



TEACHER'S GUIDE

PIONEER AND TRAILBLAZER | VOL. 20 NO. 1

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LEXILE® FRAMEWORK LEVELS

PIONEER

Rethinking Spinosaurus 520L

The Transformer..... 490L

Turning Trash into Treasure..... 540L

TRAILBLAZER

Rethinking Spinosaurus 570L

The Transformer..... 500L

Turning Trash into Treasure..... 580L

STANDARDS SUPPORTED

- Common Core State Standards (CCSS)
 - Next Generation Science Standards (NGSS)
 - C3 Framework for Social Studies State Standards (C3)
- See each lesson for the specific standard covered.

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.



Visit EXPLORERMAG.ORG to access digital issues of Explorer magazine in **English** and **Spanish**. Engage students with digital read-alouds, videos, and interactive activities.

NATIONAL GEOGRAPHIC LEARNING FRAMEWORK

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



CURIOSITY An explorer remains curious about how the world works throughout his or her life. An explorer is adventurous, seeking out new and challenging experiences.

RESPONSIBILITY An explorer has concern for the welfare of other people, cultural resources, and the natural world. An explorer is respectful, considers multiple perspectives, and honors others regardless of differences.

EMPOWERMENT An explorer acts on curiosity, respect, responsibility, and adventurousness and persists in the face of challenges.

SKILLS



OBSERVATION An explorer notices and documents the world around her or him and is able to make sense of those observations.

COMMUNICATION An explorer is a storyteller, communicating experiences and ideas effectively through language and media. An explorer has literacy skills, interpreting and creating new understanding from spoken language, writing, and a wide variety of visual and audio media.

COLLABORATION An explorer works effectively with others to achieve goals.

PROBLEM SOLVING An explorer is able to generate, evaluate, and implement solutions to problems. An explorer is a capable decision maker—able to identify alternatives and weigh trade-offs to make a well-reasoned decision.

KNOWLEDGE



THE HUMAN JOURNEY An explorer understands where we came from, how we live today, and where we may find ourselves tomorrow.

OUR CHANGING PLANET An explorer understands the amazing, intricate, and interconnected systems of the changing planet we live on.

WILDLIFE AND WILD PLACES An explorer reveals, celebrates, and helps to protect the amazing and diverse creatures we share our world with.

LANGUAGE ARTS

Notice and Use Nonfiction Features to Guide Learning

Second Grade Standard Supported

- **CCSS Reading Informational Text:** Explain how specific images (e.g., a diagram showing how a machine works) contribute to and clarify a text. (2-7)

Third Grade Standard Supported

- **CCSS Reading Informational Text:** Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur). (3-7)

What You Will Need

- “Trash into Treasure”
- Think Sheet
(Teacher’s Guide, pages 6-7)
- Clipboards
- Pencils

CONNECT & ENGAGE (5 minutes)

Kids are in a group with you in front of them.

Say: This article, “Turning Trash into Treasure,” is nonfiction. Do you know what nonfiction is? Turn and talk with a partner about what you know about nonfiction.

Kids turn and talk and share what they know about nonfiction. Make sure kids know that nonfiction is text that gives us true or real information. It includes facts. It is not made up or make believe.

Say: Let’s browse through this article before we start reading. For this lesson, we are going to focus on some of the features of nonfiction. As you look through the article, what are a few things you notice that are different from a story that is made up? Turn and talk about what you notice.

Kids turn and talk about the features of the article and then share out with the class. They should mention things such as chunks of text under different headings, bold type in the text, photos with captions, diagrams.

MODEL (10 minutes)

Kids continue to sit in a group with you in front of them.

TEACHER TIP: This segment of the lesson is about the teacher modeling for students. This should not only be instructive but also interactive.

Say: As we talked about, this article is nonfiction, and a lot of nonfiction includes features that can guide our learning. We saw some nonfiction features while browsing through this article. Features like headings, bold text, photos, captions, and diagrams can help us better understand what we are reading.

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 two-column chart. Let's look at the first pages. I'm going to read and view what's on the pages.

Say: Read aloud the title and text and refer to the photo.

Say: A title is a feature that we find in both fiction and nonfiction. In nonfiction, a title often gives us a clue about what we will be reading. When I read the title “Turning Trash into Treasure,” I get some good information. The title is letting me know that the article is about trash and turning it into some kind of treasure. By reading and thinking about the title, I have a lot of questions that I can consider as I read on. As I continue to read, the text and photo introduce me to Arthur Huang. I also find out from the text that the trash is plastic, and Arthur Huang has plans for the

LANGUAGE ARTS

Notice and Use Nonfiction Features to Guide Learning

piles of plastic trash we have on Earth. However, I still don't know what the treasure is, so I'm curious about that.

Say: Now, I'm going to write on my chart. I'll put "title" in the "FEATURE" column and "tells about the article" in the "PURPOSE" column. Under "FEATURE," I'm also going to add "photo." What is the purpose of the photo? Turn and talk about that.

Kids turn and talk.

Say: That's it! The photo lets us see the person the article is about. I'm going to write this in the "PURPOSE" column.

GUIDE (10 minutes)

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

Say: We had a good start with finding nonfiction features, and there are more in this article. As you read and notice a nonfiction feature, write down on your Think Sheet what the feature is and its purpose.

Turn to the next pages.

Say: First, let's turn and talk about a feature on the next pages that we already saw and talked about on the previous page.

Kids should notice the photos.

Say: Did you notice any new features? Turn and talk about that.

Kids turn and talk and then share what they think are new features.

Say: Did you notice the heading(s)—the bold text in a different color at the top? A heading gives you an idea about what the text that follows it will tell you. It's kind of like a title for a section of text.

TEACHER NOTE: In Pioneer, the heading is "Building with Plastic Bottles." In Trailblazer, the headings are "Building with Plastic Bottles" and "Eco-Friendly."

Say: And what about the bold words that appear in the text. What do you think their purpose is? Turn and talk about that.

Kids turn and talk. They should mention that bold words are important terms. They may also note that bold terms are often defined in a glossary.

Say: Before we continue, write these features and their purpose on your Think Sheet.

Allow time for kids to write.

Say: Did you notice the sentences near each of the photos? These are called captions. Captions are a new feature in this article. What is their purpose? Turn and talk about that.

Kids turn and talk and should note that a caption tells what is in the photo or something about the photo.

Say: Be sure to write about captions and their purpose on your Think Sheet.

Allow time for kids to read the pages and then turn and talk about what they read and how the nonfiction features helped them understand more about Arthur Huang's EcoArk.

LANGUAGE ARTS

Notice and Use Nonfiction Features to Guide Learning

COLLABORATE (25 minutes)

Say: Now it's time for you to work with a partner. Read through the next pages and note all of the nonfiction features you find that we've already talked about and written down on our Think Sheets. If you run across something new, try to figure out what to call the feature and what its purpose is. Jot down anything new you find on your Think Sheet.

Partners work together. Move around the room, conferring with partners. Kids should notice headings and bold terms as well as the new features.

- *"Wordwise" is a new feature. It is a glossary that gives definitions of the bold words in the article.*
- *"Trashpresso" and "Circular Economy" are two different types of diagrams that visually show or represent different processes. The illustrated trashpresso diagram shows and explains Huang's invention and how it works. The Circular Economy diagram shows how waste can be used and reused in a continuous cycle.*

Allow time for kids to read and then talk about the features on these pages. Encourage them to discuss how the features helped them understand what they were reading about. You might want to discuss the two diagrams on the pages to make sure kids understand them and their connection to the article.

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 feature and purpose you would like to share. I am going to invite [student name] to share new learning. We are going to share using respectful language. So when I ask: "[student name] 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: Awesome job, everyone! Don't be surprised if you start seeing these features in all of the nonfiction you read. As you read more nonfiction, you'll start to find that these features will guide you in learning and understanding.

THINK SHEET

As you read, write each feature you see.
Then write its purpose.

FEATURE	PURPOSE

HOJA DE PENSAR

A medida que lees, anota las características que veas.
Luego escribe su función.

CARACTERÍSTICA	FUNCIÓN

LESSON FRAME

Notice and Use Nonfiction Features to Guide Learning

This frame is a template of the language arts lesson. 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.

What You Will Need

- Nonfiction text
- Think Sheet template
- Clipboards
- Pencils

CONNECT & ENGAGE (5 minutes)

Kids are in a group with you in front of them.

Say: This article _____ is nonfiction. Do you know what nonfiction is? Turn and talk with a partner about what you know about nonfiction.

Kids turn and talk and share what they know about nonfiction. Make sure kids know that nonfiction is text that gives us true or real information. It includes facts. It is not made up or make believe.

Say: Let's browse through this article before we start reading. For this lesson, we are going to focus on some of the features of nonfiction. As you look through the article, what are a few things you notice that are different from a story that is made up? Turn and talk about what you notice.

Say: Kids turn and talk about the features of the article and then share out with the class. They may mention things such as chunks of text under different headings, bold type in the text, photos with captions, and diagrams.

MODEL (10 minutes)

Kids continue to sit in a group with you in front of them.

Say: As we talked about, this article is nonfiction, and a lot of nonfiction includes features that can guide our learning. We saw some nonfiction features while browsing through this article. Features like headings, bold text, photos, captions, and diagrams can help us better understand what we are reading.

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 two-column chart. Let's look at page(s) _____. I'm going to read and view what's on the pages.

Read aloud the title and text on page(s) _____ and refer to any photos.

Say: Well, I'm starting to get some information from the title, text, and photo(s) on these pages. The title is letting me know that the article has something to do with _____. Since the photo(s) are showing _____, that is giving me a clue that this article is about _____. I'm going to write this down on my chart. I'll put "title" in the "FEATURE" column and "tells about the article" in the "PURPOSE" column. Under "FEATURE" I'm also going to add "photos." What is the purpose of photos? Turn and talk about that.

Say: That's it! The photos give us information we can see. I'm going to write this information in the "PURPOSE" column.

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 with you in front of them.

Say: We had a good start with finding nonfiction features, and there are more in this article. As you read and notice a nonfiction feature, write down on your Think Sheet what the feature is and its purpose.

Turn to page(s) _____.

Say: First, see if there are any features here that we've already seen and talked about on previous pages. Turn and talk about that.

Kids turn and talk with a partner.

Say: What new features did you notice?

Kids share out.

Say: Now be sure to record these features and purposes on your Think Sheet.

COLLABORATE (25 Minutes)

Say: Now it's time for you to work with a partner. Read through pages ____ and note all of the nonfiction features you find that we've already talked about and written down on our Think Sheets. If you run across something new, try to figure out what to call the feature and what its purpose is. Jot down anything new you find on your Think Sheet.

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

Say: Allow time for kids to talk about the features on these pages and how they help them better understand what they are reading.

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 feature and purpose you would like to share.

Say: I am going to invite [student name] to share new learning. We are going to share using respectful language. So, when I ask: "[student name] 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.

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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: Awesome job, everyone! Don't be surprised if you start seeing these features in all of the nonfiction you read. As you read more nonfiction, you'll start to find that these features will guide you in learning and understanding.

RETHINKING SPINOSAURUS

SCIENCE

Standards Supported

- **NGSS Science and Engineering Practices: Scientific Knowledge is Based on Empirical Evidence:** Scientists look for patterns and order when making observations about the world. (2-LS4-1)
- **NGSS LS4.A: Evidence of Common Ancestry and Diversity:** Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments. (3-LS4-1)

What You Will Need

- Projectable PDF or interactive digital magazine
- Content Assessment Master (pages 11–12)
- Article Test (pages 19–20)

SCIENCE BACKGROUND

Spinosaurus aegyptiacus lived around 97 million years ago. Stretching more than 15 meters (50 feet) long, it was the biggest and baddest of all meat-eating dinosaurs. It also swam.

Spinosaurus floated like a crocodile as it stalked prey in North Africa's rivers. It ate lungfish, sharks, crocodilian creatures, and other dinosaurs. It used its backward-slanted, spike-shaped teeth to catch prey. The hooked claws on its long, powerful arms snagged anything that tried to get away.

German paleontologist Ernst Freiherr Strommer von Reichenbach discovered the first *Spinosaurus* fossils in 1912. The fossils he found were destroyed during World War II. In 2008, National Geographic Explorer Nizar Ibrahim led a team that discovered new fossils. Ibrahim tracked down Stromer's notes and studied the dinosaur further. His work continues to reveal new details about this ancient aquatic predator.

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 *Spinosaurus*.

EXPLORE

Display the “**Rethinking Spinosaurus**” article from the interactive digital magazine. As a class, brainstorm ideas about why a scientist might “rethink” what he or she knew about a dinosaur.

EXPLAIN

After reading, have students review the Wordwise feature at the end of the article. Challenge students to explain how the words summarize the way Nizar Ibrahim studied *Spinosaurus*. (Possible response: He *observed* a bone and other evidence to develop a *hypothesis*. He developed a *method* to conduct *experiments* that tested that hypothesis. Then he formed a *conclusion* based upon the results.) Have students turn and talk as they identify the new evidence Ibrahim found and discuss how what he did with it and how it affected his conclusion. (He found more fossils of tail bones. He studied how they connected to each other. He created digital and real life-size models to test his ideas. The results strengthened his conclusion that *Spinosaurus* spent most of its time in the water.) Encourage students to share what they learned about *Spinosaurus* and the process of scientific discovery.

ELABORATE

Have students examine photo of the life-size model and the illustration of *Spinosaurus's* tail in the article. Brainstorm ideas about why the new shape would help a dinosaur survive if it spent most of its time in the water.

EVALUATE

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

CONTENT ASSESSMENT: RETHINKING SPINOSAURUS

Use the organizer to record information about the article.

What did Nizar Ibrahim want to know when he first started studying the strange dinosaur fossils he had found?

What experiment did he do to find the answers?

What conclusion did he reach? What evidence led him to reach this conclusion?

What new evidence did he find? What does he think now? Why?

EVALUACION DE CONTENIDO: REPENSAR EL ESPINOSAURIO

Usa el organizador para anotar información sobre el artículo.

¿Qué quería saber Ibrahim cuando empezó a estudiar los extraños fósiles de dinosaurio que encontró?

¿Qué experimento hizo para encontrar las respuestas?

¿A qué conclusión llegó? ¿Qué pruebas le llevaron a esa conclusión?

¿Qué nuevas pruebas encontró? ¿Qué piensa ahora? ¿Por qué?

THE TRANSFORMER

SCIENCE

Standards Supported

- **NGSS LS4.D: Biodiversity and Humans:** There are many different kinds of living things in an area, and they exist in different places on land and in water. (2-LS4-1)
- **NGSS LS4.C: Adaptation:** For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. (3-LS4-3)

What You Will Need

- Projectable PDF or interactive digital magazine
- Content Assessment Master (pages 14–15)
- Article Test (pages 21–22)

SCIENCE BACKGROUND

Dragonflies are predatory insects found on every continent but Antarctica. There are about 7,000 different species.

Like many insects, dragonflies undergo incomplete metamorphosis. Females lay eggs in the water. After seven to eight days, the eggs hatch and wingless nymphs emerge. Nymphs may stay in the water for years, hunting aquatic insects, mosquito larvae, and small fish. They molt, or shed their skin, many times as they grow.

After a nymph goes through its final molt, a fully formed adult emerges. The adult has four horizontal wings. Dragonflies are exceptional fliers. They can fly backward, hover like helicopter, and reach speeds up to 56 kilometers (35 miles) an hour as they chase prey. That speed, paired with superior eyesight, means they usually nab what they're after. Adults may only live a few months, so their other priority is finding a mate.

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 dragonflies.

EXPLORE

Display the **article “The Transformer”** from the interactive digital magazine. As a class discuss what it means to transform.

EXPLAIN

After reading, invite students to share what they learned about the life cycle of a dragonfly. **Ask:** *What is metamorphosis?* (a process of change that takes place as insects approach adulthood) *What does it mean that dragonflies undergo incomplete metamorphosis?* (They change in three stages—egg, nymph, adult—instead of four—egg, larva, pupa, adult.) Have students turn and talk as they discuss what happens during each stage of a dragonfly's life cycle. Encourage them to explain what molting is and why it is an important part of the process. Challenge students to identify where the dragonfly lives, what it eats, and how it catches its food during each stage of its life cycle.

ELABORATE

Invite students to conduct research to identify more insects that undergo metamorphosis. Have them sort the insects they find into two groups: complete and incomplete metamorphosis. Challenge them to create an educational display that highlights key differences between these two types of insects.

EVALUATE

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

CONTENT ASSESSMENT: THE TRANSFORMER

Draw a picture of a dragonfly nymph. Then answer the questions.

nymph	Where does it live? _____ _____
	What does it eat? _____ _____
	How does it get food? _____ _____

Draw a picture of an adult dragonfly. Then answer the questions.

adult	Where does it live? _____ _____
	What does it eat? _____ _____
	How does it get food? _____ _____

EVALUACION DE CONTENIDO: LA GRAN TRANSFORMADORA

Dibuja una ninfa de libélula. Luego responde las preguntas.

ninfa	¿Dónde vive? _____ _____
	¿Qué come? _____ _____
	¿Cómo consigue su comida? _____ _____

Dibuja una libélula adulta. Luego responde las preguntas.

adulta	¿Dónde vive? _____ _____
	¿Qué come? _____ _____
	¿Cómo consigue su comida? _____ _____

TURNING TRASH INTO TREASURE

SCIENCE

Standards Supported

- **NGSS ETS1.A: Developing Possible Solutions:** Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (K-2-ETS1-2)
- **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)

What You Will Need

- Projectable PDF or interactive digital magazine
- Content Assessment Master (pages 17-18)
- Article Test (pages 23-24)

SCIENCE BACKGROUND

Plastic pollution is a growing problem around the world, and National Geographic Explorer Arthur Huang and his team have found an impressive solution. They built the EcoArk, a nine-story building in Taiwan that is constructed out of 1.5 million recycled plastic bottles.

Powered by solar energy and strong enough to withstand fires and earthquakes, EcoArk has been hailed as the future of green buildings. Huang and his team also invented the Trashpresso, an assembly line of machines that transforms plastic trash into six-sided tiles that can be used to build walls, floors, or ceilings.

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 recycling.

EXPLORE

Display the **“Turning Trash Into Treasure”** article from the interactive digital magazine. Invite students to examine the article's photos. Challenge them to identify the type of “trash” this article is about and the type of “treasure” it is being turned into.

EXPLAIN

After reading, have students share what they learned about upcycling. **Ask:** *How is EcoArk an example of upcycling?* (It is a nine-story building made out of recycled plastic bottles.) *What is Trashpresso?* (Trashpresso is an assembly line of machines that changes plastic garbage into new products.) *How does it work?* (The machines shred plastic trash into flakes. The flakes are washed, dried, and placed into molds. They are pressed and melted into tiles.) As a class, discuss how a portable system like this could help create circular economies. Brainstorm ideas about the types of products people could make.

ELABORATE

Point out to students that people are used to building with traditional materials like wood, steel, and cement. As a class, brainstorm ideas about how Arthur Huang could market his product to convince more developers to construct buildings out of recycled plastic.

EVALUATE

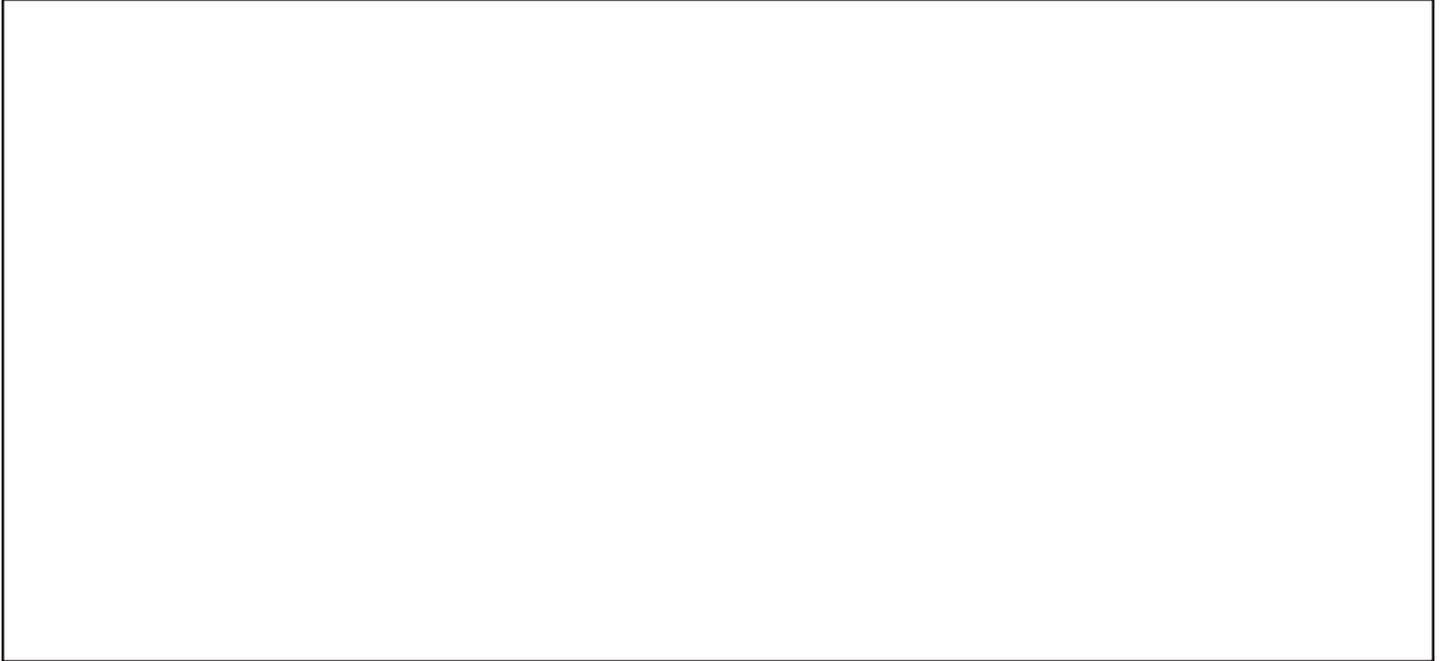
Have students complete the **Content Assessment** for this lesson. Encourage them to share and compare the results in small groups.

Name _____

Date _____

CONTENT ASSESSMENT: TURNING TRASH INTO TREASURE

Brainstorm ideas for a new product that could be made out of recycled plastic. Draw a picture of your invention.



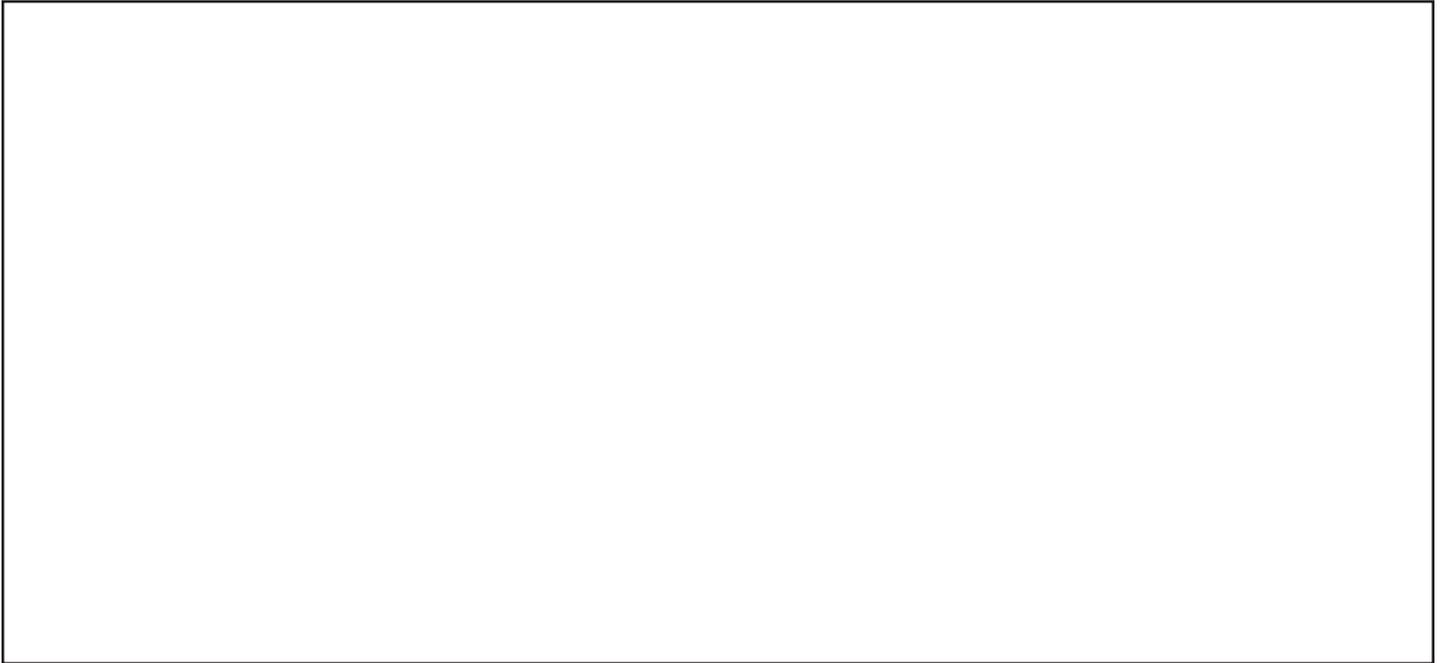
What is your invention? _____

What does it do? _____

How is it an example of upcycling? _____

EVALUACION DE CONTENIDO: DE BASURA A TESORO

Haz una lluvia de ideas sobre cómo fabricar un producto a partir de plástico reciclado. Haz un dibujo de tu invento.



¿Cuál es tu invento? _____

¿Qué hace? _____

¿Por qué es un ejemplo de suprarreciclaje? _____

ARTICLE TEST: RETHINKING SPINOSAURUS

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

1. Where hypothesis did Nizar Ibrahim form after seeing *Spinosaurus* fossils?

- Ⓐ He thought the dinosaur lived in the desert.
- Ⓑ He thought the dinosaur lived in water.
- Ⓒ He thought the dinosaur flew.

2. What experiment did he do to test his hypothesis?

- Ⓐ He hatched an egg.
- Ⓑ He trained a *Spinosaurus*.
- Ⓒ He made a digital model.

3. What is one thing he discovered?

- Ⓐ *Spinosaurus* had webbed feet.
- Ⓑ *Spinosaurus* had a short tail.
- Ⓒ *Spinosaurus* had long, powerful back legs.

4. What did new fossils reveal about *Spinosaurus*?

- Ⓐ Its jaws were round.
- Ⓑ Its tail was broad.
- Ⓒ Its feet were hoofed.

5. How did Ibrahim test the new evidence? What did it show?

PRUEBA DEL ARTICULO: REPENSAR EL ESPINOSAURIO

Lee cada pregunta. Llena el círculo de cada respuesta correcta y escribe la última respuesta en los espacios en blanco.

1. Según la hipótesis que formuló Ibrahim al ver los fósiles, ¿dónde vivía el espinosaurio?

- Ⓐ Pensó que el dinosaurio vivía en el desierto.
- Ⓑ Pensó que el dinosaurio vivía en el agua.
- Ⓒ Pensó que era un dinosaurio volador.

2. ¿Qué experimento hizo para poner a prueba su hipótesis?

- Ⓐ Abrió un huevo.
- Ⓑ Adiestró a un espinosaurio.
- Ⓒ Hizo un modelo digital.

3. ¿Cuál de estas cosas descubrió?

- Ⓐ El espinosaurio tenía pies palmeados.
- Ⓑ El espinosaurio tenía la cola corta.
- Ⓒ El espinosaurio tenía largas y poderosas patas traseras.

4. ¿Qué revelaron los fósiles recién descubiertos sobre el espinosaurio?

- Ⓐ Las mandíbulas eran redondeadas.
- Ⓑ Tenía la cola ancha.
- Ⓒ Tenía pezuñas en las patas.

5. ¿Cómo puso a prueba Ibrahim las nuevas evidencias? ¿Qué demostró esa prueba?

ARTICLE TEST: THE TRANSFORMER

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

1. What do insects do during metamorphosis?

- Ⓐ lay eggs
- Ⓑ hibernate
- Ⓒ change into adults

2. What are the stages of incomplete metamorphosis?

- Ⓐ egg, larva, pupa, adult
- Ⓑ larva, nymph, adult
- Ⓒ egg, nymph, adult

3. Where do dragonflies live when they are nymphs?

- Ⓐ on land
- Ⓑ in water
- Ⓒ on ice

4. What happens when dragonflies molt?

- Ⓐ They fly long distances.
- Ⓑ They shed their skin.
- Ⓒ They attract mates.

5. What are two ways dragonfly nymphs look different from the adults?

PRUEBA DEL ARTICULO: LA GRAN TRANSFORMADORA

Lee cada pregunta. Llena el círculo de cada respuesta correcta y escribe la última respuesta en los espacios en blanco.

1. ¿Qué hacen los insectos durante la metamorfosis?

- Ⓐ ponen huevos
- Ⓑ hibernan
- Ⓒ cambian a adultos

2. ¿Cuáles son las fases de la metamorfosis incompleta?

- Ⓐ huevo, larva, pupa, adulto
- Ⓑ larva, ninfa, adulto
- Ⓒ huevo, ninfa, adulto

3. ¿Dónde viven las libélulas cuando son ninfas?

- Ⓐ en tierra
- Ⓑ en el agua
- Ⓒ sobre el hielo

4. ¿Qué les pasa a las libélulas cuando mudan?

- Ⓐ Vuelan largas distancias.
- Ⓑ Se desprenden de su piel.
- Ⓒ Atraen a sus parejas.

5. ¿Cuáles son dos diferencias clave entre las ninfas y las libélulas adultas?

ARTICLE TEST: TURNING TRASH INTO TREASURE

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

1. What is the EcoArk?

- Ⓐ a boat
- Ⓑ a building
- Ⓒ a bottle

2. What is it made out of?

- Ⓐ glass panels
- Ⓑ concrete and steel
- Ⓒ recycled plastic

3. What makes the EcoArk eco-friendly?

- Ⓐ It creates greenhouse gases.
- Ⓑ It uses oil, coal, and natural gas.
- Ⓒ It doesn't harm the environment.

4. What is created during upcycling?

- Ⓐ more valuable products
- Ⓑ taller products
- Ⓒ very expensive products

5. How does the Trashpresso help create a circular economy?

PRUEBA DEL ARTICULO: DE BASURA A TESORO

Lee cada pregunta. Llena el círculo de cada respuesta correcta y escribe la última respuesta en los espacios en blanco.

1. ¿Qué es el EcoArk?

- Ⓐ un barco
- Ⓑ un edificio
- Ⓒ un recipiente

2. ¿De qué está hecho?

- Ⓐ de paneles de vidrio
- Ⓑ de hormigón y acero
- Ⓒ de plástico reciclado

3. ¿Qué hace que el EcoArk sea ecológico?

- Ⓐ Genera gases de efecto invernadero.
- Ⓑ Consume petróleo, carbón y gas natural.
- Ⓒ No daña el medio ambiente.

4. ¿Qué se crea durante el suprarreciclaje?

- Ⓐ productos más valiosos
- Ⓑ productos supranaturales
- Ⓒ productos muy caros

5. ¿Cómo contribuye el Trashpresso a crear una economía circular?

PIONEER AND TRAILBLAZER

ANSWER KEY

RETHINKING SPINOSAURUS

Content: pages 11-12

Question 1: Possible responses include: Are they *Spinosaurus* fossils? If so, how did *Spinosaurus* compete with other dinosaurs for prey? How did it survive? Where did it live? What did it eat?

Question 2: He used the fossils he had to make a digital model on a computer. He even made skin for his model. Later on, he built a life-size model.

Question 3: He concluded that *Spinosaurus* spent most of its time in the water. Evidence that brought him to this conclusion included the dinosaur's long tail, webbed feet, and high nostrils.

Question 4: He found more *Spinosaurus* tail bones. He is even more sure that *Spinosaurus* spent most of its time in the water because the bones showed him that *Spinosaurus'* tail wasn't narrow and pointed. It was broad with bumps on the end. The shape and bumps would have helped the dinosaur swim.

Article Test: pages 19-20

1B, 2C, 3A, 4B, 5: Ibrahim created a real model with the new tail shape and tested it in the water. He found that the tail had more forward thrust in the water than other dinosaurs have on land. *Spinosaurus* used it as a paddle in the water.

THE TRANSFORMER

Content: pages 14-15

Students should draw pictures of a dragonfly nymph and adult that resemble those shown on the opening pages of the article.

Nymph: Nymphs live in water. They eat insects, small tadpoles, and fish. They grab prey with their lower lip and stab it with sharp spines on the lip.

Adult: Adults live on land. They eat other insects. They catch prey while they're flying. They grab it with their legs, bite off the wings, and then eat it.

Article Test: pages 21-22

1C, 2C, 3B, 4B, 5: Possible responses: Nymphs don't have wings, adults do; A nymph's eyes are set far apart, but the adult's eyes are close together; Nymphs have brown and green bodies, but adult bodies are brightly colored.

TURNING TRASH INTO TREASURE

Content: pages 17-18

Answers will vary, but students should draw pictures of an invention they could create out of recycled plastic, identify what it is, describe what it can do, and explain why it is an example of upcycling.

Article Test: pages 23-24

1B, 2C, 3C, 4A, 5: Trashpresso changes waste products into something more valuable and nothing is thrown away.

PIONEER Y TRAILBLAZER

CLAVE DE RESPUESTAS

REPENSAR EL ESPINOSAURIO

Contenido: páginas 11-12

Pregunta 1: Posibles respuestas: ¿Son fósiles de espinosaurio? Si lo son, ¿cómo compitieron los espinosaurios con otros dinosaurios carnívoros? ¿Cómo sobrevivieron? ¿Dónde vivieron? ¿Qué comían?

Pregunta 2: Utilizó los fósiles que tenía para hacer un modelo digital en una computadora. Incluso creó una piel para su modelo. Más adelante construyó un modelo de tamaño natural.

Pregunta 3: Concluyó que el espinosaurio pasaba casi todo el tiempo en el agua. Las evidencias que le condujeron a esa conclusión fueron la larga cola del dinosaurio, sus pies palmeados y las fosas nasales altas.

Pregunta 4: Encontró más huesos de la cola del espinosaurio. Ahora está más convencido todavía de que el espinosaurio pasaba casi todo el tiempo en el agua, porque los huesos le demostraron que la cola del espinosaurio no era delgada ni puntiaguda. Era ancha y tenía bultos en la punta. Esa forma y esos bultos le ayudaban a nadar.

Test de artículo: páginas 19-20

1B, 2C, 3A, 4B, 5: Ibrahim creó un modelo real con la nueva forma de la cola y lo puso a prueba en el agua. Descubrió que su cola le daba más impulso en el agua que a otros dinosaurios en tierra. Los espinosaurios la usaban a modo de remo en el agua.

LA GRAN TRANSFORMADORA

Contenido: páginas 14-15

Los dibujos de los estudiantes deben ser similares a los de la ninfa y el adulto de libélula que aparecen en las primeras páginas del artículo.

Ninfa: Las ninfas viven en el agua. Comen insectos, renacuajos y pececillos. Sujetan a la presa con el labio inferior y la atraviesan con las afiladas púas del labio.

Adulta: Los adultos viven fuera del agua. Se alimentan de otros insectos. Atrapan a sus presas al vuelo. Las agarran al vuelo, les arrancan las alas y se las comen.

Test de artículo: páginas 21-22

1C, 2C, 3B, 4B, 5: Respuestas posibles: Las ninfas no tienen alas, los adultos sí; los ojos de una ninfa están separados, pero los del adulto están muy juntos; las ninfas tienen el cuerpo marrón y verde; los cuerpos de las libélulas adultas, sin embargo, son de vivos colores.

DE BASURA A TESORO

Contenido: páginas 17-18

Las respuestas variarán, pero los dibujos deben representar inventos que se puedan crear con plástico reciclado y se deben poder indentificar. También deben explicar por qué son un ejemplo de suprerreciclaje.

Test de artículo: páginas 23-24

1B, 2C, 3C, 4A, 5: El Trashpresso transforma los productos desechados en algo más valioso y no genera basura.