Dear Fifth and Sixth Grade Families,

We know this is a difficult time for us all. We have put together some work for our science students that they can do without the internet. There are articles to be read and questions to be answered for each page. We would like our students to be able to pull information from different sources like articles, bar graphs, pie graphs, line graphs, etc and be able to answer questions about the information being shown in these graphic organizers.

Another requirement for science during this unusual time in our lives is to go outside and enjoy what we do have here in Kettle Falls. Go out and explore. Turn over rocks and see what lies beneath them. Stay connected to the epidemic and stay informed to what is going on in our community, our state, our country and the world. Watch the numbers using the Washington State Department of Health and the Centers for Disease Control. Watching how this virus has affected our world is part of being a scientist. Stay educated with factual information.

We miss all of you. We miss having class every day. We are staying optimistic and hopeful about the remainder of our year together. Stay positive! Stay healthy.

Sincerely,  Mr. Ballance/Mrs. Benner

[Signature]

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Attack of the Viruses

In 1918, just as World War I was coming to an end, another enemy suddenly attacked without choosing sides. In just two years, it infected more than one-fifth of the entire world’s population and killed between 20 and 50 million people. In fact, it killed more people than the war did. What was this deadly new enemy? Why was its attack on humans so devastating?

Viral Outbreaks

The new enemy was an unusually lethal virus. It caused a disease that at the time was called the Spanish flu, even though it may not have come from Spain. As soldiers traveled between North America, Europe, and Africa, the virus spread around the world.

While most flu viruses known at that time attacked the very old and very young, the victims of the Spanish flu were healthy people between the ages of 20 and 40. Doctors didn’t have any experience with the disease, and there were no effective drugs for treating patients who caught it.

People were very frightened, and panic spread quickly. Without medicine to rely on, some turned to superstition. Some people ate sugar cubes that were soaked in kerosene. Others tied red ribbons around their right arms. Carrying a potato in your pocket was said to offer protection from catching the virus, as was eating raw onions.
As the death toll rose, health officials finally began to take action. Communities enacted drastic laws that were designed to stop the spread of the disease. Schools were closed and public gatherings were cancelled. In some places, people were required to show certificates of good health before they were allowed on trains and buses. Officials gave out face masks to be worn in public. Spitting in public, and even handshakes, became illegal in some cities.

The 1918 Spanish flu was a pandemic, a disease that occurs over a wide area and affects a lot of people. Like other viral outbreaks, it eventually died out, but not before it had claimed tens of millions of lives around the world.

Viruses still cause many diseases today. Some, like the common cold virus, cause minor illnesses. Others, such as measles, polio, hepatitis, AIDS, and Ebola, can cause serious diseases or even death.

The Ebola virus is one of the deadliest viruses in the world because, unlike many other viruses, there is no vaccine for the Ebola virus. Ebola viruses have existed for some time in West African forests where they infect monkeys, gorillas, and chimpanzees. Humans who come in contact with an infected animal or the virus can become ill, so small outbreaks of the disease have occasionally occurred.

In 2014, though, a large Ebola outbreak raged through western Africa. Many thousands of people became sick and died. But this time, scientists were more familiar with Ebola than they were with the Spanish flu virus in 1918. They knew that the disease was caused by a virus and that it was spread through contact with body fluids such as blood, sweat, and faces. As a result, health workers used protective body suits and masks when handling the infected people. Patients were isolated quickly, and officials tried to prohibit people from traveling, especially by plane.

About a year after the epidemic started, the number of new patients finally began to decrease, and the epidemic lessened. Although the virus was devastating to local populations, a larger world-wide pandemic was avoided.

Viruses can cause some of the most deadly diseases on Earth. Ebola spreads so easily that medical workers must cover all parts of their bodies to prevent getting the disease. The caregiver in the black apron, who is leaving the patient area of a temporary hospital in Africa, is being sprayed with chemicals to destroy any viruses that might be on his or her clothes.
A person fighting a virus often looks sick. Chicken pox is a viral disease that causes an itchy rash. The rash is the body’s way of fighting the virus by calling in specialized blood cells to attack it.

Viruses use the host cell’s life processes and energy to make more viruses. This diagram shows how a virus takes over a host cell to make new viruses. The host cell usually dies when it breaks open to release the new viruses.

How Viruses Cause Disease

Unlike many other things that cause disease in humans, viruses are not alive. Viruses are not made of cells. Through observations and experiments, scientists have learned that viruses can cause disease by taking over the life processes of their host’s cells. The host is the organism that the virus is infecting, such as a human.

Here’s how a virus infects its host. The virus enters the host organism through an opening such as the nose, mouth, or cut in the skin. Once inside the body, it attaches to a host cell, and some or all of the virus enters the host’s cell. Then, the virus will insert its own instructions into the host cell’s instructions. So, without knowing it, the cell starts making thousands of copies of the virus. These copies are released out of the cell, sometimes causing the cell to burst and die. The new viruses then repeat the cycle in other host cells.

A person fighting a virus often looks sick. She or he may be feverish, coughing, or covered with a rash. These symptoms are the result of the body declaring war on the virus. The body raising its temperature can help to slow down a viral infection. Sneezing and coughing are the body’s attempt to get rid of the virus. A rash may form where specialized blood cells that fight infection are called in to attack viruses.

Curiously, it is often the body’s overreaction to a viral infection that kills the host, not the virus itself. This was the case with the 1918 Spanish flu pandemic. Scientists think that when healthy people caught the virus, their bodies overreacted in an attempt to fight it. The severe response damaged their tissues and consequently led to death.
Fighting Viruses

They say that an ounce of prevention is worth a pound of cure. This is especially true of viral infections since many of the deadliest viruses are very hard to cure once they are inside body cells. Unlike bacteria, viruses can't be killed by antibiotics, which disrupt life processes, because viruses aren't alive.

By studying data from past outbreaks, scientists have learned more about how to prevent the spread of viruses. Many of the things that were done in 1918 or even in 2014 were either not effective or were done too late. For example, scientists know now that the flu virus is spread through droplets sprayed into the air when an infected person coughs or sneezes. So, covering a cough or a sneeze helps prevent the spread of the flu. Health officials didn't know this simple fact in 1918, and that is why the Spanish flu spread so easily at first. Ebola viruses spread through contact with an infected person's faces or body fluids. Healthcare workers have learned to handle patients' clothes and bedding with care to help contain the spread of viruses.

Viral outbreaks most likely will always exist. But vaccines have been incredibly effective at reducing the outbreaks of many viruses across the world.
**Virus Graphing Practice**

The temperature of an organism may have an effect on the number of viruses inside the cells of that organism. A university did an experiment that compared two different viruses and how temperature affected the number of viruses inside cells. Look at the data below. You will make a line graph. The temperature of the organism should be the X-axis and the number of virus per cell is the Y-axis. You will make two lines—one line for virus A and a second line for virus B. It is helpful to make the lines different colors and to include a key.

**If you have access to your drive, you can get this assignment on google classroom. You can make a line graph using the tools in google sheets.**

<table>
<thead>
<tr>
<th>Temperature of the organism in °C</th>
<th>Number of virus A per cell</th>
<th>Number of virus B per cell</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>60</td>
<td>77</td>
</tr>
<tr>
<td>35</td>
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<td>36</td>
<td>128</td>
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<td>2</td>
</tr>
<tr>
<td>46</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
All in the Family

In “Colorless Creatures” (pp. 10-13), you read about albinism in animals. An albino animal has inherited two copies of the gene for albinism, one gene from each parent.

The following diagrams show how genes for albinism can be passed from parents to their offspring. Use the diagrams to answer the questions. You can refer to the “Passing Down Albinism” sidebar on page 13 of the magazine for another example.

![Diagram of gene inheritance]

**KEY**  ○ gene for albinism  ○ gene for brown coloring

**Family A**

Two kangaroo parents have typical brown coloring. Both parents have one gene for typical coloring and one for albinism. This diagram shows the coloring that the offspring could inherit from their parents.

Compare and contrast the coloring of the kangaroo parents with the coloring of their offspring.

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All in the Family (cont’d.)

Family B

One kangaroo parent has typical coloring and the other parent has albinism. The parent with typical coloring has one gene for typical coloring and one for albinism. The parent with albinism has two genes for albinism. This diagram shows the coloring that the offspring could inherit from their parents.

Compare and contrast the coloring of the kangaroo parents with the coloring of their offspring.

Conclusions

1. Which set of kangaroo parents, those in Family A or Family B, are less likely to pass albinism to their offspring? Support your answer with evidence from the article and the diagrams.

2. Which family has offspring with coloring most like their parents? Support your answer with evidence from the diagram.
The Deepest Dives

In “journey to the Deep” (pp. 4-7), you read about how explorers visited the deepest trench in each of the world’s oceans. Trenches can form when one tectonic plate slides under another. The map below shows where the trenches explored by the Five Deeps Expedition are located, their depth in meters, and the plate boundaries. Analyze the map, then answer the questions.

Dive Sites of Five Deeps Expedition

1. Rank the trenches shown on the map from deepest to shallowest.

   ____________________________________________

2. According to the map, which trench is farthest north?

   ____________________________________________

3. What patterns do you observe in the map above? Look at the trenches and plate boundaries.

   ____________________________________________

4. Why do you think there are no trenches in the middle of tectonic plates? Use information from the article in your answer.

   ____________________________________________

5. Imagine you are an explorer on the Five Deeps Expedition. Based on the map, where might another trench be located? Draw an X on the map where you would like to go next. Why would you like to visit that site?

   ____________________________________________

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Women in STEM

In "Daring to Discover" (pp. 8-9), you learned about three women who worked in science, technology, engineering, and math (STEM) fields 100 years ago. Women's representation in STEM has changed over time. The graph below shows the percentages of STEM professionals in the U.S. who were women between 1960 and 2010. Study the graph, then answer the questions.

WOMEN WORKING IN SELECT STEM FIELDS (1960–2010)

1. About what percentage of people working in biology were women in 1960? In 2010?

2. Which STEM field has shown the greatest increase in the percentage of women from 1960 to 2010?

3. Which field had the largest representation of women in 1990? How has the representation of women changed in that field since 1990?


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In “Speaking Out for Earth” (pp. 10-13), you learned that greenhouse gas emissions are causing Earth’s average global temperature to increase. The circle graph below shows sources of greenhouse gas emissions in the United States. Analyze the graph, then answer the questions.

1. What are the top two sources of greenhouse gas emissions in the United States?

2. What percentage of greenhouse gas emissions comes from sources other than industry in the United States?

3. Transportation produces ____ more of the total greenhouse gas emissions than agriculture.
   A 9%  B 12%  C 20%  D 38%

4. Explain how individual changes can help decrease greenhouse gas emissions. Refer to the article and circle graph for evidence.

<table>
<thead>
<tr>
<th>Source</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
<td>Cars, trucks, ships, trains, and planes</td>
</tr>
<tr>
<td>Electricity</td>
<td>Power plants generating electricity</td>
</tr>
<tr>
<td>Industry</td>
<td>Factories making goods</td>
</tr>
<tr>
<td>Commercial &amp; Residential</td>
<td>Businesses and homes</td>
</tr>
<tr>
<td>Agriculture</td>
<td>Crops and livestock animals</td>
</tr>
</tbody>
</table>

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Rhino Ranges

In “Comeback Creatures” (pp. 4-7), you read that southern white rhino populations declined due to poaching but have started to come back. This map shows the range of white rhinos, or the places where they were found, in the 1500s; the portion of that original range where they still live today; and the places where conservationists have reintroduced them. Study the map, then answer the questions.

1. List three countries that were part of the range of white rhinos in the 1500s.

2. According to the map, white rhinos have been reintroduced, or brought back to, _____ locations in Africa.
   A 1  B 2  C 8  D 11

3. Which claim is best supported by the map?
   A White rhinos are endangered due to poaching.
   B White rhinos used to live in Zimbabwe.
   C White rhinos used to live in Kenya.
   D White rhinos could be found in at least eight countries in 2013.

4. Why do you think some reintroduced white rhinos are outside the past range? Use the article and map to support your answer.

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Speeding in Space

The solar system is composed of many things. It includes our star, the Sun, the planets and their moons, comets, and asteroids. All of these objects are in motion. Let’s see how fast one type of object—the planets—move.

First, let’s examine our planet, Earth. You know that Earth orbits around the Sun. Its revolution, or the time it takes Earth to travel around the Sun, is just over 365 days, or one year. But do you know how fast Earth moves? Earth moves at a speed of 107,206 kilometers (66,615 miles) per hour. To put this into perspective, think about a car traveling 97 kilometers (60 miles) per hour. Earth is moving around the Sun more than 1,100 times faster than that car!

Now, let’s examine the three other inner planets. Mercury is the planet closest to the Sun, and Venus is just behind it. Mercury is the fastest-moving planet in our solar system. It travels around the Sun at a speed almost twice as fast as Earth—172,332 kilometers (107,082 miles) per hour. Because Mercury’s orbital path is smaller than Earth’s, at this speed, Mercury makes a trip around the Sun every 88 Earth days. Venus moves at a speed between that of Mercury and Earth at 126,071 kilometers (78,337 miles) per hour. In the time it takes Earth to complete one revolution, Venus has already completed one revolution and started a second! Mars is the inner planet farthest from the Sun. It takes almost two Earth years for Mars to complete one trip around its orbital path, even though it travels at 86,676 kilometers (53,858 miles) per hour.

Jupiter, Saturn, Uranus, and Neptune are the outer planets. They are the planets in our solar system that are the farthest from the Sun. Jupiter travels at a speed of 47,051 kilometers (29,236 miles) per hour—at half the speed of Earth. It takes Jupiter almost 12 Earth years to make one trip around the Sun. Saturn is next, and it travels at a speed of 34,883 kilometers (21,675 miles) per hour, while Uranus moves at 24,515 kilometers (15,233 miles) per hour. That translates to about 29.5 Earth years for Saturn and 84 Earth years for Uranus to orbit the Sun. If you live to be 84 years old, Uranus will just be completing the revolution around the Sun it started when you were born. The slowest planet in our solar system is Neptune. This planet travels at a mere 19,547 kilometers (12,146 miles) per hour. At this pace, it takes Neptune almost 165 Earth-years to travel around the Sun.

Questions:
1. Describe the pattern of the speed of a planet’s revolution as you get farther from the Sun.

2. Jaime says that Mercury travels at a speed that is five times faster than Neptune. Do you agree? Why?

3. What are two factors that cause the length of a planet’s year to get longer the farther it is from the Sun?
The Life of a Snowman

It's early on a cold winter day. You look out and see a deep, fresh snow. You turn on the radio and hear the magic words: No school! What to do? You decide to build a snowman. Dressed in your warmest clothes, you firmly pack the snow into three different-sized spheres. Carefully, you stack three spheres into the shape of a snowman—the largest sphere on the bottom and the smallest one on the top. You add a carrot nose, buttons for the eyes and the mouth, and a long red scarf. You take a step back to view your work. It looks great! Now it's time for some hot chocolate.

Weeks later, the ground is bare and your snowman is gone. The snowman didn't disappear. It has a short life that is affected by the temperature of the air. Snowmen are built out of snow, which is water in its solid state. As the temperature starts to rise, the water particles that make up the snow gain energy and vibrate more and more quickly.

When the particles in the snow reach 0°C (32°F), they have reached the melting point of water. The particles now move more freely than they did when they were solid snow, and the snowman starts to melt. Eventually, the snowman will become a puddle of liquid water. The particles in liquid water slide past each other easily and are less attracted than the particles in snow.

As the temperature continues to rise above the melting point of water, the particles of the liquid water move faster and faster. Particles at the surface of the puddle begin to move so quickly that they escape into the air as gas. This process is called evaporation. The gas that forms is called water vapor. Over time, all the water particles in the puddle will move fast enough to escape into the air as a gas.

As the air temperature drops, water vapor particles lose energy and begin to move more slowly. Eventually they will cool and slow down enough to condense, or change from a gas into a liquid. These liquid particles form clouds and then fall back to the ground as rain. If the air is cold enough, the liquid water freezes and snow will fall. If enough snow falls, you can build another snowman and start the process over again!

Questions:
1. Illustrate the life of a snowman. Label each stage and provide a description.

2. What happens to the attraction of particles when a solid melts into a liquid and then evaporates into gas?
Competition in the Animal Kingdom

Animals compete for many reasons, including dominance, survival, space, and—you guessed it—food. All consumers get their energy by eating other organisms. For example, herbivores eat plants and carnivores eat meat. But sometimes several organisms in an ecosystem need the same food to survive. What happens then?

Animals that rely on the same food source to survive are often in competition. Often, several animals that consume the same food can live together in an ecosystem with no problem. Take the birds of the rain forest, for instance. Over 25 percent of the world’s birds live in these hot, wet ecosystems. Many of these birds compete for the same seeds and fruits. But each type of bird in the rain forest has adaptations that help them compete in their environment.

Toucans, for example, are known for their colorful feathers and long, multi-colored beaks. But these beaks are for more than just show—they are useful feeding tools. Adult toucans weigh about half a kilogram (a little more than a pound). This makes them too heavy to sit on small branches to feed. Instead, they sit on larger branches and use their 20-centimeter (7.5-inch) bill to reach the fruit.

Parrots also flourish in rain forest environments. Like toucans, parrots are known for their bright colors, and they have larger beaks than most birds. Certain trees in the rain forest produce fruits and seeds with tough outer coverings. While this might keep many birds from eating these tasty treats, it doesn’t stop the toucan or the parrot! These birds use their strong beaks to crack open the food. And parrots, unlike heavier toucans, can perch on lighter branches to access food that toucans can’t get to.

A macaw is a large parrot that has an unusual advantage over other birds in the competition for food. Macaws can eat fruits that are toxic to other birds. Some scientists think it is the clay these birds eat that counteracts the deadly side effects of the toxic fruits they consume.

As you can see, many birds can live in the same habitat and compete for the same food. This does not necessarily mean one species won’t survive. Many species can survive despite similar needs because each species has adaptations that allow it to get food in different ways.

Questions:
1. Max tells his teacher that since sharks and orcas both eat seals, they are in competition for food. Do you agree or disagree with his statement? Explain why.

2. How does a bird’s beak relate to the type of food it eats?

3. Do you think macaws have competition for fruit?
Land of the Midnight Sun

Have you ever heard of the midnight Sun? If you live near the Arctic Circle, it's an annual occurrence. The Arctic Circle is an imaginary line that circles the globe at about 66° N latitude and defines the Arctic region. Within the arctic are parts of Greenland, Canada, Russia, Norway, and the United States. Once a year, on the summer solstice, the Sun does not set, even at midnight—thus the name, midnight Sun. This happens each year on or around June 21.

Much of Alaska lies within the Arctic Circle. Barrow is the northernmost town in Alaska. In Barrow, from about May 10 until August 2, the Sun doesn't set. But winter is a different story for the people of Barrow. From November 18 to January 24, the Sun doesn't rise. Could you imagine going to school and coming home when it is dark? What about sleeping when the Sun is still shining? Places south of Barrow also experience extremely long summer days and extremely short winter ones. Take Anchorage, Alaska, for example. On July 1, the Sun rises at 4:28 in the morning. It doesn't set until 11:35 at night. That's 19 hours of daylight! In contrast, on January 1, the Sun rises at 10:10 the morning and sets at 3:54 p.m. That's less than six hours of daylight.

Why such differences in the number of daylight hours? It has to do with Alaska's location on Earth and Earth's tilt as it revolves around the Sun. Earth is tilted on its axis at approximately 23°. On the day of the summer solstice, the area inside the Arctic Circle is pointed most directly at the Sun. Everywhere inside the circle experiences 24 hours of sunlight. As summer changes to fall, Earth moves farther along in its orbit. The Arctic Circle points less and less directly at the Sun.

The hours of daylight decrease. Finally, on the winter solstice, the Sun no longer shines directly on the Arctic Circle. On this day, the Sun doesn't rise above the horizon anywhere above the Arctic Circle.

Questions:
1. Why doesn't a state such as Wyoming experience the midnight Sun?
2. How do Earth's revolution and the tilt of its axis affect how sunlight falls on the planet?
3. Does everyone on Earth see the Sun appear to move across the sky in the same way? Explain.
Crime Scene Forensics

When you imagine a crime scene, what do you think of? Yellow crime scene tape? K-9 dogs sniffing around for clues? A lot of what goes on during a crime scene investigation happens in a laboratory.

Forensics is a type of science used at crime scenes. Investigators look for clues to try to solve a mystery. These clues are called evidence. The materials found at a crime scene are referred to as physical evidence. Physical evidence can be odors, hairs, clothing fibers, and even fingerprints. Forensic scientists study evidence to help them solve a case. It is important to take notes and pictures of the crime scene for scientists to refer to later; they may be able to spot new physical evidence in the photos using the information they uncover in the lab.

Forensic scientists analyze the physical properties of evidence to help reveal clues about how the item was used. Scientists find out where the item was made, what it is made of, or even if it sinks or floats.

For example, investigators may have found soil that could have been tracked in on the shoes of the person who committed the crime. Forensic scientists will carefully analyze the soil sample in the lab. They look at the soil’s texture: Is it sticky or sandy? What color is it? Does it have large or small particles? And most importantly, is it like the soil near the crime scene? After analysis, forensic scientists might conclude that the soil is made of a sticky red clay that is not from the area where the crime occurred. This indicates the person who committed the crime came from a different area. The sticky red clay is compared to other soil in the area and matched to a specific location.

With further analysis, scientists can use the location from where the soil came to help identify the person who committed the crime and link them to that location.

Investigators at crime scenes often “dust for prints.” They take pictures of the fingerprints they find and compare them with those in a database. If they find fingerprints in the database that have the same shapes as those from the crime scene, they can use these prints as evidence as to prove who committed the crime.

Forensic scientists look at a variety of physical properties, including temperature, hardness, magnetism, and viscosity to help them analyze evidence. The more evidence a scientist can analyze, the better chance they have at solving the crime scene mystery.

Questions:
1. Why is it helpful for forensic scientists to take pictures of the crime scene?
2. How can you analyze hair as evidence?
3. How might a forensic scientist use temperature evidence in an investigation?
The Recyclers of the Natural World

Decomposers have a pretty gross job. As the last link on a food chain or food web, decomposers break down dead, organic matter. This matter includes dead animals, decaying roots, dead leaves, and wastes such as feces. As decomposers “eat” organic matter, they break down the materials into nitrogen, carbon dioxide, and other nutrients and return them to the soil, air, and water. These nutrients are then used by plants and animals.

There are two main groups of decomposers—bacteria and fungi. Bacteria are found everywhere, even inside your body and on your skin! Bacteria live in soil, in water, and in the air. They can even live in boiling water, frozen ground, volcanoes, and the bottom of the ocean. Most bacteria found in soil are decomposers. A spoonful of soil can contain up to a billion bacteria! Rich compost can have ten times that number.

Fungi are found mostly in moist, dark places. Many fungi grow in forests. You may have seen fungi growing on fallen logs or among dead leaves on the forest floor. The fungi give off chemicals that break down the dead matter. The fungi use some of the released nutrients for their own growth. The rest of the nutrients are released to the environment so that other organisms can use them.

Other organisms help break down organic matter, but they don’t do as complete a job as the decomposers. Scavengers are animals that find dead plants and animals to consume. Slugs are not picky eaters. They eat anything that is digestible. This includes everything from fungi to dead plants. They will even eat cardboard! Worms consume organic material as they move through the soil. What they do not use for their life processes is excreted as a cast. Bacteria then break down the casts into even smaller molecules. Turkey vultures are scavengers that consume dead animals. They use their sense of smell to locate their next meal from high in the sky. They then land and rip the meat off the dead carcass. In fact, the word “vulture” comes from a Latin word that means to pluck or tear.

Decomposers are part of every ecosystem. They do the dirty work of keeping the environment clean and recycling materials for other organisms to use.

Questions:
1. What would happen if all the decomposers were suddenly to die off?

2. Why might a gardener add earthworms to a compost pile?

3. Scavengers eat dead organisms, but they are not decomposers. What happens to the bodies of scavengers after they die?
Every Member Counts

Savannas are a type of grassland. They contain plants like acacia trees and grasses, which are considered producers. Producers make food using energy from the Sun through the process of photosynthesis. All the animals in the food web depend on producers to survive.

Many types of animals live in the savanna, and they often compete for resources such as water, food, and shelter. For example, zebras and gazelles both eat grasses. These animals are considered primary consumers because they eat producers. A consumer is any organism that cannot make its own food.

gazelles. But there may not be enough gazelles to support the cheetah population. Many cheetahs will likely die. Fewer zebras also means less food for hyenas and lions to eat. Some of them may die, too.

As you can see, all the organisms in a food web are interdependent. If the numbers of one type of organism are reduced, many other organisms in the web are affected. Removing just one factor from a food web throws off the entire ecosystem.

Questions:
1. Draw a food web of the savanna.
2. If you didn’t include the Sun in your food web, where would you place it?
3. Imagine a food web that consists of butterflies, birds, and foxes. What would happen to the other members of the food web if the birds became diseased and died?

Credit: Ehrman Photographic/Shutterstock.com
California's Water Shortage

Did you know that Earth is sometimes called the water planet? Water doesn't stay in just one place, though. The water cycle is the constant movement of water among the land, ocean, and atmosphere. The key processes in the water cycle are evaporation, condensation, and precipitation. The ocean is the greatest source of water for evaporation. When ocean water evaporates, the salts in the water are left behind. As water vapor in the air cools, it condenses into liquid water. The water drops grow and form clouds. When the drops become large enough, they fall as precipitation, and the cycle continues.

Although water is continually cycling, not all areas of the planet receive the same amount of precipitation. Parts of California sometimes are at risk of experiencing water shortages. For some communities, that means mandatory water restrictions. These restrictions limit the consumption of water to certain days, times, and uses.

What causes water shortages? Like much of the western U.S., California greatly depends on melting snow to resupply rivers, lakes, and streams. Recently, winter storms have not dropped the usual amount of snow. Record temperatures have increased evaporation. The combination of these factors leaves the land parched. With surface resources low, some areas, especially those that are heavily farmed, have drilled for groundwater. This water is used for growing crops or watering livestock. Groundwater resources take many years to recharge. The shortage of water could have negative impacts on the agriculture industry.

Scientists and engineers are looking at ways to help California and other places on Earth that experience droughts. Some of the technology they are investigating includes turning salt water into freshwater, harvesting water with fog catchers, and recycling wastewater.

Questions:

1. You drop your water bottle on the sidewalk. Describe how the water cycle will change the spilled water.

2. Northern California has many forests. How might droughts affect these environments?

3. California produces almost half of all the fruits, nuts, and vegetables grown in the United States. How might a long-term drought in California affect all parts of the country?
The Amazing Potato

Potatoes make up one-third of the total amount of vegetables that Americans consume. In fact, it is estimated that the average American eats an average of 53 kilograms (117 pounds) of potatoes every year! That's a lot of potatoes!

Vegetables are plant parts, but not the parts that contain seeds people eat for food. These parts include stems, such as celery stalks; roots, such as carrots; and leaves, such as lettuce. Potatoes grow underground, so you may think they are roots. But potatoes are tubers, enlarged stems that contain starch. Like most plants, potatoes produce flowers that make fruits. The fruits of a potato plant look a lot like cherry tomatoes. But don’t eat them! Except for the tubers, all parts of a potato plant are poisonous.

The Inca of Peru were the first people to grow potatoes as a crop between 7,000 and 10,000 years ago. Potatoes are now grown in cool climates or during cool seasons all over the world. Unlike many vegetable crops, potatoes are easy to grow and can grow in poor soil.

Potatoes need sunlight, water, air, and soil to grow and thrive. Just like other plants, potatoes absorb energy from the Sun though their leaves. Potatoes use this energy in the process of photosynthesis to produce a type of sugar called starch. The starch found in potatoes is a great source of carbohydrates. The human body uses carbohydrates for energy. In addition, a medium potato (about 155 grams, or 5.5 ounces) provides 45 percent of the vitamin C, 18 percent of the potassium, and 10 percent of the vitamin B6 that you need every day. Before they are processed or anything is added to them, potatoes are fat-free, cholesterol-free, and low in sodium (salt). In the United States, about two-thirds of the potatoes consumed are in the form of French fries or potato chips.

So, what makes the potato so popular? Some say it’s the ease of production. Others think it’s the variety of ways you can consume them. What do you think?

Questions
1. Potatoes were a popular food in Europe in the 1600s and 1700s. What characteristics of potatoes made them a good crop for these northern areas?

2. Janelle states that when she eats a potato, she is getting energy from the Sun. Tell whether you think this statement is true or false, and why.

3. What habitat would be best for growing potatoes? Why?
The Great Popcorn Debate

If you've ever been to a movie theater, you've probably heard or smelled popcorn as it was being made. Many people argue about whether popping corn is a physical change or chemical change. Let's explore a little bit about physical and chemical changes, and then you can decide!

In physical changes, matter remains constant. This means that no new types of matter are formed. However, matter can change state during physical changes. Consider a stick of butter. The butter starts as a solid. As the temperature rises, the butter melts into a liquid. Even though the butter changed state, its matter remained constant. Putting liquid butter in the refrigerator will cause it to become solid again.

In contrast, chemical changes result in the formation of a new substance. Think of a log that is tossed into a campfire. The beginning product is a hard piece of solid wood. After it is burned, the product is a pile of ashes. While the log is in the fire, the substances that make up the log are burned and gases are released. The gases and ashes can't be put back together to make another piece of wood; new matter has formed.

Popcorn starts out as a kernel with a hard shell. There is a tiny bit of water hiding inside each kernel. As the kernels are heated, this water is also heated. As it heats, the water particles move faster and farther and farther apart, and they force the kernel to expand. This increases the pressure inside the kernel, and the water is heated even more. This changes the inside of the kernel into a gel-like material. Eventually, the kernel has so much heat and pressure inside that it ruptures, or explodes. The water that was inside the kernel boils away and evaporates. The gel-like material solidifies into a fluffy puff of popcorn. Sometimes popcorn can be as much as 40 to 50 times the size of the original kernel.

So, is popping popcorn a physical or chemical change? Look at the evidence. Use the following questions to help you decide:

- Did matter change state?
- Was a new type of matter produced?
- Can heat be applied during physical changes? Chemical changes? Both?

Make a claim about whether popping popcorn is a physical or chemical change. Support your idea with evidence and reasoning.

| Claim (a statement or conclusion that answers the question you are testing) |
| Evidence (data that supports your claim) | Reasoning (a justification explaining why your evidence supports your claim using scientific principles) |

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1. Which of these statements can be inferred from information in the graph?

A. Both the human population and miles traveled have increased since 1970.
B. Air pollution has increased and miles traveled has decreased since 1970.
C. Both air pollution and miles traveled have decreased since 1970.
D. Both the human population and energy consumption have decreased since 1970.

2. What is the difference between oxygen gas and ozone gas?

A. Oxygen gas is not necessary for animals to exist, ozone is important to breathing.
B. There is no difference between oxygen gas and ozone; they are the same thing.
C. Oxygen gas contains two atoms of oxygen, ozone contains three atoms. Ozone gas is found in small amounts in the atmosphere.
D. Ozone gas is found only in the upper atmosphere; oxygen gas is found very close to Earth's surface.

3. How does this figure show the greenhouse effect of Earth's atmosphere?
7. What are cold winds that blow from the east to the west near the North Pole and the South Pole called?
   A. westerlies
   B. polar easterlies
   C. jet stream
   D. trade winds

8. Which types of radiation are considered to be in the near-visible light spectrum?
   A. infrared and purple light
   B. ultraviolet and black light
   C. infrared and ultraviolet
   D. red, blue and yellow light

9. What is wind that blows from the land to the sea due to local temperature and pressure differences called?
   A. land breeze
   B. sea breeze
   C. global wind
   D. trade wind

10. What makes mountain tops good places to place electricity generating wind turbines?
    A. cold air rising
    B. the presence of mountain waves
    C. trade winds
    D. northeastern flow of air over the mountains

**STOP** This is the end of the test. When you have completed all the questions and reviewed your answers, press the button below to grade the test.

Grade the Test
1. What produces the type of energy shown here?

A. ○ high levels of moisture in the air
B. ○ uneven heating of the atmosphere by the sun
C. ○ UV rays that penetrate the atmosphere
D. ○ sunlight directly hitting the structures shown

2. Which best describes a natural resource?

A. ○ something in the environment that can be transformed into something else
B. ○ something in the environment that humans have worked to conserve
C. ○ something in the environment that is useful or necessary for the survival of living things
D. ○ something in the environment that humans have an impact on

3. Which is a nonrenewable resource?

A. ○ water
B. ○ uranium
C. ○ soil
D. ○ corn

4. What scientific observation indicates that global warming is occurring?
8. Why are compact fluorescent lightbulbs (CFLs) better than incandescent bulbs?
   A. CFLs use half the energy of incandescent bulbs and last just as long.
   B. CFLs use one tenth the energy of incandescent bulbs and last just as long.
   C. CFLs use one fourth the energy and last ten times as long.
   D. CFLs use the same amount of energy but last ten times as long.

9. What part of a molecule of CFC breaks down ozone in the atmosphere?

   A. the carbon atom
   B. the chlorine atoms
   C. the fluorine atom
   D. the intact CFC molecule

10. Which two substances will fuel-cell vehicles use for power?
    A. ethanol and oxygen
    B. ethanol and gasoline
    C. electricity and gasoline
    D. hydrogen and oxygen

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Grade the Test