



Explorer



Extreme Plants 2

Lava Domes 8 Screws 16

TEACHER'S GUIDE Pathfinder and Adventurer Vol. 18 No. 3

IN THIS GUIDE:

About the Learning Framework 2

Language Arts
Lesson and BLMs 3-8

Extreme Plants
Science Lesson and BLM 9-10

Living with Lava Domes
Social Studies Lesson and BLM.. 11-12

Something Screwy Going On
Science Lesson and BLM 13-14

Egypt Posters
Social Studies Lesson and BLM.. 15-16

Article and Poster Tests 17-20

Answer Key 21

Educational consultant **Stephanie Harvey** has helped shape the instructional vision for this Teacher's Guide. Her goal is to ensure you have the tools you need to enhance student understanding and engagement with nonfiction text.

Lexile® Framework Levels

Pathfinder

Extreme Plants	700
Living with Lava Domes.....	790
Something Screwy Going On	580

Adventurer

Extreme Plants	910
Living with Lava Domes.....	800
Something Screwy Going On.....	630

Standards Supported

- Common Core State Standards (CCSS)
- Next Generation Science Standards (NGSS)
- C3 Framework for Social Studies State Standards (C3)



Looking for a fun way to test your student's recall? Each story in this issue of Explorer has an accompanying Kahoot! quiz.

For additional resources to extend your students' learning, visit EXPLORER's website:

[NATGEO.ORG/EXPLORERMAG-RESOURCES](https://www.natgeo.org/explorermag-resources)

INTRODUCTION

BACKGROUND

Since 1888, the National Geographic Society has funded scientists and explorers and shared their findings with the world. To support educators who use our resources, we have created a Learning Framework, which lays out what we believe students should learn from their experiences with the Society.

PURPOSE

The Learning Framework was designed to convey the Society's core beliefs and values. It is built around a set of attitudes, skills, and knowledge that embody the explorer mindset.

To determine the learning outcomes within the Learning Framework, we dug deep into national standards in key subject areas. We also sought advice from subject matter and child development experts, along with the combined expertise of NG instructional designers, researchers, and content developers. To learn more, go to: <https://www.nationalgeographic.org/education/learningframework/>.

IMPLEMENTATION

Each article in this magazine has a knowledge-based link to the Learning Framework.

MINDSET OF AN EXPLORER

KEY FOCUS AREAS



Attitudes

National Geographic kids are:

CURIIOUS about how the world works, seeking out new and challenging experiences throughout their lives.

RESPONSIBLE, with concern for the welfare of other people, cultural resources, and the natural world. NG kids are respectful, considering multiple perspectives, and honoring others regardless of differences.

EMPOWERED to make a difference. NG kids act on curiosity, respect, and responsibility. They are adventurous and persist in the face of challenges.



Skills

National Geographic kids can:

OBSERVE and document the world around them and make sense of those observations.

COMMUNICATE experiences and ideas effectively through language and media. They are storytellers!

COLLABORATE with others to achieve goals.

SOLVE PROBLEMS by generating, evaluating, and implementing solutions after identifying alternatives, weighing trade-offs, and making well-reasoned decisions.



Knowledge

National Geographic kids understand:

THE HUMAN JOURNEY is all about where we have been, where we live now (and why), and where we are going.

OUR CHANGING PLANET encompasses all that coexists on our planet—interconnected through systems that generate and nurture each other.

WILDLIFE AND WILD PLACES inhabit our planet—from the butterflies in our backyards to the lions in Africa.

LANGUAGE ARTS Notice and Use Nonfiction Features to Guide Learning

Standard Supported

• **CCSS Reading Informational Text:** Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears. (4–7)

What You'll Need

- “Living with Lava Domes” (Explorer, pages 8–15)
- Think Sheet (Teacher’s Guide, page 6)
- Clipboards and pencils

CONNECT & ENGAGE (5 minutes)

Kids are in a group on the floor in front of you. Sit on a low chair and hold up pages 8–9 in the magazine.

TEACHER TIP: The reason kids are grouped on the floor is that the focus needs to be on the teacher’s instruction. However, the whole point of “Connect and Engage” is to get kids fired up, and there will be plenty of interaction throughout this segment and the entire lesson.

Say: Take a look at these pictures! What do you notice? Turn to each other and talk.

Kids turn and talk about the large photo and also the photos of the scientists.

Say: The headline of this article is “Living with Lava Domes.” Turn and talk about what you think it means.

Kids turn and talk about what the title might mean, based on the photo and the title. Some may have an idea; others may not be.

Say: I think this headline is talking about what we see in that large photo. What’s happening there looks a little scary. I’m guessing that’s a lava dome, and if you live near it, you’d have to learn how to live with it and try to stay safe.

I’m also curious about those pictures of the people. I think they may have something to do with these lava domes. What do you think?

Kids share out their thinking.

Say: Let’s read on and see if we can find some answers.

MODEL (10 minutes)

Kids sit in a group on the floor, with you in a low chair in front of them.

TEACHER TIP: While this segment of the lesson is about the teacher modeling for students, be careful not to go on and on. This has to be interactive. Kids should be turning and talking a lot.

Say: This article is nonfiction, and a lot of nonfiction includes features that can guide our learning. Nonfiction features are things like headlines, subheads, pictures, captions, labels, and diagrams. We have all of those in this article.

Say: I am going to read through a bit of this article and show you my thinking. I’m also going to write down my thinking on this three-column chart. Let’s look first at pages 8–9 again. I’m going to read what’s on the pages.

Read aloud the text on page 8. Tell students this is sort of a subtitle that tells what the article is about.

Say: Well, we got a lot of information from this feature. This is kind of like a subtitle. It’s a text feature. A feature like this follows the headline and tells more about the article. I’m going to write that down on my chart. I’ll put “subtitle” in the “FEATURE” column, “text feature” in the “TEXT or GRAPHIC FEATURE” column, and “tells more about the article” in the “PURPOSE” column. Now let’s look at the people’s pictures and the text under them. Both of these are features, too. (Read the text under the pictures.) What is the purpose of these features? Turn and talk about that.

Say: *That's it! The pictures show us what these scientists look like, and the labels tell us their names and what they do. I'm going to write that in the "PURPOSE" column, but first I'll write "pictures" and "labels" in the "FEATURE" column and note that the pictures are graphic features and the labels are text features in the middle column.*

Say: *There are so many features in this article. Let's look at a few more. Turn to pages 10–11. See that red text? Those are called subheads. What do you think their purpose is? Turn and talk about that. (Kids turn and talk and a few share out.) Great! Those heads give us an idea of what each of these sections will tell us. Since the subheads are text, they are text features. What other text and graphic features do you see on these pages? (Kids share what they think are features.) Yep! More pictures, but this time we have something a little different in those pictures. We have captions in them. And, one of those pictures is actually called a diagram. See those labels in the picture at the top of page 11? They show us exactly where the Santa María volcano is and the four lava domes at its base. (Read the captions and also the labels in the diagram.)*

Say: *Oh, and there are some bold words on page 10. You've probably seen bold words in text before. That's another type of text feature. They let us know these words are important and may be new to us.*

Say: *We have something else on page 10 that is a different graphic feature. It's a map. Can anyone tell the purpose of a map? (Kids share out.) Yes. Maps show us the location of a place. In this case, we can see where the lava domes are located.*

Say: *Okay, now I need to get all of these features and purposes written down on my chart. Help me remember all of them, and I'll write them down.*

GUIDE (10 minutes)

Hand out Think Sheets and have kids attach them to their clipboards. Kids remain in a group in front of you on the floor.

Say: *We had a good start with identifying features and purposes, but there are so many more in this article, and it's your turn to start writing down on your Think Sheet the features, whether they are text or graphic features, and their purposes.*

Turn to pages 12–13.

Say: *First, turn and talk about some of the features on these pages that we already saw and talked about on the previous pages.*

Kids should notice the subheads, the picture, and the caption.

Say: *Did you notice any new features? (Kids share what they think is a new feature.) That illustration, or drawing, on page 12 is something new in this article, isn't it? It's called a cross-section diagram. It's a graphic feature that includes text feature elements. It's different from the diagram on page 11, because it shows us what is inside an eruption. It even shows us numbered information that let's us know what happens first, next, and so on. Wow! There is a ton of information on this cross-section diagram. This is a hard-working feature!*

Say: *Okay, go ahead and turn and talk about this new feature with the person next to you, and be sure to record this feature and its purpose on your Think Sheet*

COLLABORATE (25 minutes)

Say: *Now it's time for you to work with a partner. Go through pages 14–15 and note all of the nonfiction features you find. See if you can name what they are and their purposes. Use your Think Sheet to help you remember. If you run across something new, try to figure out what to call the feature, whether it is a text or graphic feature, and what its purpose is. Jot down anything new you find on your Think Sheet.*

Say: *If you finish early, look through the other articles in the magazine to find other familiar as well as new nonfiction features.*

Partners work together. Move around the room, conferring with partners. Students should notice "Wordwise" as a new text feature. It is a glossary that gives definitions of the bold words in the article.

SHARE THE LEARNING (10 minutes)

Kids join a sharing circle with you and share out, using respectful language.

TEACHER TIP: The sharing phase is done in a circle, so that the focus is on one another rather than the teacher.

Say: *Okay, flip through the article and consult your Think Sheet and choose a text or graphic feature and purpose you would like to share. I am going to invite _____ to share new learning. We are going to share using respectful language. So when I ask: "_____ would you like to share your new learning?" You need to say: "Yes, thank you." Then you can share your learning. After you share, ask if anyone has any comments or questions. Then you can invite someone else to share. To do that, you need to call on the person by name and use the same language we just practiced. When we use polite, respectful sharing language, everyone pays closer attention to the important information being shared. Also, everyone likes to be listened to when they share out, so remember to pay attention to the person who is sharing.*

Kids share out and invite others to share, always using the respectful sharing language that was modeled. There should be time for about three or four kids to share out with the whole group. Once they are finished, have everyone turn and share with the person next to them, so that all have a chance to be heard.

Say: *You learned so much today about nonfiction features. Turn and talk about how they can help us when we read nonfiction.*

Several kids share out.

Say: *Don't be surprised if you start seeing features in all of the nonfiction you read. That's one of the great things about nonfiction. All these features are super helpful. So remember, when you read nonfiction, it is important to notice the nonfiction features to guide your learning. Awesome job, everyone!*

THINK SHEET

Note the nonfiction features as you read. Write the feature, whether it is a text or graphic feature, and its purpose.

FEATURE	TEXT	PURPOSE

LESSON FRAME Notice and Use Nonfiction Features to Guide Learning

You can use this lesson frame with all Explorer articles and any nonfiction text. When students are curious and asking questions as they read, they are engaging with the text to seek out information and expand understanding.

What You'll Need

- Nonfiction text
- Think Sheet template
- Clipboards and pencils

This frame is a kind of template of the lesson we just worked on. It has the instructional moves and language of the lesson, but the specific content has been removed. This way you can use the Lesson Frame for the other articles in the issue or for any nonfiction text you might be teaching.

CONNECT & ENGAGE (5 minutes)

Kids are in a group on the floor in front of you. Sit on a low chair and hold up a few pages in the magazine.

Say: *Take a look at these pictures! What do you notice? Turn to each other and talk.*

Kids turn and talk about the photos and other features on the pages.

Say: *The headline of this article is "_____." Turn and talk about what you think the title means.*

Kids turn and talk about what the headline might mean, based on the photos and the headline. Some may have an idea; others may not.

Say: *I think this headline is talking about _____.*

Say: *I'm also curious about _____. What else are you curious about?*

Kids share out.

Say: *Let's read on and see if we can find some answers.*

MODEL (10 minutes)

Kids sit in a group on the floor, with you in a low chair in front of them.

Say: *This article is nonfiction, and a lot of nonfiction includes features that can guide our learning. Nonfiction features are things like headlines, subheads, pictures, captions, labels, and diagrams. Some of these features are text features, such as headlines, subheads, captions, and so on. Others are graphic features. Graphic features are things like photos, diagrams, illustrations, and maps.*

Say: *I am going to read through a bit of this article and show you my thinking. I'm also going to write down my thinking on this three-column chart. Let's look first at pages _____. I'm going to read what's on the pages.*

Read aloud the text. Tell students about the features on the pages.

Say: *Well, we got a lot of information from this feature. This is called _____. The purpose of a feature like this is _____. I'm going to write that down on my chart. I'll put "_____" in the "FEATURE" column, "_____" in the middle column, and "_____" in the "PURPOSE" column. Now let's look at another feature on these pages. (Find another feature.) What is the purpose of this feature? Turn and talk about that.*

Say: *That's it! I'm going to write that in the "PURPOSE" column, but first I'll write "_____" in the "FEATURE" column and note whether it is a text or graphic feature in the middle column.*

Say: *There are so many features in this article. Let's look at a few more. Turn to pages _____. See that _____? That's called _____. It's a [text/graphic] feature. What do you think its purpose is? Turn and talk about that. (Kids turn and talk and a few share out.) Great! That feature helps us by _____. What other features do you see on these pages? (Kids share what they think are text and graphic features and their purposes.)*

Okay, now I need to get all of these features and purposes written down on my chart. Help me remember all of them, and I'll write them down.

LESSON FRAME Notice and Use Nonfiction Features to Guide Learning

GUIDE (10 minutes)

Hand out Think Sheets and have kids attach them to their clipboards. Kids remain in a group in front of you on the floor.

Say: *We had a good start with identifying features and purposes, but there are so many more in this article, and it's your turn to start writing down on your Think Sheet the features, whether they are text or graphic features, and their purposes.*

Turn to pages ____.

Say: *First, turn and talk about some of the features on these pages that we already saw and talked about on the previous pages.*

Kids should notice familiar features that were previously discussed.

Say: *Did you notice any new features? (Kids share what they think are new features.)*

Say: *Okay, go ahead and turn and talk about the new features with the person next to you, and be sure to record the features and their purposes on your Think Sheet.*

COLLABORATE (25 Minutes)

Say: *Now it's time for you to work with a partner. Go through pages ____ and note all of the nonfiction features you find. See if you can name what they are and their purposes. Use your Think Sheet to help you remember. If you run across something new, try to figure out what to call the feature, whether it is a text or graphic feature, and what its purpose is. Jot down anything new you find on your Think Sheet.*

Say: *If you finish early, look through the other articles in the magazine to find other familiar as well as new nonfiction features.*

Partners work together. Move around the room, conferring with partners.

SHARE THE LEARNING (10 minutes)

Kids join a sharing circle with you and share out, using respectful language.

Say: *Okay, flip through the article and consult your Think Sheet and choose a text or graphic feature and purpose you would like to share. I am going to invite _____ to share new learning. We are going to share using respectful language. So when I ask: "_____ would you like to share your new learning?" You need to say: "Yes, thank you." Then you can share your learning. After you share, ask if anyone has any comments or questions. Then you can invite someone else to share. To do that, you need to call on the person by name and use the same language we just practiced. When we use polite, respectful sharing language, everyone pays closer attention to the important information being shared. Also, everyone likes to be listened to when they share out, so remember to pay attention to the person who is sharing.*

Kids share out and invite others to share, always using the respectful sharing language that was modeled. There should be time for about 3 or 4 kids to share out with the whole group. Once they are finished, have everyone turn and share with the person next to them, so that all have a chance to be heard.

Say: *You learned so much today about nonfiction features. Turn and talk about how they can help us when we read nonfiction.*

Several kids share out.

Say: *Don't be surprised if you start seeing features in all of the nonfiction you read. That's one of the great things about nonfiction. All these features are super helpful. So remember, when you read nonfiction, it is important to notice the nonfiction features to guide your learning. Awesome job, everyone!*

SCIENCE

Standards Supported

- **NGSS LS1.A: Structure and Function:** Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1)
- **NGSS Connections to Nature of Science: Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena:** Science explanations describe the mechanisms for natural events. (5-LS2-1)

Resources

- Content Assessment Master (page 10)
- Article Test (page 17)

Science Background

Plants are living things. Like all living things, they have special parts that help them get what they need to survive. For most plants, these parts include roots, stems, leaves, flowers, fruit, and seeds.

In some plants, these parts have unique adaptations that range from strange to downright deadly. The castor bean plant falls into the latter category. Its seeds contain a poison called ricin. Ricin does its job. It protects the seeds. But just a little bit can be deadly to people or animals.

The Venus flytrap has deadly leaves...at least for insects. The leaves snap shut, trapping small prey inside. The plant then digests its meal. The gympie-gympie tree's leaves aren't deadly, but just brushing up against their fuzzy, needle-like hairs can cause terrible pain.

With the titan arum plant and *rafflesia* plant, it's all about the flower. Their massive blooms reek like a dumpster. To some pollinators, that scent is irresistible. And when it comes to stems, it's hard to beat tortoise-shell bamboo. This plant's stalk grows so fast you can actually see it getting bigger.



Click here for the Kahoot! quiz:

[https://play.kahoot.it/#/k/](https://play.kahoot.it/#/k/a0e29c33-46a9-476b-88f4-7dd50ca18054)

[a0e29c33-46a9-476b-88f4-7dd50ca18054](https://play.kahoot.it/#/k/a0e29c33-46a9-476b-88f4-7dd50ca18054)

ENGAGE

Encourage students to flip through the article and turn and talk with a partner to discuss what they see. Invite students to ask questions or share what they already know about plants that could be identified as extreme.

EXPLORE

Display pages 2-3 of the projectable magazine. Invite students to examine the photo, headline, and text. Point out that none of the phrases in the text apply to the plant in the photo, a Venus flytrap. Brainstorm ideas for a phrase that describes this extreme plant.

EXPLAIN

After reading, remind students that all plants have parts that help them survive, such as seeds, leaves, and flowers. In some cases, those parts have adapted in extreme ways. **Ask:** *What is extreme about castor bean seeds?* (They contain ricin, a deadly poison.) Have students turn and talk as they identify the extreme parts of other plants featured in the article. (gympie-gympie tree leaves, titan arum flower, Venus flytrap leaves, *rafflesia* flower, tortoise-shell bamboo shoots) Encourage students to identify different ways these extreme parts help the plant survive. (protection, attract pollinators, catch food, fast growth) Challenge students to explain why these plants need their extreme adaptations to survive where they live.

ELABORATE

Point out to students that most plants have leaves, roots, and a stem. The *rafflesia* plant does not. It is a parasite that attaches itself to another plant so it can survive. As a class, debate whether or not this is an extreme adaptation. Challenge students to find other examples of plants with missing parts.

EVALUATE

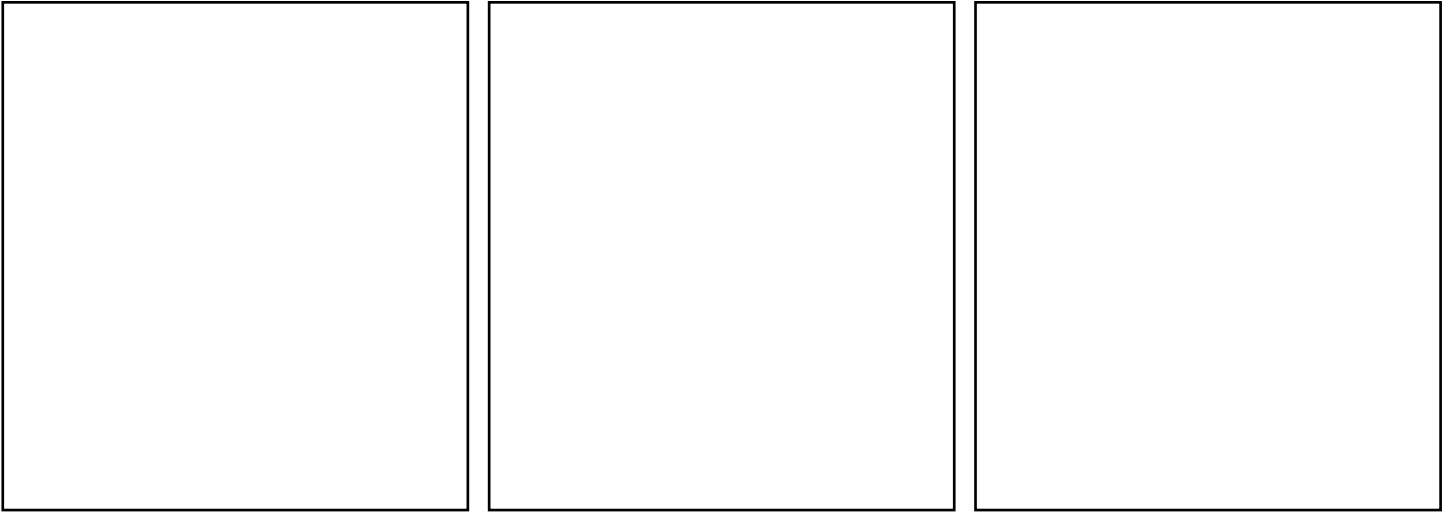
Have students complete the **Content Assessment** for this lesson. Encourage them to share and compare their results in small groups.

Name _____

Date _____

CONTENT ASSESSMENT: Extreme Plants

Pick one plant from the article. Draw a series of pictures to show how the plant uses its extreme parts.



Identify the plant. _____

Describe the plant's extreme parts. _____

Explain how the extreme parts help the plant survive. _____

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Living with Lava Domes

SCIENCE

Standards Supported

- **NGSS ESS2.B: Plate Tectonics and Large-Scale System Interactions:** The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. (4-ESS2-2)
- **NGSS ESS2.A: Earth Materials and Systems:** Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. (5-ESS2-1)

Resources

- Content Assessment Master (page 12)
- Article Test (page 18)

Science Background

In 1902, Guatemala's Santa María volcano had a massive eruption. About 20 years later, the Santiaguito lava-dome complex formed at the volcano's base. Since then, the lava domes here have been erupting nearly every hour. Why? That's what volcanologist Stephanie Grocke wants to find out.

Grocke, photographer Gabby Salazar, and cartographer Ross Donihue undertook a month-long study of the system. Using mapping and time-lapse photography, they hope to discover the system's secret.



Click here for the Kahoot! quiz:
<https://play.kahoot.it/#/k/f8d22af3-dec3-4b99-9291-9e4a7d83df34>

ENGAGE

Encourage students to flip through the article and turn and talk with a partner to discuss what they see. Invite students to ask questions or share what they already know about volcanoes.

EXPLORE

Display pages 8-9 of the projectable magazine. Highlight the headline. **Ask:** *What is a lava dome and why do people need to know how to live with them?* Invite students to share their ideas.

EXPLAIN

After reading, encourage students to use details from the article to understand what a lava dome is. **Ask:** *What kind of lava forms a lava dome? (thick, sticky lava) Why does this type of lava create a lava dome? (The lava is too thick and gooey to flow far. So, it piles up and makes a large dome.)* Have students turn and talk as they discuss what happens when a lava dome erupts. (Details can be found on page 12 of the article.) Challenge them to identify the mystery the scientists are trying to solve. (What causes these lava domes to erupt so regularly?) Encourage students to discuss how time-lapse photos and maps could help solve this mystery. Then have them brainstorm ideas about how the scientists could share what they learn with people living in the area.

ELABORATE

Point out to students that during large eruptions, lava domes can produce a large volume of ash and volcanic rock. Have students explain why these materials are particularly dangerous when they mix with rain to create a lahar. Encourage them to identify other dangers that arise when water gets into the volcanic mix.

EVALUATE

Have students complete the **Content Assessment** for this lesson. Encourage them to share and compare their results in small groups.

CONTENT ASSESSMENT: Living with Lava Domes

Put these events in the correct order to explain how a lava dome erupts.

- _____ A hot column of volcanic ash and gas shoots into the air.
- _____ Lava flows slowly across the land.
- _____ Lahars, mixtures of water and ash, move rapidly down streams and rivers.
- _____ Magma rises from below Earth's surface.
- _____ Gases explode, breaking the seal.
- _____ Rising gases put pressure on the sealed vent.
- _____ Once the gases have escaped, the explosion ends. The seal closes again.
- _____ During large eruptions, pyroclastic flows made of gas and volcanic matter move at high speeds.

Answer each question.

1. What are each of the scientists contributing to the study?

2. Why do you think these lava domes erupt so regularly?

Standards Supported

- **NGSS ETS1.A: Defining and Delimiting Engineering Problems:** Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1)
- **NGSS Crosscutting Concepts: Cause and Effect:** Cause and effect relationships are routinely identified, tested, and used to explain change. (5-PS1-4)

Resources

- Content Assessment Master (page 14)
- Article Test (page 19)

Science Background

Machines can be complicated gadgets with lots of moving parts. Or, they can be quite simple. In fact, simple machines are machines that only have a few parts.

In this article, the fourth of a six-part series about simple machines, students will learn about screws. A screw is basically a ramp wrapped around a rod. The ridges of the ramp are called threads.

The number of threads affects how a screw does work. Fewer threads means you will need to use more force. But it will take less time to get the job done.

People use screws every day. The stem of a lightbulb is a screw. So is a spiral staircase. Screws are the perfect simple machine to use when you need to hold something in place or move something along.



Click here for the Kahoot! quiz:
<https://play.kahoot.it/#/k/ee3d12c0-6ae6-46ae-825d-fc3103f248f3>

ENGAGE

Encourage students to flip through the article and turn and talk with a partner to discuss what they see. Invite students to ask questions or share what they already know about screws.

EXPLORE

Display pages 16-17 of the projectable magazine. Invite students to examine the photos, headline, and deck. Brainstorm ideas about how the screws they see could hold things in place or move things along.

EXPLAIN

After reading, point out to students that a screw is a type of simple machine. **Ask:** *What do you call the ridges that go down the sides of a screw?* (threads) Have students turn and talk as they discuss how threads help a screw do work. (As you twist a screw, you provide the effort that creates the force that drives a screw forward.) Encourage students to explain the relationship between the number of threads, amount of force needed, and the time it takes to twist a screw into place. (A screw with fewer threads requires more force but takes less time to move than a screw with more threads.) Challenge students to identify screws in the article that hold things in place and screws that move things along. Encourage them to make a list of other screws they've seen that perform these same tasks.

ELABORATE

Divide the class into pairs. Provide the necessary supplies and then have partners complete the activity on pages 22-23 of their student magazines. After partners have completed the activity as directed, challenge them to think of a way to improve it. Encourage pairs to write directions, test their method, and explain the results to the class.

EVALUATE

Have students complete the **Content Assessment** for this lesson. Encourage them to share and compare their results in small groups.

CONTENT ASSESSMENT: Something Screwy Going On

Use this organizer to record data as you complete the experiment on pages 22-23 of your student magazine.

1. How is the simple machine you made like Archimedes' screw? How is it different?

2. How did you create the force needed to make your screw do work? _____

3. In Step 5, what caused the water to climb up the tubing? _____

4. What did you change to try to improve the activity? _____

5. What happened when you made this change? _____

6. Based upon what you know about screws, why do you think you got these results?

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Standard Supported

- **C3: History: Change, Continuity, and Context:** Generate questions about individuals and groups who have shaped significant historical changes and continuities. (D2.His.3.3-5)

Resources

- Ancient Egypt poster (Teacher's edition)
- Life in Ancient Egypt poster (Teacher's edition)
- Content Assessment Master (page 16)
- Poster Test (page 20)

Social Studies Background

Asking questions is the first step in acquiring historical knowledge. But to fully understand history, students must know which questions to ask, how to evaluate the answers, and how to use those answers to create accurate arguments about the past. Historical thinking is a process that takes time to develop. Recognizing that, each month *Explorer* magazine will introduce students to a different ancient civilization. Use the accompanying lessons to guide students as they develop these skills.

ENGAGE

Encourage students to examine the maps and turn and talk with a partner to discuss what they see. Invite students to ask questions or share what they already know about ancient Egypt.

EXPLORE

Display the **Ancient Egypt poster**. Point out that Lower Egypt is higher than Upper Egypt on the larger map. Brainstorm ideas to explain why these labels are correct. (The Nile River flows from south to north.)

EXPLAIN

Invite students to examine the **Ancient Egypt poster**. **Ask:** *Which landforms and which waterform caused ancient Egypt to be a land of extremes?* (Eastern and Western Deserts and Nile River) Have students turn and talk to discuss reasons why the Nile River was so important in ancient Egypt. Encourage them to then review the timeline and information about great leaders. Challenge students to explain how ideas about leadership in ancient Egypt evolved over time. Then display the **Life in Ancient Egypt poster**. Have students review the poster to learn more about life in ancient Egypt. Encourage them to identify examples that illustrate the importance of history and religion in ancient Egyptian culture.

ELABORATE

Point out to students that the Nile River was essentially a river of life in ancient Egypt. In addition to being a major trade route, people relied on its annual floods to create fertile land where they could plant and grow crops. Encourage students to conduct research to learn how the Nile River impacts life in Egypt today.

EVALUATE

Have students complete the **Content Assessment** for this lesson. Encourage them to share and compare their results in small groups.

CONTENT ASSESSMENT: Egypt Posters

Answer each question about ancient Egypt.

<p>Why was the Nile River so important in ancient Egypt?</p>	
<p>How did ancient Egyptian ideas about pharaohs change over time?</p>	
<p>What did ancient Egyptians believe about the afterlife?</p>	

Write five other facts you learned about ancient Egypt.

1.	
2.	
3.	
4.	
5.	

ARTICLE TEST: Extreme Plants

Read each question. Fill in the circle next to the correct answer and then write your response on the lines.

- 1. Why are a castor bean's seeds dangerous?
 - Ⓐ They are poisonous.
 - Ⓑ They sting.
 - Ⓒ They break off in your skin.

- 2. Which extreme plants have very smelly flowers?
 - Ⓐ gympie-gympie tree and titan arum plant
 - Ⓑ gympie-gympie tree and *rafflesia* plant
 - Ⓒ *rafflesia* plant and titan arum plant

- 3. Which parts are missing on a *rafflesia* plant?
 - Ⓐ leaves and roots
 - Ⓑ roots and stems
 - Ⓒ leaves, roots, and stems

- 4. Why is tortoise-shell bamboo considered to be extreme?
 - Ⓐ It has giant flowers.
 - Ⓑ It grows really fast.
 - Ⓒ Its leaves eat insects.

- 5. How does a Venus flytrap get the nutrients it needs to survive?

ARTICLE TEST: Living with Lava Domes

Read each question. Fill in the circle next to the correct answer and then write your response on the lines.

1. Which volcano created the Santiaguito lava-dome complex in Guatemala?

- Ⓐ Caliente
- Ⓑ Santa María
- Ⓒ El Brujo

2. Why did Stephanie Grocke want to study the Santiaguito complex?

- Ⓐ It has four lava domes.
- Ⓑ Its lava domes all erupt at the same time.
- Ⓒ There are almost continuous eruptions.

3. What causes the seal on a lava dome to break?

- Ⓐ rising gases
- Ⓑ columns of ash
- Ⓒ flowing lava

4. What is a lahar?

- Ⓐ a column of gas shooting into the air
- Ⓑ a slow-flowing river of lava
- Ⓒ a mixture of rapidly moving water and ash

5. What are pyroclastic flows? Why are they so dangerous?

ARTICLE TEST: Something Screwy Going On

Read each question. Fill in the circle next to the correct answer and then write your response on the lines.

1. Which screw requires more force to use?
Ⓐ a screw with fewer threads
Ⓑ a screw with more threads
Ⓒ a screw with spiral threads

2. Which screw takes less time to move?
Ⓐ a screw with fewer threads
Ⓑ a screw with more threads
Ⓒ a screw with spiral threads

3. Which direction does force move when you insert a screw?
Ⓐ forward
Ⓑ backward
Ⓒ sideways

4. What holds a screw in place?
Ⓐ effort
Ⓑ friction
Ⓒ distance

5. What was Archimedes' screw? How did it work?

POSTER TEST: Egypt Posters

Read each question. Fill in the circle next to the correct answer and then write your response on the lines.

1. Which river ran through ancient Egypt?
Ⓐ Mediterranean
Ⓑ Nile
Ⓒ Mississippi

2. Where was Tutankhamun buried?
Ⓐ Valley of the Kings
Ⓑ Sinai Peninsula
Ⓒ Thebes

3. What was hieroglyphics?
Ⓐ a type of pyramid
Ⓑ a path to the afterlife
Ⓒ a form of picture writing

4. Who was the ancient Egyptian god of the sun?
Ⓐ Horus-Ra
Ⓑ Amun
Ⓒ Anubis

5. Why did ancient Egyptians mummify people's bodies after they died?

Pathfinder and Adventurer

ANSWER KEY

Extreme Plants

Assess Content, page 10

Answers will vary depending on which plant students choose to draw. However, students should create a series drawings showing how the plant uses its extreme parts. Remaining answers should contain information from the article.

Article Test, page 17

1. A; 2. C; 3. C; 4. B; 5. Possible response: A Venus flytrap has hinged leaves with stiff hairs inside that sense motion. When touched, the leaf snaps shut. The plant's digestive juices then break down the soft parts of the insect. The plant absorbs the nutrients. The leaf opens and the unwanted parts fall out.

Living with Lava Domes

Assess Content, page 12

Event order: 4, 6, 7, 1, 3, 2, 8, 5.

1. Photographer Gabby Salazar is using time-lapse photography to observe changes in the lava domes over a period of time. Cartographer Ross Donihue is taking GPS readings and using a drone to take aerial photographs so he can map their expedition and make infographics to help show the risks of active volcanoes. Volcanologist Stephanie Grocke planned the expedition and is interpreting the science as they test this new method to monitor lava-dome activity.
2. Answers will vary.

Article Test, page 18

1. B; 2. C; 3. A; 4. C; 5. Pyroclastic flows are scorching clouds of gas, ash, and rock. They are dangerous because they move so fast you can't outrun them.

Something Screwy Going On

Assess Content, page 14

1. Possible response: Same: Both lift water and move it from one place to another. Different: Archimedes placed his screw inside the tube. Water moved between the screw's threads. This screw is outside the tube. Water travels inside its threads.
2. Students turned the pipe.
4-6: Answers will vary depending upon which factor students change in their experiments.

Article Test, page 19

1. A; 2. A; 3. A; 4. B; 5: Archimedes' screw was an invention that lifted water from a river to irrigate crops. A large screw was fitted inside a tube. One end of the tube was in a river. A worker turned a crank at the other end. Threads pushed water up the tube and dumped it on the crops at the other end.

Egypt Posters

Assess Content, page 16

1. The Nile River was an important trade route for ancient Egyptians. They also relied on its flooding to create fertile farmland where they could grow crops.
2. During the Old Kingdom period, ancient Egyptians viewed pharaohs as god-kings who ruled over their people. During the Middle Kingdom, a pharaoh was the "shepherd of his people," tasked with building public works. And during the New Kingdom, the pharaoh was a ruler as well as an important religious figure.
3. Ancient Egyptians believed that by preserving a dead person's body, their soul could live in the afterlife.
Additional facts will vary, but all should come from the ancient Egypt posters.

Poster Test, page 20

1. B; 2. A; 3. C; 4. B; 5: Ancient Egyptians believed that by preserving a dead person's body, their soul could live on in the afterlife.