kill pathogens directly; others create antibodies, which are chemicals that destroy pathogens. Platelets are pieces of cells in the blood that help your body repair itself after injury. When you get a cut, platelets stop the bleeding by bunching together and forming a clot.

Key words

The Largest Organ in Your Body

Main idea notes

Body **organs** aren't all internal like the brain or the heart. There's one we wear on the outside. Skin is our largest **organ—**the average adult has about 8 pounds and 22 square feet of it. This fleshy covering does a lot more than make us look good. Your skin covers and protects everything inside your body. Without skin, people's muscles, bones, and **organs** would be hanging out all over the place. Skin holds everything together.

Skin acts as a waterproof, insulating shield that guards the body against extreme temperature, sunlight, and chemicals. It releases substances that prevent infection and makes vitamin D for converting calcium into healthy bones. Additionally, skin is a huge sensor packed with nerves that keep the brain in touch with the outside world. At the same time, skin is stretchy and allows us free movement. It is an amazingly useful **organ**.

Skin is made up of layers. The outermost is the epidermis. This consists mainly of cells that are made from the tough protein called keratin. Keratin is also the same protein that makes nails and hair.

Cells in the epidermis form several layers that constantly grow outwards as the outer cells die and flake off. It takes roughly five weeks for newly created cells to work their way to the surface. The covering of dead skin is thicker on some parts of the body than others. For example, it is ten times thicker on the soles of the feet than around the eyes. The epidermis is attached to a deeper skin layer below known as the dermis, which gives the organ its strength and stretchiness.

Blood vessels in the dermis help regulate body temperature by increasing blood flow to the skin to allow heat to escape, or by restricting the flow when it's cold. A network of nerve fibers pick up feelings such as touch, temperature, and pain, relaying them to the brain.

The dermis also holds hair follicles and glands with ducts that pass up through the skin. Sweat glands bring down the body's temperature through perspiration. Sweating also gets rid of waste fluids. Apocrine glands, which develop during the teenage years, produce a scented sweat that can cause body odor, especially around the armpits. Another type of gland releases an oily substance that keeps the hair and skin healthy.

Skin color is due to melanin, a pigment produced in the epidermis to protect us from the sun's potentially cancer-causing ultraviolet (UV) rays. Dark-skinned people produce more numerous and deeper-colored melanin cells. People with the darkest complexions are native to tropical regions, particularly those with few forested areas.

Fair skin is an adaptation found in people from northern latitudes where solar rays are relatively weak. In these areas of the world, having dark skin is less helpful because of humans' need for bone-strengthening vitamin D. Vitamin D is produced through exposure to UV rays. But hotter, sunnier environments bring the risk of serious skin damage. Australia, where the majority of the population is of northern European descent, has the world's highest rates of skin cancer, accounting for more than 80 percent of all cancers diagnosed there each year.

Key words

Cardiac Arrest

Main idea notes

Sept. 15, 2006: That was the day that Matt Nader's heart stopped, his athletic dreams ended, and he got a second chance at life. The Texas teen was an all-American football player headed for the University of Texas Longhorns. But at a game during his senior year of high school, he experienced sudden cardiac arrest.

"It felt like a grenade exploded in my chest," Nader told an interviewer from Current Health. "Then I lost consciousness." His heart had stopped beating, condemning him to almost certain death.

Every time the heart beats, its main **function** is to pump oxygen-rich blood throughout the body and receive the blood back once the oxygen has been used. What makes the heart beat? Every pump needs a power source. In the heart's case, specialized **tissue** sends electrical impulses through muscle fibers and causes them to **contract**, creating the heartbeat.

During cardiac arrest, the heart stops, the person quickly loses consciousness, and heart rate and blood pressure drop. Every second counts once the brain and other **organs** lose their oxygen supply. Most people will die if they don't get help within four to six minutes. Only 8 percent of people who have cardiac arrest outside a hospital make it home again, according to the American Heart Association.

Any death from cardiac arrest is tragic, but the death of a teen is especially devastating. Unfortunately, each year a small number of teens—often athletes—experience sudden cardiac arrest. In many cases, they have undiagnosed heart conditions, but in other cases, no explanation is ever found. STOP Athletes seem to be at a slightly higher risk because physical activity may strain a weak heart.

Hypertrophic cardiomyopathy (HCM)—a dangerous thickening of the heart muscle—is the leading cause of sudden cardiac arrest in young athletes. A normal heart has orderly sheets of muscle, but an HCM heart's muscle fibers are intertwined irregularly. These irregular fibers can interfere with a regular heartbeat.

Nader's heart seems normal, and his cardiac arrest has never been explained. CPR and an automated external defibrillator (AED) saved him. "My school had bought an AED four years earlier but had never used it," he says. "I wouldn't be here if they didn't have that AED." The American Heart Association recommends that all schools have defibrillators.

Matt Nader now has a tiny defibrillator implanted in his chest in case of another cardiac arrest. He is enjoying college life and still works with his beloved Longhorns, now as a student assistant. "I'm here because people around me knew what to do," he says. "I can't even put my gratitude into words."

Key words

Tornado Alley and Storm Chasers

Main idea notes

Each day we breathe about 20,000 times. All of this breathing couldn't happen without help from the respiratory **system**, which includes the nose, throat, trachea (windpipe), and lungs. With each breath, you take in air through your nostrils and mouth, and your lungs fill up and empty out. The process of taking air into the lungs is called inhalation and the process of breathing it out is called exhalation.

Although we can't see it, the air we breathe is made up of several gases. Oxygen is the most important for keeping us alive because body **cells** need it for energy and growth. Without oxygen, the body's **cells** would die. Carbon dioxide is the waste gas that is produced when we breathe. Respiration is when oxygen from the environment is exchanged for carbon dioxide waste from the body.

Asthma is a lung **condition** that causes respiratory, or breathing, difficulty. Lots of people have asthma, from young kids to the elderly. Asthma affects the bronchial tubes — also known as airways. With normal breathing, air flows in through the nose or mouth and then into the trachea. From there, it easily passes through the bronchial tubes, into the lungs, and finally back out again.

Breath doesn't always flow as easily through the airways when people have asthma, though. Their bronchial tubes are inflamed, so they swell up and produce lots of thick mucus. The inflamed airways are also very sensitive to allergens and pollutants, so things like dust or smoke can cause the involuntary muscle around the airways to tighten up. All of this can constrict, or narrow, the bronchial tubes and make it hard for air to move through.

Key words

The Digestive System

Main idea notes

If it's been a while since your last meal, you probably feel hungry. You eat until you're satisfied and then go about your day. But for the next 20 hours or so, your digestive **system** is doing its job as the food you ate travels through your body. The nutrients in food give the body's cells the fuel they need to **function**. But before food can do this, every morsel you eat has to be broken down into nutrients that can be absorbed by the body.

The digestive **system** is made up of the alimentary canal (also called the digestive tract) and the other abdominal **organs** that play a part in digestion, such as the liver and pancreas. The digestive tract is the long tube of **organs** — including the esophagus, the stomach, and the intestines — that runs from the mouth to the anus. An adult's digestive tract is about 30 feet long.

The process of digestion starts well before food reaches the stomach. When we see, smell, taste, or even imagine a tasty snack, our salivary glands begin producing saliva. This flow of saliva is set in motion by a brain reflex that is triggered when we sense food or even think about eating. The brain sends a message to the salivary glands, located under the tongue, telling them to prepare for a meal.

As the teeth tear and chop the food, saliva breaks it down and moistens it for easy swallowing. Swallowing, which is done by muscles in the tongue and mouth, moves the food into the throat. From the throat, food travels down the esophagus, a muscular tube in the chest. Muscles in the esophagus **contract** in waves to force food down to the stomach. This takes about 2 or 3 seconds — and most people aren't even aware of it!

At the end of the esophagus, a special opening allows food to enter the stomach and then squeezes shut to keep food from flowing back up into the esophagus. The stomach muscles churn and mix the food with acids and enzymes, breaking it into much smaller pieces. By the time food is ready to leave the stomach, it has been processed into a thick liquid.

The small intestine continues to break down the food mixture even more so your body is able to absorb all of its nutrients. Your food can spend as long as 4 hours in the small intestine. Nutrients pass through the intestinal wall into blood vessels as a very thin, watery mixture. The circulatory **system** works to distribute these nutrients to the rest of the body.

Your large intestine finishes the process of digesting food — a process that starts in your mouth and stomach and ends with you going to the bathroom. The large intestine absorbs water from undigested food and stores solid wastes until they are passed out of the body as waste.

The digestive **system** is an important part of your body. Without it, you couldn't get the nutrients you need to grow properly and stay healthy. Your digestive system requires regular care to run smoothly. You can help it by drinking plenty of water and eating a healthy diet that includes foods rich in fiber. High-fiber foods, like fruits, vegetables, and whole grains, make it easier for your large intestine to do its job. And next time you sit down to lunch, you'll know where your food goes — from start to finish!

Key words

The Nervous System

Main idea notes

Think of the brain as a central computer that monitors and controls all the **functions** of your body. The nervous **system** is like a network for that central computer: Neurons, or nerve cells, carry messages back and forth from the brain to different parts of the body. This happens through the spinal cord, which runs from the brain down through the back. The spinal cord contains threadlike nerves that branch out to every organ and body part. The brain and the spinal cord are protected by bone.

When a message comes into the brain from anywhere in the body, the brain sends a message out through the spinal cord telling the body how to react. Sensory neurons send messages from sensory receptors in your skin, eyes, nose, tongue, or ears toward the brain. Motor neurons send messages away from the brain to your muscles. For example, if you accidentally touch a hot stove, the sensory receptors in your skin shoot a message of pain to your brain. The spinal cord carries a message from your brain back to the muscles in your hand, telling it to pull away.

In the summer of 2006, a promising baseball pitcher named Rob Summers was in a car accident that seriously injured the lower part of his spinal cord. The damage to his spinal cord stopped the brain's messages from reaching many of the motor neurons in his lower body. The accident left him paraplegic—unable to move his lower body. "The doctors told me that I had no hope of walking again," says Summers. "My comment was, 'You don't know me very well. I'm going to fight until I get well again.'"

Summers spent the next two years adjusting to life in a wheelchair. Then he was chosen for an experimental research project to see if it was possible to teach the spinal cord to control body movement independently of the brain. In a four-and-a-half-hour operation, the research team implanted electrodes in Summers's spinal cord. The electrodes were then wired to a pulse generator that was implanted in his back. A device outside the body acts like a remote control for the pulse generator.

After the surgery, the researchers switched on the pulse generator for two hours a day, electrically stimulating the nerves in his spinal cord. Nerves are able to respond to electrical stimulation because the messages they carry are in the form of electric signals. On the third day of electrical stimulation, Summers was able to stand. “It was unbelievable,” he says. “There was so much going through my head at that point. I was amazed; I was in shock.”

The research team explains it this way: Summers’s spinal cord wasn’t totally damaged in the accident. It could still receive limited messages from the muscles in his lower body. Messages carried from the legs by sensory neurons are traveling to Summers’s electrically stimulated spinal cord. The spinal cord then sends messages along the motor neurons and makes the legs move.

“Our big finding is that the spinal cord is as sophisticated as the brain,” says researcher Susan Harkema. “The spinal cord basically takes information from the brain and then handles all the details. We didn’t know that before.”

Today, Summers can walk slowly on a treadmill with the aid of an assistant and a supporting harness. He can move his hips, knees, ankles, and toes voluntarily. “Now I can stand,” says Summers. “I’ve gotten my confidence back to just go out in public.” His goal is to stand and walk completely normally. “I’m working toward that every day.”

Unit 4 Student Texts

- Our Solar System
- Space Exploration
- An Interview with Buzz Aldrin
- Living on the Mom
- Challenger Expedition
- A Message for Aliens
- Mars Mission
- Drones Take Off

Key words

Our Solar System

Main idea notes

The Sun

Our Sun is a star. It only appears to be larger than other stars because it is much closer to Earth than the stars we see at night. At one time, people thought the Sun was a huge burning rock. Actually, the Sun is made of a type of super hot matter called plasma, which is similar to a gas.

And the Sun does not burn; it glows in the same way that a light bulb glows—only much brighter. The Sun consists of layers. A heavy core makes up the inner part of the Sun. Particles react in the core to release large amounts of energy that provides the light and heat that living things on earth need to survive. The Sun's outer layer, the corona, consists of swirling layers of plasma.

Just how hot does it get on the sun? On the corona, temperatures hover around 10,000 degrees Fahrenheit. If you think that's hot, temperatures in the core are around 13,600,000 degrees! On Earth, much of the heat humans and other living things need to survive is supplied by the sun.

The Solar System

Our solar system is made up of the sun and everything that travels around it. This includes eight planets, moons, asteroids, comets, and meteoroids. The four planets closest to the sun—Mercury, Venus, Earth, and Mars—are called the **terrestrial planets** because they have solid, rocky surfaces. STOP

Everything in the Solar System orbits around the Sun. Now why does a planet orbit the Sun and not the other way around? The lighter object orbits the heavier one, and the Sun is, by far, the heaviest object in the solar system. The Sun is 1000 times heavier than the largest planet, Jupiter, and it is more than 300,000 times heavier than Earth. As the heavyweight in our solar system, the Sun has the strongest gravitational pull.

The Moon

The Moon is the closest body in space to Earth. It has no light of its own, but light from the Sun reflects off its surface. This is what makes it appear lit to us. The Moon is Earth's satellite, so it orbits around the earth. As the Moon revolves around Earth, it seems to have different shapes, but it does not actually change. The different shapes are called the phases of the

Key words

Main idea notes

Moon. We see the phases because of changes in the size of the lighted part of the Moon that is visible from Earth. Only the half of the Moon that faces the Sun is lighted. The positions of the Moon, Earth, and Sun determine how the Moon will look from Earth

Mercury

The planet Mercury is the closest of the planets to the Sun. It is often called a morning star because Mercury shines brightly in the early morning just before the sun rises. The surface of the planet Mercury is covered with craters. These craters have been created from the many times Mercury has been hit with asteroids and comets. Because Mercury's crust is so thick and hard, no volcanic activity can make its way through to the surface of the planet. Since this surface volcanic activity cannot happen, Mercury will forever keep its scars.

Venus

Venus is in many ways Earth's sister planet. It is almost identical in size, gravity and density as the Earth. In other words, Venus is made up of almost the exact same types of materials as the Earth and in about the same amounts. Venus has volcanoes, mountains and sand, just like Earth.
However, if they are twins, then Venus is the evil twin; she is the Earth gone wrong, very wrong. Venus is a deadly world where the surface temperature is hot enough to cook a meal in mere minutes. There is nowhere to hide from this ever-present furnace. And with the atmosphere containing mostly carbon dioxide, it makes Venus a highly toxic place. No living thing would ever be able to survive on Venus.

Earth

Earth, our home planet, is the only planet in our solar system known to harbor life—life that is incredibly diverse. All the things we need to survive exist under a thin layer of atmosphere that separates us from cold, airless space. The Earth's atmosphere is made up of the perfect balance for us to breathe and live. Many planets have atmospheres, but only Earth's is breathable.

Earth is a rocky planet, also known as a terrestrial planet, with a surface of mountains, valleys, canyons, plains and so much more. What makes Earth different from the other terrestrial

Key words

planets is that it is also an ocean planet: 70 percent of the Earth's surface is covered in oceans.

Main idea notes

Mars

Mars excites scientists because its mild temperament is more like the Earth's than any of the other planets. Evidence suggests that Mars once had rivers, streams, lakes, and even an ocean. As Mars' atmosphere slowly depleted into outer space, the surface water began to permanently evaporate. Today the only water on Mars is either frozen in the polar caps or underground. You may sometimes hear Mars referred to as the "Red Planet." This is because the surface of Mars is red. If you stood on the surface of Mars, you would see red dirt and rocks everywhere.

Key words

Space Exploration

Main idea notes

Throughout history, people have been curious about what is beyond Earth. Such curiosity has led some to study the stars and planets, while others have developed theories to explain how the universe functions. Space travel and exploration have been topics of scientific inquiry for hundreds of years. However, one of the most rapid and important series of advances in space exploration began in the 1950s.

Two countries, the United States and the Soviet Union, led the world into an era of intense exploration. After World War II, these countries had strong political differences. Known as the Cold War, this period of political disagreements and military rivalry did not end in actual combat. However, the rivalry between the United States and the Soviet Union fueled many competitions, from sports to space exploration.

History changed on October 4, 1957, when *Sputnik 1*, the world's first artificial **satellite**, was **launched** into space. It **orbited** Earth in about 98 minutes, giving the Soviets a great victory because they put a **satellite** in **orbit** before the United States. Most Americans were shocked and worried that the Soviets had technology that was superior to the United States. As a result, the U.S. increased funding for its space program and on January 31, 1958 successfully launched its own satellite, called *Explorer 1*.

The **launch** of *Sputnik 1* and *Explorer 1* marked the beginning of the Space Race, a long-term competition between the U.S. and the Soviet Union to make discoveries in space. Both countries wanted to be the leader in space exploration. During the Space Race, leaders from both countries were under great pressure to meet some tough deadlines. They developed and used many new technologies in a very short period of time.

Testing the limits of the human body in space was an important objective of both countries. To test the theory that organisms could survive in space, animals were sent into space first. The United States launched Ham the chimpanzee, and the Soviets sent a dog named Laika. Though Ham returned safely to, Laika died aboard *Sputnik 2*.

Key words

Main idea notes

Soviet cosmonaut Yuri Gagarin became the first person in space when he orbited the Earth in his *Vostok* spacecraft in April of 1961. Eager to catch up with the Soviet Union, Alan Shepard, Jr. became the first American in space about a month later. His 15-minute flight aboard a capsule called *Freedom 7* was watched by 45 million television viewers. The *Freedom 7* reached a high altitude, but did not orbit Earth as the Soviet's *Vostok* had. The Soviet Union was ahead in the Space Race.

As the Space Race became more competitive, more and more **space missions** were **launched.** Many milestones were achieved in a very short period of time: John Glenn circled Earth three times, becoming the first American to orbit Earth. The Soviets sent the first woman to space and successfully accomplished the first space walk outside of a spacecraft. Both countries began sending space probes, unmanned exploratory spacecraft, to the Moon. Even though the Soviets had beaten the Americans to every space milestone, the United Space ultimately won the Space Race when they successfully put the first human on the Moon in 1969.

Space exploration is no longer a competition between countries. Instead it is an international project. Sixteen countries worked together to build the International Space Station (ISS), the largest object ever flown in space. The ISS was built to be a space research laboratory where crew members could conduct experiments in scientific fields such as astronomy and meteorology. The ISS also provides opportunities to test spacecraft systems and equipment and act as a staging base for future **space missions** to the Moon or Mars.

Key words

An Interview with Buzz Aldrin

Main idea notes

The objective of NASA’s Apollo program was to land an American on the Moon and then return him or her safely to Earth. On July 16, 1969, the United States was ready to make history when astronauts Neil Armstrong, Michael Collins and Edwin "Buzz" Aldrin were **launched** in the spacecraft *Columbia*. The plan was to have a lunar module called *Eagle* separate from the command module, *Columbia*. The lunar module would land on the surface of the Moon while the command module **orbited** the Moon.

On July 20, 1969, *Eagle* landed safely on the Moon. “That’s one small step for man, one giant leap for mankind.” These were the words astronaut Neil Armstrong spoke as he became the first human to ever step foot on the Moon. As Michael Collins continued **orbiting** in the *Columbia,* Buzz Aldrin joined Armstrong on the lunar surface. The two men took pictures, collected rocks and soil samples, and planted an American flag on the Moon’s surface. Millions of people on Earth watched the historic event on television.

Below, Buzz Aldrin answers questions in a Scholastics Books interview from 1998.

Is the surface of the moon different from that of Earth? The surface of the moon is like nothing here on Earth! It's totally lacking any evidence of life. It has lots of fine, powder-like dust mixed with a variety of pebbles, rocks, and boulders. There are many pebbles, fewer rocks, and even fewer boulders. The dust is a dark gray. And with no air molecules to separate the dust, it clings together like cement.

W**hat was the most memorable part of walking on the moon?** There are two moments that are recorded in my mind. One was just the second or two after we shut the engine down and we realized that the spacecraft was on the moon. That really was the major achievement. When I was outside seeing the Earth, my other thought was that there were only three human beings who were not on Earth. (The third was Michael Collins, who was **orbiting** the moon in a craft that would take the astronauts back to Earth.)

Key words

Living on the Moon

Main idea notes

Only 12 people have set foot on the moon—so far. The last time was in late 1972, when two astronauts walked on its surface. Their final visit, the longest of any, lasted just three days. Now astronauts are preparing for another **mission** to our space neighbor. This time, though, they plan to stay there.

NASA recently announced plans to build a permanent colony on the moon. The space agency hopes that astronauts will be living and working there by 2024. One goal of the moon colony is to prepare astronauts for a trip to Mars in the future.

Under the plan, four-person crews will begin with week-long **missions** to the moon. By 2024, when more equipment has been set up, astronauts will be able to reside, or live, on the moon for as long as six months. Astronauts will travel in roving vehicles to explore the area near the lunar base.

The moon is the only place beyond Earth that humans have visited. About 238,900 miles away, the moon is Earth's closest space neighbor. Unlike Earth, the moon has no air, wind, or weather. Its dusty terrain, or surface, is covered with deep craters. So how can humans survive on the moon? There are some basic needs that the moon colonists would have to take care of, such as power, breathable air, and water

It would be ideal to get as much of these resources as possible from the moon itself, because shipping costs to the moon are unbelievable – close to $50,000 per pound. Just one gallon of water weighs about eight pounds, so it would cost $400,000 to get it to the moon! Obviously you want to carry as little as possible to the moon and manufacture as much as you can once you get there.

NASA hopes to establish a lunar colony near one of the moon's poles. "These locations experience sunlight for longer periods of time than other locations on the moon, which will make it possible to use solar power," NASA official Michael Braukus told WR News. Solar power is energy from the sun that can be used to generate electricity.

Obtaining breathable air, in the form of oxygen, is fairly easy on the moon. Oxygen doesn't exist only as a gas above the ground.

Key words

Main idea notes

It can also be found in certain kinds of moon rocks. Scientists are experimenting with how oxygen in the rocks can be collected using heat and electricity.

Water is trickier. There's now some evidence that there may be water, in the form of buried ice at the south pole of the moon. If so, water mining might be possible, and it would solve a lot of problems. Water is necessary for drinking and irrigation, and it can also be converted to hydrogen and oxygen for use as rocket fuel.

If water isn't available on the moon, it must be imported from Earth. One way to do that would be to ship liquid hydrogen from the earth to the moon, and then combine it with oxygen from the moon's soil to create water. This might be the cheapest way to get water to the moon.

The moon **mission** was part of President George W. Bush's long-term space plan. The proposed base is the first step in the bold plan to prepare astronauts for their ultimate destination—Mars.

Because Mars is so far from Earth, a **mission** to Mars will require humans to stay for long periods of time. Astronauts will not be able to bring enough supplies for the entire mission. They will have to use the elements on Mars to survive. "By demonstrating we can survive on another world for a long time, we build confidence that we can venture much farther from Earth and stay for longer periods of time," says Braukus of NASA.

While some supporters are excited about **launching** a new era of space exploration, not everyone is pleased with the plan. Critics warn that it will be difficult to fund the moon program. So far, NASA has not put a price tag on the **mission** but welcomes participation by other countries to help carry out its plan.

Key words | **Challenger Expedition** | Main idea notes

NASA created the space shuttle as a reusable **launch** vehicle to carry astronauts and cargo into space and back again. It was designed to carry as many as seven astronauts at a time. Once in space, the shuttle flew many different types of **missions**. For instance, it launched **satellites** and served as an **orbiting** science laboratory. Astronauts collected information on space, planets, stars and comets. Its crews repaired and improved other spacecraft, such as the Hubble Space Telescope. On its later **missions**, the space shuttle was mostly used to work on the International Space Station.

Space shuttles are made up of many different parts, but the three main pieces are the rocket boosters, the fuel tank and the orbiter. There are two rocket boosters that are used to lift the shuttle off the ground and blast into space. The tank on the outside of the shuttle holds fuel to be used by the rocket boosters for **launch**. Orbiters carry the passengers, astronaut and whatever they bring with them.

Space shuttles are rockets, not engines. Rockets do not need air to run, which is why they work so well in space, where there is no air. During **launch**, NASA uses solid fuels to push the space shuttle up and out, sending the shuttle into **orbit**. After the **launch**, the fuel tanks separate and fall off the shuttle so it can easily **orbit** at a lighter mass. When a **mission** is completed, the shuttle reduces speed and after descending through the atmosphere, lands like a glider.

Challenger, NASA's second space shuttle to enter service, made a total of nine voyages. In 1986, it was scheduled to **launch** on January 22 carrying a seven-member crew that included Christa McAuliffe, a 37-year-old high school social studies instructor from New Hampshire. McAuliffe had earned a spot on the **mission** through NASA's Teacher in Space Program. After undergoing months of training, she was set to become the first ordinary American citizen to travel into space.

The mission's **launch** from Kennedy Space Center at Cape Canaveral, Florida, was delayed for six days due to weather and technical problems. The morning of January 28 was unusually cold. Engineers warned their superiors that certain components—particularly the rubber O-rings that sealed the joints of the shuttle's solid rocket boosters—were vulnerable

Key words

Main idea notes

to failure at low temperatures. However, these warnings went unheeded, and at 11:39 a.m. Challenger lifted off.

Seventy-three seconds later, hundreds of spectators on the ground, including the families of McAuliffe and the other astronauts on board, stared in disbelief as the shuttle exploded in a plume of smoke and fire. Millions more watched the tragedy on live television. Within instants, the spacecraft broke apart and plunged into the ocean, killing its entire crew.

It was the first time the US had lost astronauts in flight, and it was a profound loss for the country. President Reagan summed up that sense of national grief in a special televised message to the nation that evening. He even made a special mention of the many children who were affected.

Staring straight into the camera, he said, "I want to say something to the schoolchildren of America who were watching the live coverage of the shuttle's takeoff. I know it is hard to understand, but sometimes painful things like this happen. It's all part of the process of exploration and discovery. It's all part of taking a chance and expanding man's horizons. The future doesn't belong to the fainthearted; it belongs to the brave. The Challenger crew was pulling us into the future, and we'll continue to follow them."

Shortly after the disaster, President Reagan formed a special commission, or group, to determine what went wrong with Challenger. Their investigation revealed that the O-ring seal on Challenger's solid rocket booster, which had become brittle in the cold temperatures, failed. Flames then broke out of the booster and damaged the external fuel tank, causing the spacecraft to disintegrate. The commission also found that the company that designed the solid rocket boosters had ignored warnings about potential issues. NASA managers were aware of these design problems but also failed to take action.

After the Challenger wreckage was examined, the pieces were buried and sealed in abandoned Minuteman missile silos at Cape Canaveral Air Force Station, where they remain today.

Challenger's explosion changed the space shuttle program in several ways. Plans to fly other civilians in space, such as journalists, were shelved. Barbara Morgan would be the next

Key words

civilian to fly aboard a shuttle, was 22 years after the Challenger tragedy. Additionally, astronauts were pulled off of duties such as repairing satellites to better preserve their safety.

Every January, NASA pauses to remember the last crew of Challenger, and the other crews lost in pursuing space, on a NASA Day of Remembrance. Additionally, Challenger has an educational legacy: members of the crews' families founded the Challenger Center for Space Science Education program, which brings students on simulated space missions.

Main idea notes

Key words

A Message for Aliens?

Main idea notes

What would you say to an extraterrestrial being—a living thing that's not from Earth? Now you will have a chance to contribute to a message that NASA, the U.S. space agency, is planning to send to a spacecraft that is currently traveling in outer space. The message is intended for any intelligent life forms the spacecraft may encounter in its travels.

NASA (the National Aeronautics and Space Administration) will be transmitting the message to the *New Horizons* space probe. *New Horizons* is an unmanned spacecraft that is on a path to Pluto. The digital message sent to the probe will include words, sounds, maps, and maybe even photos of what life is like on Earth in 2014

The project to create this digital record is called the One Earth: New Horizons Message. Jon Lomberg, a design director at NASA, is leading the project. When Lomberg announced NASA's approval for the One Earth: New Horizons Message at a science festival earlier this year, there was a lot of excitement from the crowd. "I think you could hear us cheering all the way out to Pluto," he said.

Engineers will pull together all the data that will make up the One Earth: New Horizons Message, and then stream it from Earth to *New Horizons*. Scientists believe *New Horizons* will be able to continue exploring outer space after completing its mission. In fact, the spacecraft will likely leave our solar system. In the next few months, scientists will be gathering the messages, facts, and files from people all over the world to show what life is like for humans on Earth in 2014.

Key words

Mars Mission

Main idea notes

It had taken decades of hard work, but at long last the day arrived. Hundreds of spectators gathered at NASA's Kennedy Air Force Base to watch the Orion 254 shuttle shoot up into outer space, headed for Mars. Almost everyone in the world had tuned in to watch live coverage of the launch. Onboard the shuttle two astronauts, dressed in puffy white spacesuits, patiently waited for blastoff. Roy Ruiz and Ciara Jones were the astronauts NASA had specially selected to undertake this risky mission. In just a few minutes, they would begin an adventure that would carry them further away from Earth than anyone else in human history.

A voice came over the speakers that hovered above the excited spectators. "In 1969, human beings walked on the moon for the first time," said the confident voice, "and now, in July of 2020, we expand our frontier to Mars. Please send your good wishes to our brave astronauts as they begin this groundbreaking mission. " Everyone erupted into cheers and whistles. Family and friends of the astronauts stood at the front of the crowd. Tears streamed down their faces. They were proud of Roy and Ciara, but they did not know when or if they would ever see them again. The voyage would take at least a year to complete, and it involved many risks.

"Ten," counted the deep voice, "nine, eight, seven, six, five, four, three, two, one!" Huge fuel jets attached to the shuttle Orion shot white-hot streaks of fire into the ground, and the shuttle and tanks immediately shot upward into the sky. The shuttle's fuel tanks had to generate enough force to propel the shuttle from Earth's surface all the way into outer space. That's why NASA scientists designed the jets to be so big and powerful.

Within minutes, Roy and Ciara passed through the top layers of the earth's atmosphere. The fuel jets, which were no longer necessary, broke away from the shuttle and drifted off into outer space. Roy and Ciara began to float inside the shuttle because Earth's gravitational pull no longer weighed them down. Oxygen tanks fed air into their surroundings so they could breathe. Roy and Ciara took their first deep breaths in space and gazed out the window. A brilliant blue sphere rose before them. That was Earth, and they were now speeding away from it at 75,000 miles per hour.

Key words

Main idea notes

"Ground control to Roy and Ciara," said a happy voice on the radio from Mission Control.
"Roy Ruiz to Mission Control," replied Roy.
"That was a perfect takeoff," the officer said. "Congratulations!"
"Thanks," said Roy. "We'll keep you posted as we move along."

NASA chose Roy and Ciara for the Mars mission for important reasons. They were both very intelligent and physically fit. They were also got along well and worked together easily. Over such a long trip, NASA felt it was better to send people who would not easily get into fights. If anything went wrong on board the spacecraft, Roy and Ciara would have to work as a tight team to fix the problem. For an entire year they would have to survive without a single freshly cooked meal—all their food was stored on the craft in vacuum- sealed packs and tubes. There were a limited number of oxygen tanks containing their air supply. If the mission had a problem that required a lengthy repair, they risked running out of air to breathe. To maintain a good attitude among these challenges, the two astronauts had to get along well.

For one whole quiet year the couple sailed across space. Sometimes Roy felt claustrophobic inside the small craft. When this happened, he exercised on the special fitness machines or put on his spacesuit to check on the external parts of the spacecraft. Ciara wrote in a journal about the beautiful sights she saw out the window—distant galaxies and stars, and a giant asteroid not so far away.

By the time Orion finally approached the dry, red-colored surface of Mars, people on Earth had almost forgotten about them. But as the craft got closer and closer to the planet, news channels on Earth started buzzing. "Men on Mars, at long last! Another giant leap for mankind!" they proclaimed.

Roy, an expert pilot, landed the spacecraft with a gentle thud. "Bravo!" shouted Mission Control. Everyone was clapping in the background. "You're about to make history!"

Roy switched on the television monitors outside the spacecraft so citizens of Earth could watch this historic, first walk on Mars. The two astronauts fixed microphones to the insides of

Key words

Main idea notes

their spacesuits so they could talk to Mission Control, each other, and the rest of the earthly world. They fastened their spacesuits to cords inside the craft, and stepped out into the swirling dust.

As he took his first steps, Roy saw a flicker of silver out of the corner of his eye. It seemed to move through the air and settle behind a rock to his right.

“You’re not going to believe this,” said Roy. “But I swear I saw something silver, moving behind that rock just ahead.”

“Are you saying...that you might have seen a life form?” asked the Mission Control commander in a serious, quiet voice.

“Could be,” said Roy. “Won’t know for sure until we explore a bit.” “Indeed,” said Ciara. “We’ll have to be very quiet and slow.”

Side by side, tools in hand, and Roy and Ciara ventured forth into the mysterious red landscape.

Key words

Drones Take Off

Main idea notes

One day in the not-so-distant future, an unmanned aerial vehicle, also known as a drone, flies over an apple orchard. As it zips around, it snaps high-definition photos and runs them through software that analyzes the crops' health. The software homes in on a corner of the field that doesn't look so good: Insects are attacking the apples. The drone turns and heads toward the area. Sprayers on its wings dispense pesticide, killing the insects that are harming the trees. Then the drone returns to its patrol.

Weeks later, an apple from that same orchard arrives at a grocery warehouse near you. From your cell phone, you add it to your cart and click "deliver." Twenty minutes later, you hear a whirring noise outside. A different drone lands on your doorstep. It sets your apple down and zips away. This scenario sounds like science fiction. But scientists think it could become a reality—and probably sooner than you think. From moviemakers to animal conservationists, people are already finding ways to use drones.

Drones Today

Drones were first built in the early 1900s for military pilots and gunners to use as target practice. Today the military remains the leading user of drones. But as drones have become smaller and more affordable, people outside the military have begun to use them.

Today, the hottest application for drones is in Hollywood. Filmmakers are using drones equipped with cameras to capture footage that would otherwise be dangerous and expensive to shoot. Action scenes, for example, have traditionally been filmed using helicopters. To capture the shot, the crew sometimes has to fly in the helicopter, which can cost $10,000 per day. Camera drones, by contrast, can get close to the action without endangering lives. And they're far less expensive than helicopters: A state-of-the-art camera drone costs about $25,000 and can be used over and over again.

Privacy Concerns

In the United States, anyone who owns or flies an airplane or

Key words

drone must get a license and permission from the Federal currently facing a debate about privacy and safety issues.

Main idea notes

The public is concerned that camera drones could be used to peer into windows and spy on people. And since drones don't have flight guidelines, critics worry that they could crash into buildings, people, and other drones. Before drones can be flown over populated areas, says Taylor, rules are needed about who can fly them, and when and where.

Air Delivery

Some companies aren't letting any obstacle stop them from investigating uses for drones. Amazon, the online store, says it intends to start a new service called Prime Air as early as 2015. It says it will be able to deliver packages via drone in under 30 minutes. Pizza deliveries could follow. Drones might even deliver Internet access. Facebook is working on a project that would launch drones that broadcast Internet signals to parts of the world that aren't connected.

What about drones for personal use? Already, anyone can go online and buy a camera drone for a few hundred dollars. In the near future, people could use drones to snap selfies from the perfect vantage point or record footage as people skateboard or play soccer. Someday, personal drones could even race you during your workout. Experts say that when it comes to the uses of drones, the sky is—literally—the limit.