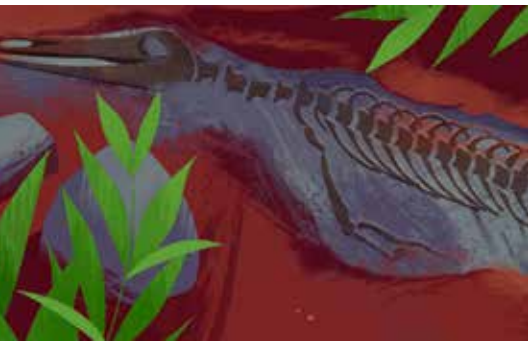
AmplifyScience



Louisiana Companion

Student Booklet: Grade 8

These materials are based upon work partially supported by the National Science Foundation under grant numbers DRL-1119584, DRL-1417939, ESI-0242733, ESI-0628272, and ESI-0822119. The Federal Government has certain rights in this material. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

These materials are based upon work partially supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R305A130610 to The Regents of the University of California. The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education.

Developed by the Learning Design Group at the University of California, Berkeley's Lawrence Hall of Science.

Amplify.
55 Washington Street, Suite 800
Brooklyn, NY 11201
1-800-823-1969
www.amplify.com

Louisiana Companion Student Booklet: Grade 8
ISBN: 978-1-64333-331-1

Table of Contents

Student Booklet Pages

Safety Guidelines for Science Investigations

1. **Follow instructions.** Listen carefully to your teacher's instructions. Ask questions if you don't know what to do.

2. **Don't taste things.** No tasting anything or putting it near your mouth unless your teacher says it is safe to do so.

3. **Smell substances like a chemist.** When you smell a substance, don't put your nose near it. Instead, gently move the air from above the substance to your nose. This is how chemists smell substances.

4. **Protect your eyes.** Wear safety goggles if something wet could splash into your eyes, if powder or dust might get in your eyes, or if something sharp could fly into your eyes.

5. **Protect your hands.** Wear gloves if you are working with materials or chemicals that could irritate your skin.

6. **Keep your hands away from your face.** Do not touch your face, mouth, ears, eyes, or nose while working with chemicals, plants, or animals.

7. **Tell your teacher if you have allergies.** This will keep you safe and comfortable during science class.

8. **Be calm and careful.** Move carefully and slowly around the classroom. Save your outdoor behavior for recess.

9. **Report all spills, accidents, and injuries to your teacher.** Tell your teacher if something spills, if there is an accident, or if someone gets injured.

10. **Avoid anything that could cause a burn.** Allow your teacher to work with hot water or hot equipment.

11. **Wash your hands after class.** Make sure to wash your hands thoroughly with soap and water after handling plants, animals, or science materials.

Using Rock as a Clock: Dating the Dinosaur Extinction

For hundreds of years, people have found dinosaur fossils embedded in rock, all across the world. As more and more dinosaur bones were found, scientists began to study them. Scientists were amazed by the size of many dinosaurs and the variety of different organisms they found. However, they were also left with many questions: *Why aren't the dinosaurs still living now? What caused these organisms that once lived all over Earth to go extinct?*

Our current explanation for what happened to the dinosaurs was developed by many scientists, using information from many different sources. Some of the most important clues came from an unexpected place. Scientists discovered that the atoms that make up some rock can help them figure out how old that rock is. Using this process, which is called radioactive dating, along with knowledge about how different geologic events (such as volcanic eruptions and changes to Earth's climate) affect rock layers, scientists have been able to create a "geologic clock" of Earth's history that shows when different important events happened. One of those important events was the extinction of the dinosaurs. Scientists figured out that most species of dinosaurs, as well as many other organisms—more than 70% of life on Earth—went extinct around 66 million years ago. Something huge happened to cause this mass extinction, but what?

In the late 1970s, scientists discovered a strange geologic feature in Mexico. It was later found to be a massive crater, likely caused by a huge asteroid hitting Earth. The crater, which is estimated to be up to 180 kilometers (112 miles) wide, was named Chicxulub (CHICKS-oo-loob) after a nearby town. Scientists estimate that

An artist created this image of an asteroid hitting Earth to form the Chicxulub crater.

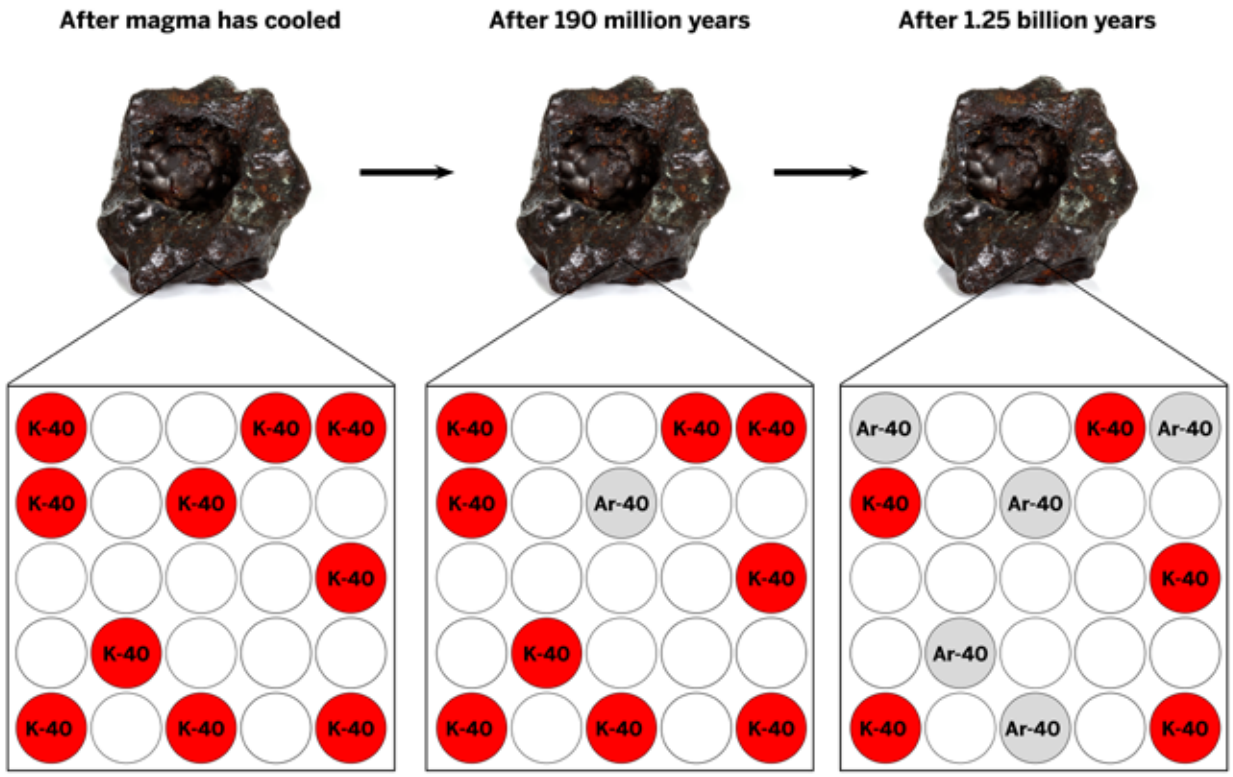
the object that hit Earth to create the Chicxulub crater was 15 kilometers (10 miles) across, making it bigger than Mount Everest! When scientists found evidence of such a large object hitting Earth, they wondered if they could find evidence that it might have caused the dinosaur extinction. First, they needed to figure out when the object hit. That's where radioactive dating comes in.

Clues in Rock

Like all matter on Earth, rock is made of atoms. There are many different types of atoms—for example, carbon, oxygen, and potassium are all atoms. However, not all atoms of a given type are the same. There are actually different versions of each type of atom. These different versions of atoms are called isotopes. Scientists label different isotopes with numbers. For example, carbon-12 or carbon-14 are two different isotopes of carbon. (Scientists usually abbreviate these as C-12 and C-14.)

Some isotopes are radioactive. The radioactive versions of an atom are unstable—they easily break down and change. Radioactive atoms can also do something unique. When they break down, they can change into other types of atoms. Geologists use the special properties of radioactive atoms to do radioactive dating, which is how they are able to find the age of rock that formed long ago.

Potassium-40 (K-40), a radioactive isotope found in most rock, is often used by geologists to do radioactive dating. Over time, the K-40 atoms break down and change into argon-40 atoms (Ar-40). Since the breakdown of K-40 into Ar-40 happens at a particular rate, if scientists look at the amount of K-40 compared with Ar-40 in a sample, they can estimate the age of the rock that the sample was taken from. Scientists can only do radioactive dating on one type of rock—rock that has formed from melting and cooling. This is because rock formed from



This diagram shows how much Ar-40 there is in a rock sample as the K-40 breaks down and changes over millions of years.

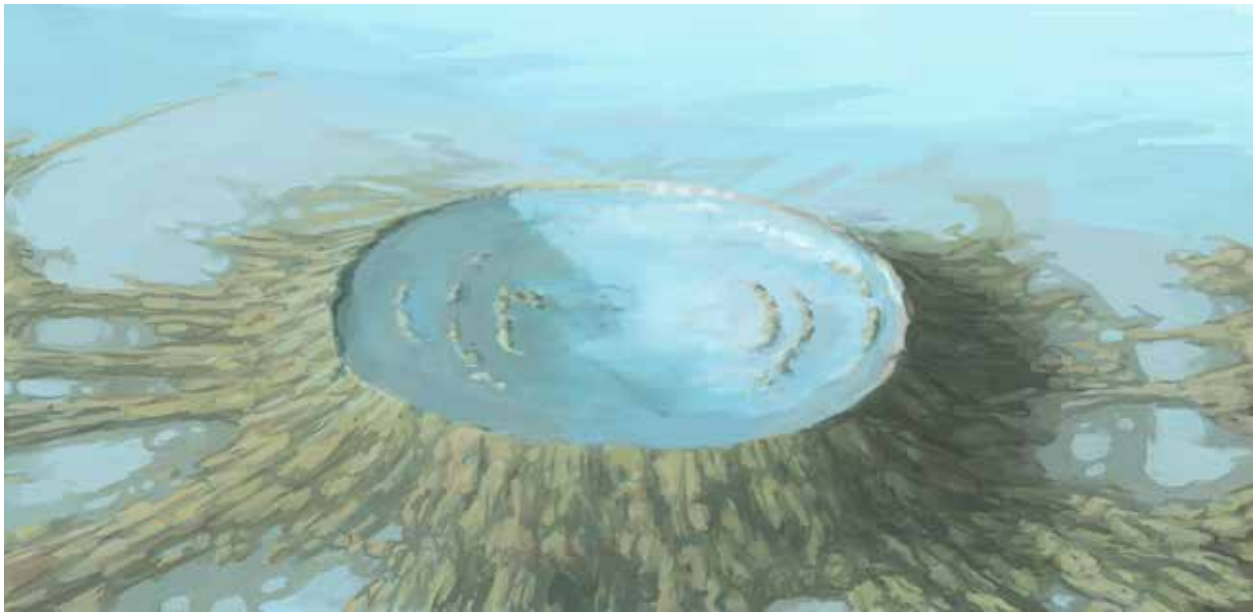
material that has melted and then cooled does not have Ar-40 atoms when it first hardens. When scientists find Ar-40 atoms in a sample of rock, they know that this Ar-40 came from K-40 atoms. The more Ar-40 there is in the sample, the more time has passed since that melted rock cooled.

Dating the Chicxulub Crater

When the asteroid hit Earth, the energy from the impact was so great that it caused some of the rock material at the surface to melt. This melted rock then cooled and hardened. Geologists were able to use radioactive dating to find out the age of the rock. They dated the rock by comparing the amount of K-40 atoms present with the amount of Ar-40 atoms and found that it was approximately 66 million years old—it formed around the same time the dinosaurs went extinct.

These results support the idea that the impact that created the Chicxulub crater played a role in the extinction of the dinosaurs, which also happened around 66 million years ago. Many scientists began to collect evidence to understand more about the way the extinction happened. The impact that created the crater would have killed many organisms immediately, but this only explains the death of organisms in the area of the impact. The mass extinction happened all over Earth. Scientists have also found evidence that the impact caused many other effects that changed conditions all over Earth, including a megatsunami and massive wildfires. In addition, radioactive dating of rock samples from ancient volcanoes confirms that many volcanic eruptions occurred around the same time the crater was formed and may have been caused by the impact. The impact, along with the fires and volcanoes, caused so much dust and gas to fly into the atmosphere that the sun was blocked out. Without sunlight, many plants and animals, including most dinosaurs, died out.

Radioactive dating has been a useful tool to help us better understand what was happening so many millions of years ago, but many questions still remain. As scientists continue working to explain the events that led to dinosaur extinction, they will need to use clues from radioactive dating as well as information about fossils, climate, and more.



An artist's drawing of what the Chicxulub crater might look like. Most of the crater is underwater.

Name: _____ Date: _____

Reading "Using Rock as a Clock: Dating the Dinosaur Extinction"

1. Read and annotate the "Using Rock as a Clock: Dating the Dinosaur Extinction" article.
2. Choose and mark annotations to discuss with your partner. Once you have discussed these annotations, mark them as discussed.
3. Now, choose and mark a question or connection, either one you already discussed or a different one that you would like to discuss with the class.
4. Answer the reflection question below.

   Rate how successful you were at using Active Reading skills by responding to the following statement:

   As I read, I paid attention to my own understanding and recorded my thoughts and questions.

   - ☐ Never
   - ☐ Almost never
   - ☐ Sometimes
   - ☐ Frequently/often
   - ☐ All the time

Active Reading Guidelines

1. Think carefully about what you read. Pay attention to your own understanding.
2. As you read, annotate the text to make a record of your thinking. Highlight challenging words and add notes to record questions and make connections to your own experience.
3. Examine all visual representations carefully. Consider how they go together with the text.
4. After you read, discuss what you have read with others to help you better understand the text.

Name: _____ Date: _____

Rereading "Using Rock as a Clock: Dating the Dinosaur Extinction"

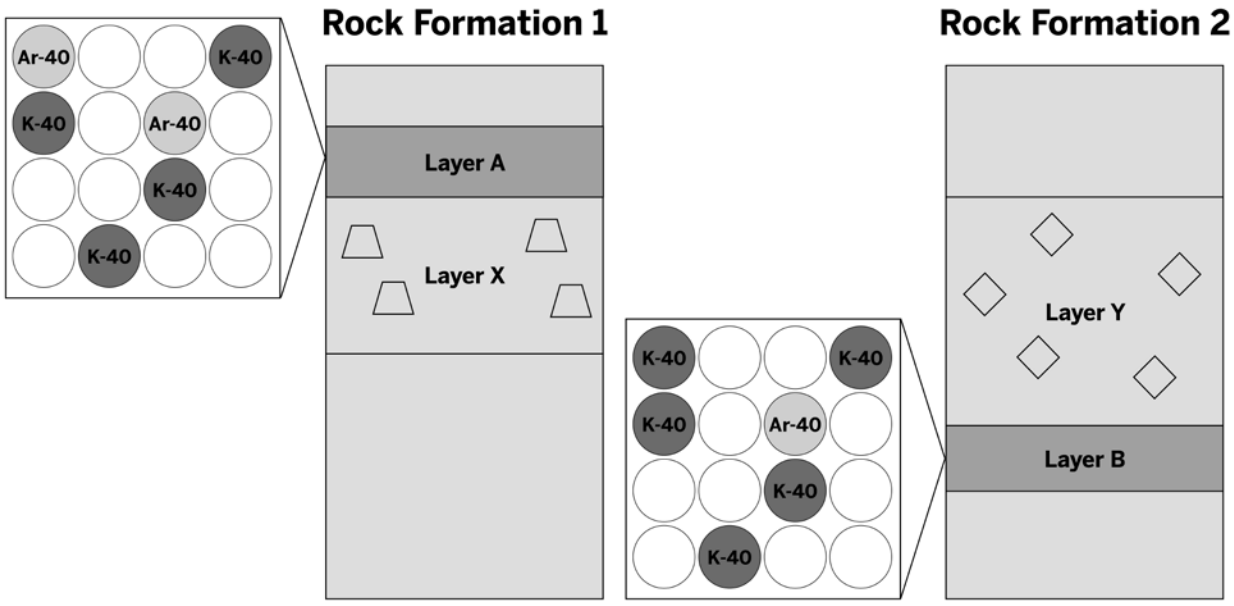
Part 1

Reread the "Clues in Rocks" section of the article "Using Rock as a Clock: Dating the Dinosaur Extinction." As you read, you may want to highlight or annotate parts of the text that will help you answer the question *How do scientists use radioactive dating to figure out how old a rock is?* After you read, you will examine the diagram and answer the question below.

Part 2

This diagram shows two different rock formations. Each rock formation contains a layer of rock (Layer A and Layer B) that formed when rock material melted and cooled. The diagram also shows a zoomed-in view of the atoms of each of these rock layers. Examine the diagram and then answer the question below.

Two Rock Formations



Which rock layer is older, Layer A or Layer B? Explain how you know.

_____

_____

_____

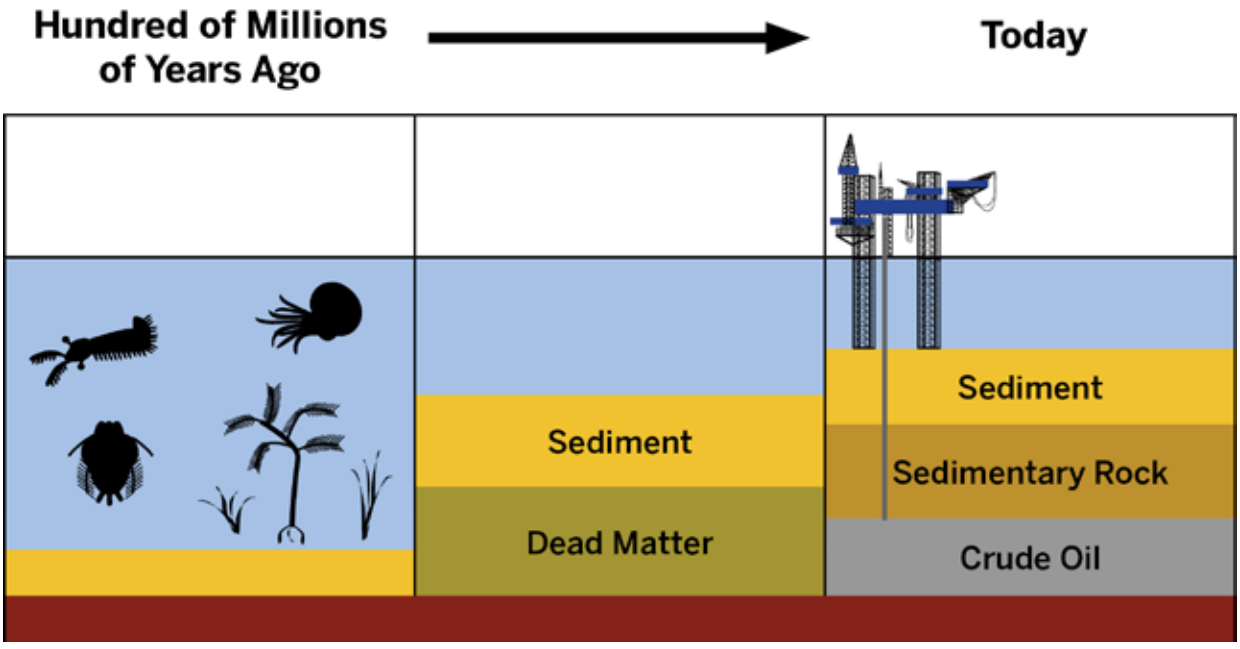
_____

From Living Things to Plastic: A Journey Through Rock

Four hundred million years ago, living things—mostly tiny plant-like organisms called algae, but also ocean plants and animals—floated near the surface of an ancient ocean. Now, the atoms that made up those living things could be part of the plastic water bottle you used at lunch. How did that happen? The story begins with the creation of oil, the material used to make plastic.

How Did Living Things Turn Into Oil?

When the ocean organisms died, they sank to the bottom of the ocean, forming a layer of dead matter. Over time, this dead matter was buried under sediment—mud or sand that washed into the ocean and settled to the ocean floor. Over millions of years, more and more layers of sediment formed. As the layer of dead organisms got buried under more and more sediment, the pressure and temperature increased. With high pressure, high temperatures, and the passage of millions of years, a layer of sediment can be compacted and cemented to form sedimentary rock. This same compaction process transformed the layer of dead matter as well, turning it into a thick, black liquid called crude oil.



Hundreds of millions of years ago, ocean organisms died and sank to the bottom of the ocean.

Over time, this dead matter was buried under sediment.

With high pressure, high temperature, and the passage of millions of years, the sediment was compacted and cemented to form sedimentary rock, and the dead matter turned into crude oil.

How Do People Get Crude Oil Out?

Crude oil is useful to people in many ways, but first it needs to be extracted from underground. Since the 1800s, humans have used drills to get down through layers of sedimentary rock and reach the pooled oil underground.

Crude oil comes from ocean organisms, but it can be found both under the ocean floor and under land, since over the millions of years it takes crude oil to form, the position of some parts of the ocean has changed. About 17% of the crude oil drilled for in the United States comes from under the ocean floor in the Gulf of Mexico. Some of this drilling happens in water 1,000 meters deep (over 3,000 feet deep) and reaches down more than 10,000 meters (about 35,000 feet) under the ocean floor.

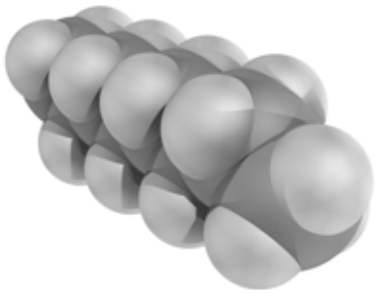
It takes powerful drills, complex machines, and many workers to bring up oil from that far underground and underwater. Things sometimes go wrong, which can cause harmful spills and accidents. Oil can spread to large areas of the ocean and beaches, killing many animals. Crude oil drilling platforms in the ocean also release pollution into the water, even during normal operations.

People use crude oil to make many things, including gasoline, jet fuel, heating oil, and more. It's also used to make plastic. There is a huge amount of crude oil below the Gulf of Mexico, but it is not unlimited. Crude oil is a nonrenewable resource, meaning that people use it much faster than it forms—after all, it takes millions of years for crude oil to form!

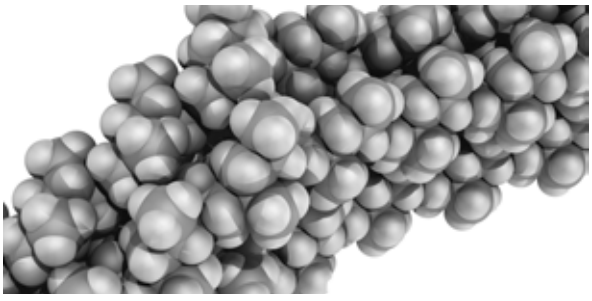
How Is Crude Oil Turned Into Plastics?

Crude oil and plastic have very different properties, so it might be surprising that one can be made from the other. Crude oil is a liquid at room temperature with a strong odor. Plastic is a solid at room temperature with a faint odor or none at all. Crude oil catches fire very easily, while plastic usually does not. Despite these differences, there is something the same about crude oil and plastic: they are both made of the same two types of atoms—carbon and hydrogen. (Everything is made of atoms, and there are about 100 different types of atoms.) However, if you could see their atoms, you would also notice that they are arranged in very different ways. Crude oil is made up of molecules that each have just a few atoms. Plastics are made up of long chains of atoms that form large molecules. There are different types of plastic, each with somewhat different arrangements of atoms in their molecules.

People transform crude oil into plastic by causing a chemical reaction to occur. In a chemical reaction, the atoms of the starting substance (in this case, crude oil) rearrange to form different molecules (in this case, the molecules that make up the plastic). The same atoms are there before and after the chemical reaction, but they are arranged and grouped differently.



Crude oil is a mixture of smaller-sized molecules, such as this octane molecule.



Plastics are made of long chains of atoms that form large molecules, such as this polypropylene molecule.

What Happens to Plastic?

The atoms that make up plastic were once in crude oil. Before that they were in dead matter on the ocean floor, and before that they were in living ocean organisms. What happens to the atoms once they are part of plastic? Do they cycle back to become part of different molecules again? Not easily or quickly.

One of the properties of plastic is that it is quite stable: the molecules do not break down easily. This can be helpful for making products that last, but it also causes problems. Plastic that is thrown away may break into smaller pieces, but its molecules continue to be plastic molecules. Over eight million tons of plastic end up in the ocean every year. Plastic can't be broken down or used by living things, but animals often eat it by mistake. Scientists have cut open dead birds and sea creatures and found their stomachs full of small and large pieces of plastic, which can kill an animal. Animals may also become tangled or trapped in plastic waste.

The synthetic materials we make from crude oil—such as plastic— don't quickly cycle back to form more crude oil. That's part of the reason why crude oil is a nonrenewable resource. Even

This seagull was found with a stomach full of plastic.

though there are huge amounts of crude oil on Earth, it may someday run out.

If you zoom in and look at plastic, you'll see that it's just a bunch of carbon and hydrogen atoms, just like the oil it came from and the dead plants and animals that oil came from. Through chemical reactions, the atoms have been rearranged into new substances with very different properties. It's hard to believe that all the plastic in the world was once living organisms, floating in the ocean hundreds of millions of years ago!

Plastic does not easily break down, so it can remain in the ocean for hundreds of years.

Name: _____ Date: _____

Reading "From Living Things to Plastic: A Journey Through Rock"

1. Read and annotate the "From Living Things to Plastic: A Journey Through Rock" article.
2. Choose and mark annotations to discuss with your partner. Once you have discussed these annotations, mark them as discussed.
3. Now, choose and mark a question or connection, either one you already discussed or a different one that you would like to discuss with the class.
4. Answer the reflection question below.

   Rate how successful you were at using Active Reading skills by responding to the following statement:

   As I read, I paid attention to my own understanding and recorded my thoughts and questions.

   - ☐ Never
   - ☐ Almost never
   - ☐ Sometimes
   - ☐ Frequently/often
   - ☐ All the time

Active Reading Guidelines

1. Think carefully about what you read. Pay attention to your own understanding.
2. As you read, annotate the text to make a record of your thinking. Highlight challenging words and add notes to record questions and make connections to your own experience.
3. Examine all visual representations carefully. Consider how they go together with the text.
4. After you read, discuss what you have read with others to help you better understand the text.

Name: _____ Date: _____

Rereading "From Living Things to Plastic: A Journey Through Rock"

1. Reread parts of the article "From Living Things to Plastic: A Journey Through Rock" to learn more about natural resource use and to find evidence about the questions you will answer below.
2. Focus on the paragraphs titled "How Do People Get Crude Oil Out?" and "How Is Crude Oil Turned Into Plastic?"
3. Record your answers to the questions below based on what you read.

What makes crude oil a **nonrenewable** resource?

_____

_____

_____

_____

If the human population and the amount of plastic each person uses keep increasing, what will be some of the effects to the environment and to our natural resources?

_____

_____

_____

_____

Name: _____ Date: _____

Monitoring and Reducing Human Impacts

1. Refer to the Human Impact Action Cards for this activity.
2. Discuss each question below and on the next page with your partner before you record your own answers.

Why are the actions described on the Human Impact Action Cards important? What causes the problems that these actions can help solve?

_____

_____

_____

_____

Which action on one of the Human Impact Action Cards that **monitors** impact do you think might be most important? Why would having this information help people protect the environment?

_____

_____

_____

_____

Which action on one of the Human Impact Action Cards that **reduces** impact do you think might be most important? How would doing this help protect the environment?

_____

_____

_____

_____

Name: _____ Date: _____

Monitoring and Reducing Human Impacts (continued)

Think of one more action that people could take related to the impact from crude oil or plastic.

- Describe the action.

_____

_____

_____

- Does this **monitor** impact or **reduce** impact? _____

- Why would this action help protect the environment?

_____

_____

_____

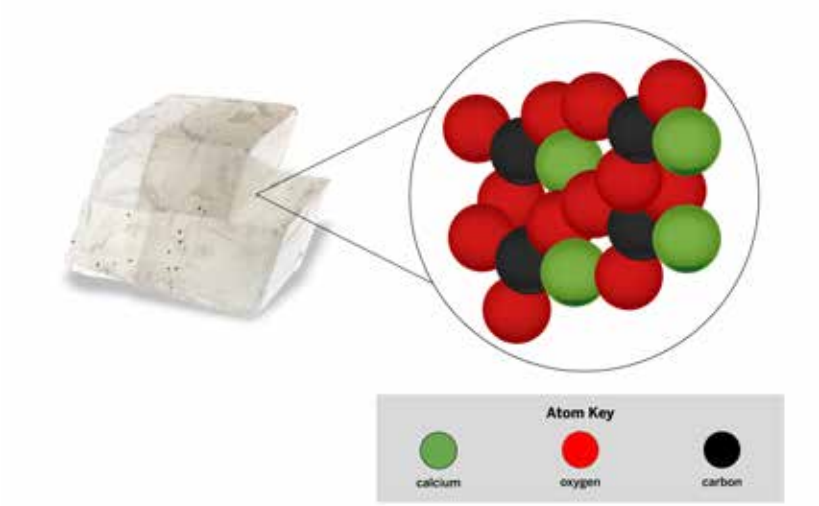
_____

Bryce Canyon and its hoodoos were created by various types of weathering.

Bryce Canyon Hoodoos

In the southwest of Utah, massive stone columns tower over the treetops of Bryce Canyon National Park. These columns, once part of a larger plateau, are known as hoodoos. Despite its name, Bryce Canyon is not a true canyon. Canyons are formed by physical weathering of rock by flowing water, such as rivers. The hoodoos of Bryce Canyon formed through a combination of physical weathering by rain, snow, wind, and chemical weathering. During chemical weathering, some of the rock turns into new substances and breaks down.

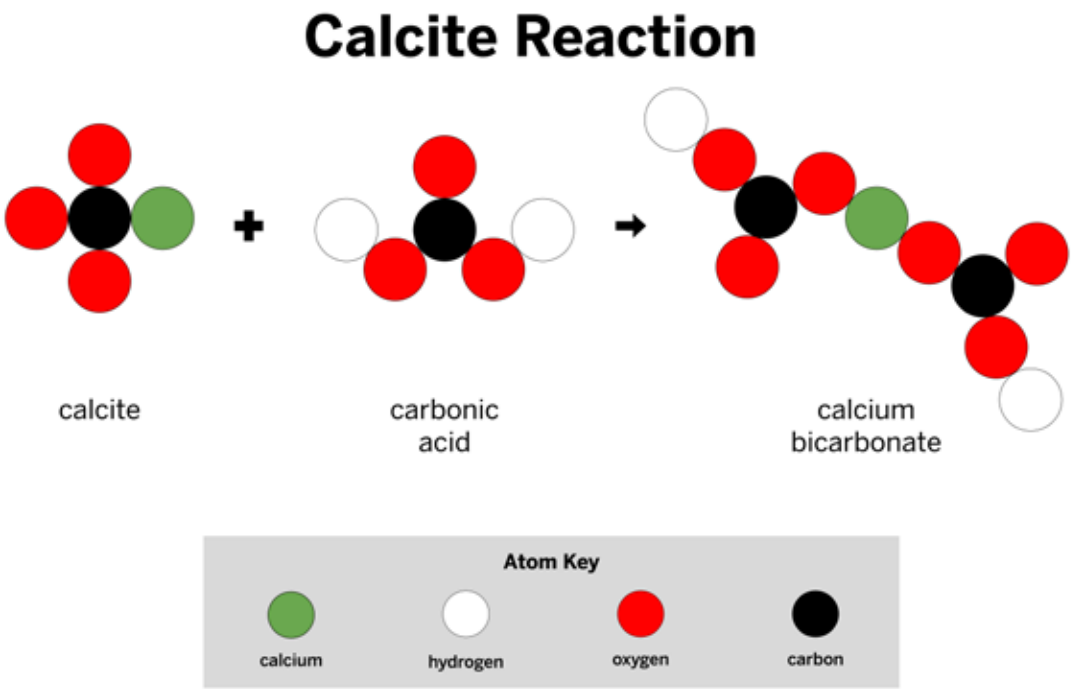
All matter, everything in the universe, is made up of tiny pieces called atoms. Atoms are arranged into groups (often molecules) that repeat to make up substances. Some substances are made of repeating groups of atoms that are all linked together into extended structures. For example, one of the most common types of rock found in the Bryce Canyon hoodoos is called limestone. Limestone is mostly made out of the mineral calcite. Calcite is formed from repeating



Pure calcite is made up of repeating groups of calcium, carbon, and oxygen atoms. The repeating groups of atoms are connected to form an extended structure.

groups of calcium, carbon, and oxygen atoms that all connect together to form an extended structure. The types of atoms that are grouped and the way they are arranged is what gives a substance its unique properties. One property of calcite is that it easily reacts with acids.

When substances interact with one another and form new substances, we call this a chemical reaction. As it rains on the rocks of Bryce Canyon, carbonic acid in the rainwater reacts with the calcite in the limestone. The atoms that make up calcite and carbonic acid rearrange to form a new substance: calcium bicarbonate.



When calcite reacts with carbonic acid, the atoms that make up those substances rearrange to form new substances.

Over time, a large plateau will wear down into a thinner wall. Eventually, holes may form and widen until only columns of rock remain.

As the calcite reacts with the carbonic acid to form new substances, it is used up, slowly being removed from the larger rock mass it was once a part of. The limestone plateaus eventually wear down, and the holes widen until the weird and wonderful shapes of the hoodoos are left behind.

Like most rocks, the hoodoos are not made of just one material. One mineral that helps give the hoodoos their special shape is called dolomite. Dolomite is similar to calcite with repeating groups of calcium, carbon, and oxygen atoms; however, unlike calcite, dolomite is also partially made up of magnesium atoms. Since dolomite has a different group of repeating atoms, it has different properties than calcite. Though the dolomite will eventually weather and erode away like the rest of the rock, a property of dolomite is that it does not react to acids as easily as calcite. This allows it to remain for longer periods of time, acting as a sort of protective cap, or umbrella, for the hoodoo. Different amounts of calcite in the hoodoo will allow for different amounts of weathering, which is why we see different sizes and shapes of hoodoos in Bryce Canyon.

Dolomite does not react as easily to acid, leaving a protective cap on top of a hoodoo.

Chemical weathering is responsible for creating many amazing rock formations. The reaction between carbonic acid and calcite that helps form hoodoos is just one example. Some minerals can react with pollution dissolved in rainwater, oxygen in the air, and even water molecules. These reactions cause the minerals to change to different substances with very different properties. Over time, enough rock breaks down to create unique formations.

Spherical rock formations are created as a result of chemical weathering.

Name: _____ Date: _____

Reading "Bryce Canyon Hoodoos"

1. Read and annotate the "Bryce Canyon Hoodoos" article.
2. Choose and mark annotations to discuss with your partner. Once you have discussed these annotations, mark them as discussed.
3. Now, choose and mark a question or connection, either one you already discussed or a different one that you would like to discuss with the class.
4. Answer the reflection question below.

   Rate how successful you were at using Active Reading skills by responding to the following statement:

   As I read, I paid attention to my own understanding and recorded my thoughts and questions.

   - ☐ Never
   - ☐ Almost never
   - ☐ Sometimes
   - ☐ Frequently/often
   - ☐ All the time

Active Reading Guidelines

1. Think carefully about what you read. Pay attention to your own understanding.
2. As you read, annotate the text to make a record of your thinking. Highlight challenging words and add notes to record questions and make connections to your own experience.
3. Examine all visual representations carefully. Consider how they go together with the text.
4. After you read, discuss what you have read with others to help you better understand the text.

Name: _____ Date: _____

Rereading "Bryce Canyon Hoodoos"

Preview the questions below and on the next page. Then, reread the article "Bryce Canyon Hoodoos" to answer the questions. As you read, you may want to highlight or annotate parts of the text that will help you answer the questions.

Part 1

What is the difference between chemical weathering and physical weathering?

_____

_____

_____

_____

What atoms make up calcite?

_____

What happens to the atoms of calcite when the rock undergoes chemical weathering?

_____

_____

_____

_____

Name: _____ Date: _____

Rereading "Bryce Canyon Hoodoos" (continued)

Part 2

Geologists found a rock with a piece that had broken off, exposing the inside. When they examined the inside, they noticed that the properties of the rock on the inside were different from the properties of the rock on the outside. The outside that had been exposed to oxygen for a while had a reddish color, while the inside was more brown.

What could have happened to the atoms that make up the rock to cause the properties to change?

_____

_____

_____

_____

Name: _____ Date: _____

Designing Hot Packs and Cold Packs

Part 1: Researching Substances

Safety Note: Using Chemicals

Do not taste or touch the substances in the investigation. Mix substances only when you are told to do so by your teacher. The substances present skin irritation risks. Wash exposed areas when finished. If a substance gets on your skin or clothes, tell your teacher and rinse off the substance with water. If you get a substance in your eyes, tell your teacher and rinse your eyes with water for 15 minutes. If a substance is inhaled, move to fresh air and seek medical help for any breathing difficulties.

Criteria

- Reach the highest or lowest temperature possible.
- Use as little of the substances as possible.

Procedure

1. Test what happens when you mix different combinations of substances in a plastic bag. Use these tests to explore substances that you might use in a hot pack or cold pack design.
2. In each test, mix no more than two solids with water. Clearly label your bag with the names of the substances and record them in the table on the next page. Remember to use a separate measuring spoon for each substance to avoid contaminating the substances.
3. For solids, measure ¼ teaspoon (leveled) and add it to the plastic bag. For water, measure 45 mL. Add the water last.
4. Quickly and carefully press the air out of the bag and seal it. Mix the substances with your fingers outside the bag.
5. Observe what happens and record the results.

Substances

- baking soda ($NaCHO_3$)
- calcium chloride ($CaCl$)
- citric acid ($C_6H_8O_7$)
- water (H_2O)

Name: _____ Date: _____

Designing Hot Packs and Cold Packs (continued)

Part 1: Researching Substances (continued)

Substances	Observations

Name: _____ Date: _____

Designing Hot Packs and Cold Packs (continued)

Part 1: Researching Substances (continued)

1. Which type of pack will you design? (Circle one.)

   a hot pack

   a cold pack

2. Which substances will you use in your design? (Check all that apply.)

   baking soda ($NaCHO_3$)

   calcium chloride (CaCl)

   citric acid ($C_6H_8O_7$)

   water (H_2O)

3. Why did you choose these substances?

_____

_____

_____

Name: _____ Date: _____

Designing Hot Packs and Cold Packs (continued)

Part 2: Finding an Optimal Design

Constraints

- In any design, do not use more than 1 teaspoon of calcium chloride, baking soda, or citric acid.
- If using water, always use 45 mL.

PLAN #1	**BUILD** Substance _____ Amount _____ _____ _____ _____ _____
TEST Highest or lowest temperature: _____ Notes:	
ANALYZE	

Name: _____ Date: _____

Designing Hot Packs and Cold Packs (continued)

Part 2: Finding an Optimal Design (continued)

PLAN #2	BUILD Substance _____ Amount _____ _____ _____ _____ _____
TEST Highest or lowest temperature: _____ Notes:	
ANALYZE	

PLAN #3	BUILD Substance _____ Amount _____ _____ _____ _____ _____
TEST Highest or lowest temperature: _____ Notes:	
ANALYZE	

Name: _____ Date: _____

Designing Hot Packs and Cold Packs (continued)

Part 2: Finding an Optimal Design (continued)

PLAN #4	**BUILD** Substance _____ Amount _____ _____ _____ _____ _____
TEST Highest or lowest temperature: _____ Notes:	
ANALYZE	

PLAN #5	**BUILD** Substance _____ Amount _____ _____ _____ _____ _____
TEST Highest or lowest temperature: _____ Notes:	
ANALYZE	

Name: _____ Date: _____

Designing Hot Packs and Cold Packs (continued)

Part 3: Writing a Proposal

Explain how your hot pack or cold pack works.

_____

_____

_____

_____

_____

_____

Explain why your design is the optimal design. Be sure to address each criterion and provide evidence that shows how your design meets each criterion.

_____

_____

_____

_____

_____

_____

_____

_____

Why the Corpse Flower Smells So Bad

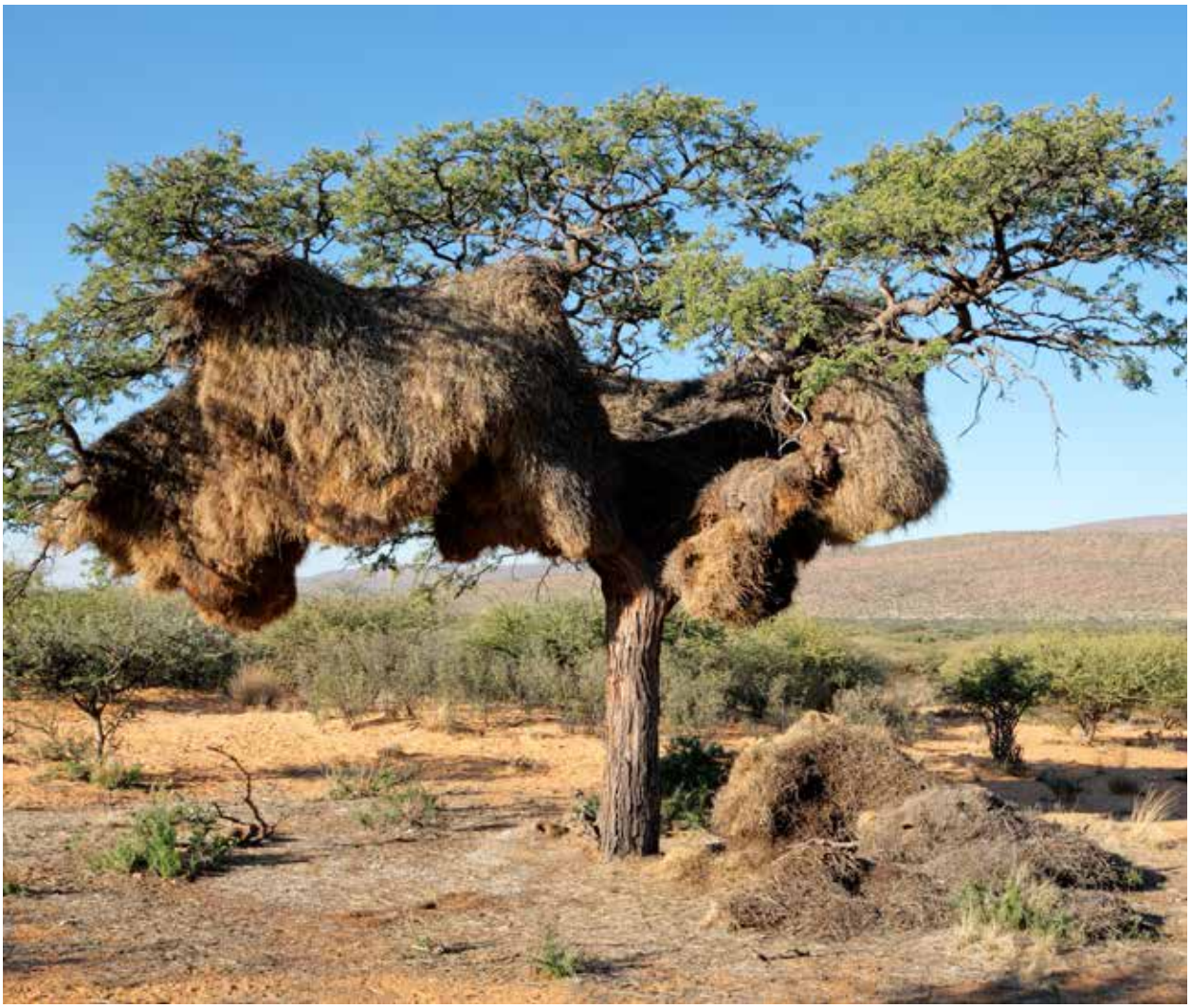
Sending out a terrible smell may not seem like the best way to increase your chance of reproducing. However, it's a very successful adaptation for the plant *Amorphophallus titanum*, or corpse flower.

Rotting meat smells awful to humans, but that same odor smells like a good meal to insects that eat rotting meat, such as flesh flies and carrion beetles. In order to attract these insects, the corpse flower releases a powerful smell of decay. In addition, the plant has structures that increase reproductive success. For example, the petal of its flower is a deep red that's similar to the color of meat, and at the peak of its reproduction process, it gets warm, like a piece of rotting meat would be. All these adaptations help the corpse flower attract insects that feed on decaying meat. By tricking insects into landing on it, the flower increases its odds of reproducing successfully.

Why does the corpse flower need to attract insects to reproduce? Flowering plants can't reproduce on their own; they need the pollen produced by their flowers to be moved from one plant to another, and they need animals to do the moving. This process is called pollination. Most plants are pollinated by bees, butterflies, moths, or bats. To make pollination more likely, some plants put out smells that attract the type of animal most likely to pollinate them—a sweet smell to attract bees, for example. In the case of the corpse flower, a rotting-meat smell attracts flies and beetles to help with pollination. More insects mean more chances to reproduce.

When it blooms, the corpse flower can reach six feet tall.

Many plants have structures and behaviors that increase their odds of reproducing. In fact, that's why flowers have scents and colors in the first place—to attract a variety of pollinators. Other plants have structures such as seeds that catch the wind or stick to animals passing by, which helps them come into contact with new environments. These adaptations all arose from random mutations in the plants' genes. Even though they were random, these particular mutations happened to help individual organisms reproduce and pass on their genes, and so the genes became more common in the population. So, smelling like rotting meat might not be a great strategy for humans—but for the corpse flower, it's just the right thing.



Sociable weavers often build their huge nests in trees.

Apartments Built by Birds

In the dry grasslands of southern Africa, there is a kind of bird that builds something like an apartment building. The sociable weaver is a fairly small, plain, brown bird, but its nests are anything but ordinary. A weaver nest can be as large as six meters (20 feet) wide and 3 meters (10 feet) tall, with over 100 separate chambers. The nests are woven from stiff grasses, built around trees or poles. A large group of up to 250 birds lives together, building and repairing the nest.

It may seem like building a huge nest to house hundreds of birds takes a lot of effort compared to building a small nest for one pair the way many kinds of birds do. However, these group nests offer a lot of benefits that increase the weaver birds' chances of survival and ability to reproduce.

One of the main benefits of the nests is temperature control. The environment in this part of Africa gets very hot during the day and

quite cold at night, but the temperature inside these large nests stays just right—not too hot or too cold. This is especially important for eggs and young birds, but it also helps the adults. A large nest is better than a small one for keeping temperature controlled. This is because in a large nest, more of the nest is separated from the outside air.

Another benefit of these bird apartment buildings is that they allow the weavers to get help from one another as they care for eggs and young. Younger adult weaver birds often don't lay their own eggs, but they help older birds build and repair their nest chambers and gather food (seeds and insects) for their young.

Living in large groups may also help sociable weavers avoid losing eggs and young to predators, especially snakes. There are many types of snakes in the weavers' environment

Sociable weavers can also build their nests around poles

Sociable weavers live in large groups and help one another raise their young.

A male sociable weaver does a mating display while holding a piece of nest material.

that eat young birds and bird eggs. Living in a large group means more eyes to watch for snakes and more birds to give alarm calls warning when a snake approaches.

Sociable weavers have some other interesting behaviors that help the species survive. For example, when they are ready to reproduce, males do specific mating displays to attract females. A male sociable weaver will pace back and forth in front of a female, holding nest material high in his beak, while repeatedly flipping his tail up over his back. The more impressive the display, the more likely the male is to find a mate.

These behaviors—building enormous nests, living in large groups, helping one another raise young, doing mating displays—are adaptive traits that help sociable weavers survive and reproduce to pass on their genes. Over millions of years, individuals with these behaviors survived more often and had more young, and these traits became more and more common in the population. Through the process of natural selection, they became the fascinating sociable weaver birds we see today.

Name: _____ Date: _____

Reading About Plant and Animal Reproduction

1. Read and annotate the "Why the Corpse Flower Smells So Bad" article and the "Apartments Built by Birds" article.
2. Choose and mark annotations to discuss with your partner. Once you have discussed these annotations, mark them as discussed.
3. Now, choose and mark a question or connection, either one you already discussed or a different one that you would like to discuss with the class.
4. Answer the reflection question below.

   Rate how successful you were at using Active Reading skills by responding to the following statement:

   As I read, I paid attention to my own understanding and recorded my thoughts and questions.

   - ☐ Never
   - ☐ Almost never
   - ☐ Sometimes
   - ☐ Frequently/often
   - ☐ All the time

Active Reading Guidelines

1. Think carefully about what you read. Pay attention to your own understanding.
2. As you read, annotate the text to make a record of your thinking. Highlight challenging words and add notes to record questions and make connections to your own experience.
3. Examine all visual representations carefully. Consider how they go together with the text.
4. After you read, discuss what you have read with others to help you better understand the text.

Name: _____ Date: _____

Rereading About Plant and Animal Reproduction

1. Preview the questions below and on the next page.
2. With your partner, decide who will reread the "Why the Corpse Flower Smells So Bad" article and who will reread the "Apartments Built by Birds" article.
3. As you read, highlight or annotate parts of the text that will help you answer the questions.
4. Discuss with your partner, sharing what you found in the article you reread.
5. Record your answers to all five questions. Look back at either article for evidence as needed.

"Why the Corpse Flower Smells So Bad"

What is one of the corpse flower's traits that the article describes? What makes that an adaptive trait?

_____

_____

_____

_____

Imagine two corpse flower plants. One makes a very strong smell, and the other makes only a slight smell. Which plant do you think will have more offspring? Why?

_____

_____

_____

_____

Name: _____ Date: _____

Rereading About Plant and Animal Reproduction (continued)

"Apartments Built by Birds"

What is one of the sociable weaver's traits that the article describes? What makes that an adaptive trait?

_____

_____

_____

_____

Imagine two pairs of sociable weaver birds. One pair has the trait of making a small nest on its own. The other pair is part of a large group with a large group nest. Which pair do you think will have more offspring? Why?

_____

_____

_____

_____

Both articles

How does a trait that helps a plant or animal reproduce become a common trait in the population?

_____

_____

_____

_____

People around the world compete to grow the largest pumpkins.

Growing Giant Pumpkins

Can you imagine a jack-o-lantern as big as a car? It might have glowing eyes as big as headlights and a grin as big as a bumper. A jack-o-lantern of that size has to come from a very large pumpkin! Some farmers do grow these giant pumpkins, competing to see who can grow the biggest and heaviest pumpkin. Growing giant pumpkins takes knowledge and skill, but farmers can use both genetic and environmental factors to make their pumpkins as big as possible. Planting the seeds with the best genetics for large pumpkins is as crucial as providing the best environmental conditions for pumpkins. Both factors strongly influence the growth of giant pumpkins.

Not every pumpkin is capable of growing to a monster size. Each pumpkin's genes determine how big it can get, and different types of pumpkins have genes that instruct them to grow in different ways. Some pumpkins' genes instruct them to stay small.

These small pumpkins are good for decorating. Others are medium-sized and good for making pies. One way farmers can grow the biggest pumpkins is by planting seeds from types of pumpkins that grow very large. Every world-

champion giant pumpkin grown since 1979 has come from the same type of seed, a variety called Atlantic Giant. Atlantic Giants can grow to weigh over 1,000 pounds!

Using Atlantic Giant seeds won't automatically allow you to grow a world-championship pumpkin, however. A giant pumpkin needs support from its environment to grow really huge. Farmers who grow giant pumpkins begin by making sure the soil has plenty of nutrients the pumpkin plant can use. Farmers add plenty of fertilizer. They plant the pumpkin plants in sunny places so the plants' cells can perform lots of photosynthesis, and farmers make sure the plants get plenty of water. Another way farmers can encourage their pumpkins to grow is by making sure each plant only has one pumpkin—they cut off every vine except the one with the biggest, strongest pumpkin and remove any other pumpkins that begin to grow on that vine. That way, all the plant's energy and resources go toward just one pumpkin. A healthy Atlantic Giant pumpkin grown this way can gain 40 to 50 pounds every day. That's a lot of pie!

Farmers who grow giant pumpkins only allow one pumpkin on each vine to grow to maturity. This way, all the plant's energy goes to that one pumpkin.

Name: _____ Date: _____

Reading "Growing Giant Pumpkins"

1. Read and annotate the "Growing Giant Pumpkins" article.
2. Choose and mark annotations to discuss with your partner. Once you have discussed these annotations, mark them as discussed.
3. Now, choose and mark a question or connection, either one you already discussed or a different one that you would like to discuss with the class.
4. Answer the reflection question below.

   Rate how successful you were at using Active Reading skills by responding to the following statement:

   As I read, I paid attention to my own understanding and recorded my thoughts and questions.

   - ☐ Never
   - ☐ Almost never
   - ☐ Sometimes
   - ☐ Frequently/often
   - ☐ All the time

Active Reading Guidelines

1. Think carefully about what you read. Pay attention to your own understanding.
2. As you read, annotate the text to make a record of your thinking. Highlight challenging words and add notes to record questions and make connections to your own experience.
3. Examine all visual representations carefully. Consider how they go together with the text.
4. After you read, discuss what you have read with others to help you better understand the text.

Name: _____ Date: _____

Rereading "Growing Giant Pumpkins"

Preview the questions below and on the next page. Then, reread the article "Growing Giant Pumpkins" to answer the questions. As you read, you may want to highlight or annotate parts of the text that will help you answer the questions.

Part 1

What are the different factors that can affect how big a pumpkin can grow?

_____

_____

_____

_____

_____

_____

Part 2

Francis planted two types of sunflowers in different parts of her yard. One type had a gene that usually leads to taller plants, and the other type had a gene that usually leads to shorter plants. The plants got different amounts of sunlight because some parts in her yard get a lot of sun, and other parts get only a little sun. Francis let all the plants grow for two months. Her results are shown below. She was surprised to see that some of the plants with the tall gene did not grow very tall.

Gene: tall
Environment: lots of sun

Plant A

Gene: tall
Environment: a little sun

Plant B

Gene: short
Environment: lots of sun

Plant C

Name: _____ Date: _____

Rereading "Growing Giant Pumpkins" (continued)

Part 2 (continued)

Explain why you think that Plant A grew taller than Plant C.

_____

_____

_____

_____

Explain why you think that Plant B did not grow as much as Plant A.

_____

_____

_____

_____

What advice would you give Francis if she wanted to grow the tallest sunflowers possible?

_____

_____

_____

_____

_____

_____

Grade 8 Glossary

atoms: the tiny pieces that all matter—all the stuff in the world—is made of

átomos: los pedacitos diminutos de los cuales toda la materia del mundo está hecha

chemical reaction: a process in which atoms rearrange to form new substances

reacción química: un proceso en el que los átomos se reorganizan para formar nuevas sustancias

endothermic reaction: a chemical reaction that absorbs and stores energy

reacción endotérmica: una reacción química que absorbe y almacena energía

exothermic reaction: a chemical reaction that releases energy

reacción exotérmica: una reacción química que libera energía

extended structure: a structure formed by repeating groups of atoms that link together in a large network

estructura extendida: una estructura formada por grupos repetidos de átomos que se enlazan entre sí en una gran red

matter: anything that has mass and takes up space

materia: cualquier cosa que tenga masa y ocupe espacio

molecule: a group of atoms joined together in a particular way

molécula: un grupo de átomos unidos de una manera particular

natural resource: something found in nature that is useful to people

recurso natural: algo en la naturaleza que es útil para las personas

nonrenewable resource: a natural resource that is not easily replaced or replenished after it is used

recurso no renovable: un recurso natural que no se reemplaza o repone fácilmente después de su uso

property: something that can be observed about a substance, such as color, smell, or boiling point

propiedad: algo que se puede observar acerca de una sustancia, como el color, olor o punto de ebullición

radioactive dating: a way of figuring out the age of materials, such as rock, based on how its atoms change over time

datación radiométrica: una forma de averiguar la edad de un material, como rocas, con base en cómo cambian sus átomos con el tiempo

rearrange: to change the order or position of something

reorganizar: cambiar el orden o posición de algo

rock formation: a region of rock that formed together as a single rock type

formación de roca: una región de roca que se formó junta como un solo tipo de roca

sample: a small part that is meant to show what the whole is like

muestra: una pequeña parte que sirve para mostrar cómo es el todo

substance: something that is made of all the same atoms or groups of atoms

sustancia: algo que está completamente hecho de los mismos átomos o grupos de átomos

synthetic material: a material, such as plastic or nylon, that humans make from things found in nature by using chemical reactions

material sintético: un material, como plástico o nailon, que fabrican los humanos mediante reacciones químicas a partir de cosas que se encuentran en la naturaleza

Lawrence Hall of Science:
Program Directors: Jacqueline Barber and P. David Pearson
Curriculum Director, Grades K–1: Alison K. Billman
Curriculum Director, Grades 2–5: Jennifer Tilson
Curriculum Director, Grades 6–8: Suzanna Loper
Assessment and Analytics Director: Eric Greenwald
Learning Progressions and Coherence Lead: Lauren Mayumi Brodsky
Operations and Project Director: Cameron Kate Yahr
Student Apps Director: Ari Krakowski
Student Content Director: Ashley Chase

Leadership Team: Jonathan Curley, Ania Driscoll-Lind, Andrew Falk, Megan Goss, Ryan Montgomery, Padraig Nash, Kathryn Chong Quigley, Carissa Romano, Elizabeth Shafer, Traci K. Shields, Jane Strohm

Louisiana Grade 8 Development Team: Chloë Delafield, Benjamin Frazier, Christina Morales, Natalie Roman, Jacqueline Ryan, Leslie Stenger, Lizzy Vlasses, Rachel Walsh

Louisiana Grade 8 Editorial and Production: Trudihope Schlomowitz

Amplify:

Amanda Jaksha	Charvi Magdaong	Matt Reed
Irene Chan	Thomas Maher	Eve Silberman
Samuel Crane	Rick Martin	Steven Zavari

Credits:
Photographs: Pages S3 (rock), S9 (bottom), S14–S15 (calcite), S16 (bottom)–S17, S28–S31, S35-S36: Shutterstock; Pages S20: Attribution-ShareAlike 3.0 Unported (CC BY-SA 3.0); Page S2: SCIENCE PHOTO LIBRARY/Science Source; Page S4: Spencer Sutton/Science Source; Page S8: SCIENCE PHOTO LIBRARY/ Science Source; Page S9 (top): Science Source; Page S16 (top): Brian Roanhorse/NPS

THE LAWRENCE
HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

Amplify.

Published and Distributed by Amplify.
www.amplify.com