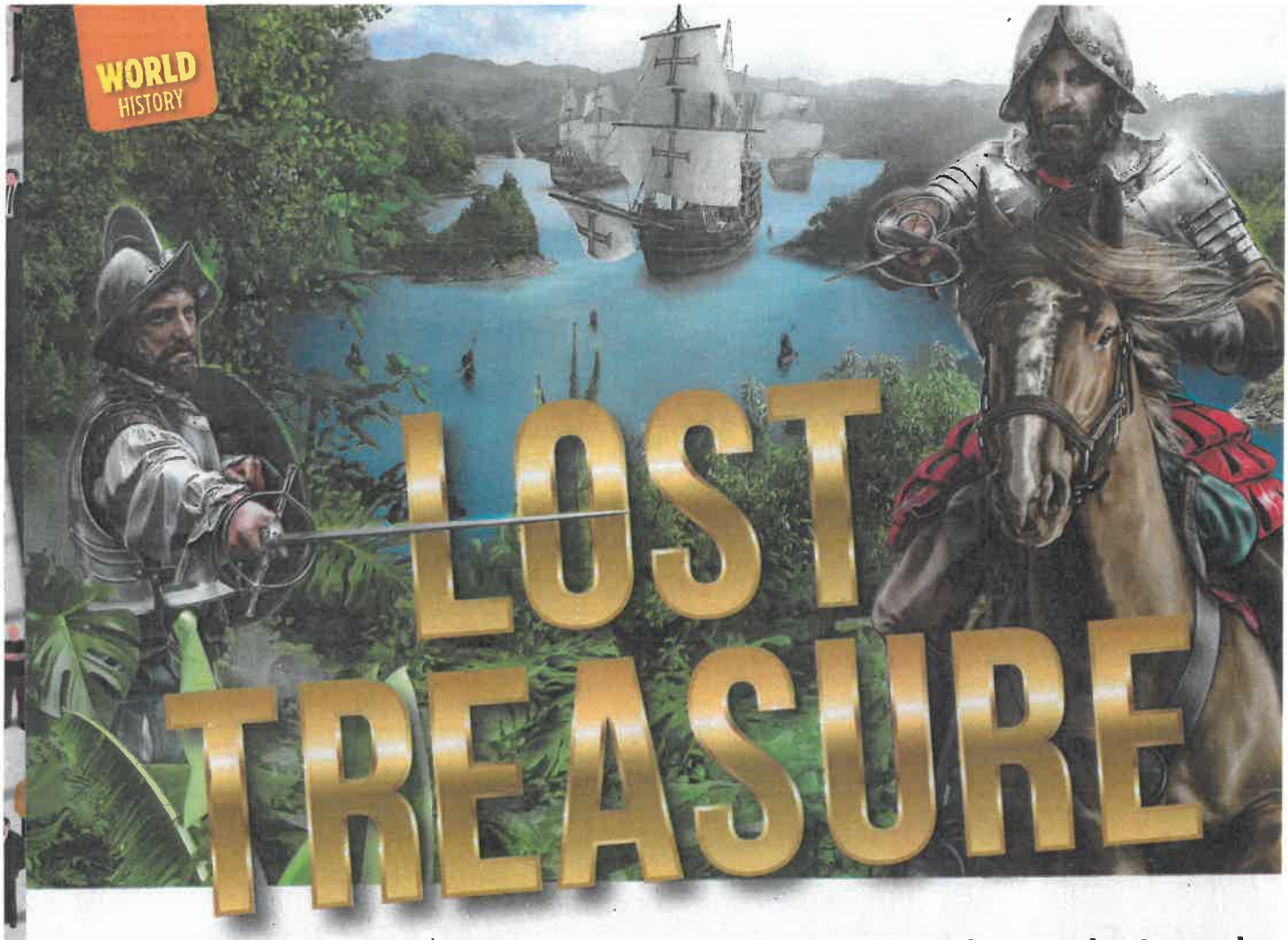
5th Science and Social Studies

WORLD HISTORY



LOST TREASURE

A gold bar found in Mexico once belonged to a mighty ancient empire.

As You Read, Think About: Why do experts think the gold bar is such an important artifact?

June 30, 1520: A fierce battle breaks out in the capital of a great empire. The Aztec ruler, Montezuma II, is found dead. Aztec warriors chase Spanish invaders from Tenochtitlán (tay-nawch-teet-LAHN), their biggest city.

The fleeing Spanish carry bars of gold and other treasures they stole from the Aztecs. Some soldiers drop the gold as they try to escape through the city's **canals**. Weighed down by the loot, others fall into the water and drown. To the Spanish, that night becomes known as *La Noche Triste*, or "the Sad Night."

Now, nearly 500 years later, researchers have determined that a gold bar discovered in Mexico was part of the Aztec treasure lost on that historic night.

A Great Empire

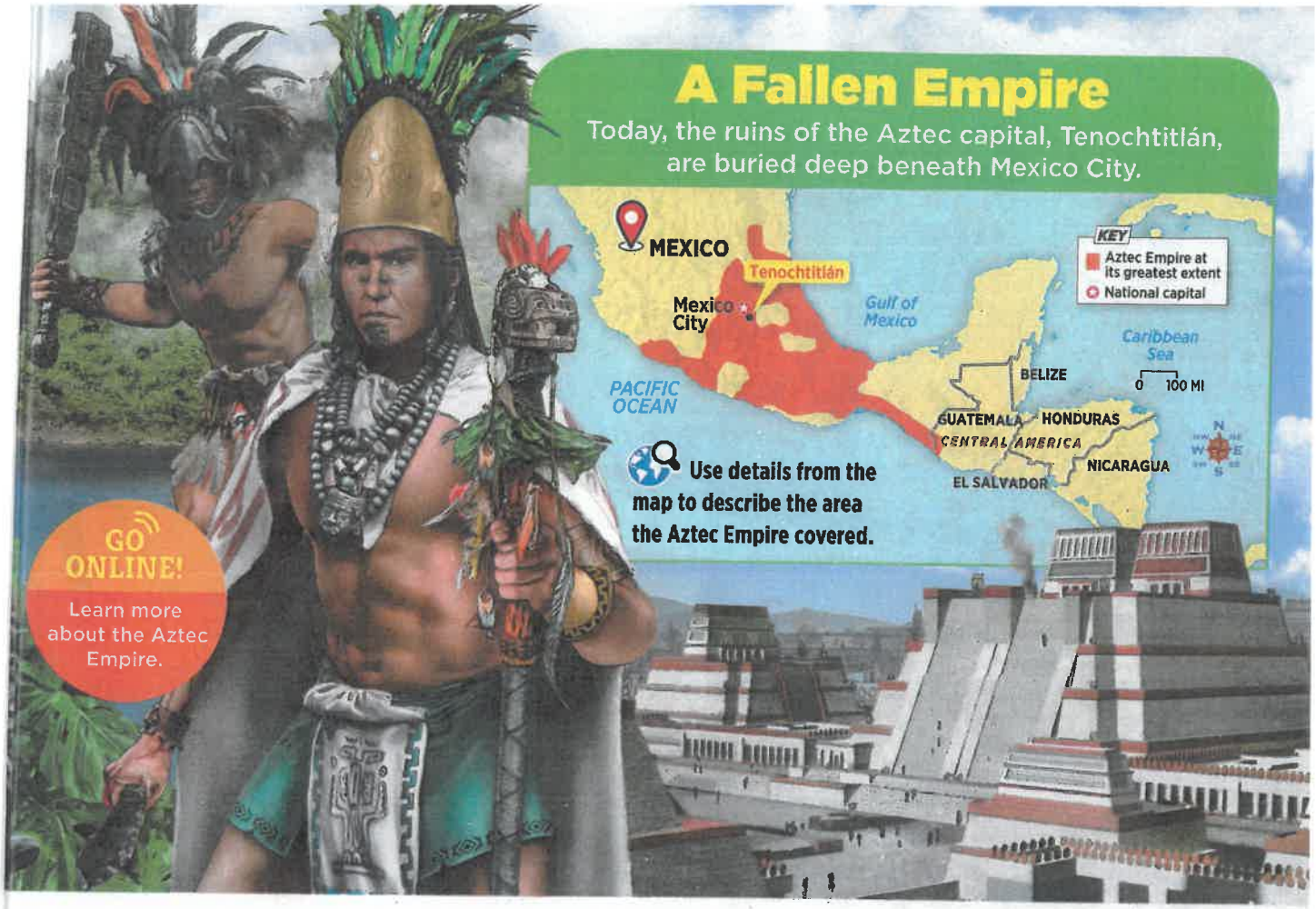
The Aztecs were a wandering people who settled in what is now central Mexico beginning in the late 13th century. They built a powerful **civilization** that thrived for about 200 years.

"There were several million Aztecs," says Michael Smith, an archaeology professor at Arizona State University. "They had a large, complex society."

The Aztecs built vast temples and palaces, developed advanced methods of farming, and created a writing system using symbols. Aztec children went to school and studied history, art, and music.

Tenochtitlán was the center of the empire. It was set on an island in a lake and had canals for streets

DID YOU KNOW?
The Aztec gold bar measures about 10 inches. It's twice as long as it's shown in this photo.



Surprise Visitors

In 1519, the Aztec Empire was at the peak of its power when conquistadors, or conquerors from Spain, arrived. They were led by Hernán Cortés (ehr-NAN kor-TEZ). Montezuma II was uncertain about the visitors, but he invited them to stay in his palace. The Spaniards weren't very good guests, however. For one thing, they began stealing Aztec jewelry.

"They wanted gold that they could carry back to Spain," says Smith. "They had metalworkers melt down a lot of the jewelry and form it into gold bars."

Soon the relationship grew sour, and the Spanish took Montezuma II prisoner. Historians aren't sure exactly who killed him on June 30, 1520, but they agree that his death was the beginning of the end of the Aztec Empire. After fleeing Tenochtitlán that night, Cortés and his army returned about a year later. They soon conquered the Aztecs and established a new colony.

A Golden Clue

In 1981, a construction worker was digging at the site of a new bank in Mexico City. He pulled something unexpected from the mud: a large gold bar weighing about 4 pounds.

Archaeologists studied the bar, but questions remained about its origin. Now, nearly 40 years later, experts have confirmed that it is stolen Aztec treasure dropped by the fleeing conquistadors.

The bar was found in what had been a canal that Cortés and his soldiers used to escape. Experts analyzed the gold with a special type of X-ray and matched it with other gold Aztec artifacts from that time period.

Smith says the gold bar is the first direct evidence of the events of *La Noche Triste*—and a connection to one of the great ancient civilizations.

—by Natalie Smith

WORDS TO KNOW

canals *noun, plural.* human-made waterways used for transportation or for irrigation of land

civilization *noun.* a highly developed and organized society

Page 3: Jim McMahon/Mapman® (map)

MEDIA LITERACY

Were You FOOLED?

GO ONLINE! Can you spot a fake news article?

This year's biggest viral challenge turned out to be a hoax. Here's what you need to know to separate fun from fact.

It started with a wild claim: On February 10, the pull of gravity on Earth would change, allowing a broom to stay balanced when you stood it upright. Within hours, people all over social media were taking the broomstick challenge. On TikTok alone, videos of it have been viewed tens of millions of times.

But the challenge turned out to be based on a hoax. Brooms really can stand upright on any day of the year.

The broomstick challenge is pretty harmless. But experts say it's just one example of a more serious problem on social media: misinformation. That's information that is partly or entirely incorrect, misleading, or **deceptive**. And on popular apps like YouTube and TikTok, it's easy for bad information to go viral.

More Likely to Share

Every day, countless bits of misinformation are shared on social media. Misinformation comes in many forms: a fake news article posted on Twitter or an altered photo passed around on Instagram. It might also be a video from a popular YouTuber that

presents false information as fact.

Often people spread hoaxes for fun or to get likes or shares. But other times, misinformation is about important topics that people are passionate about, like the environment or politics. The goal of these viral hoaxes is to influence people's opinions—and even affect how people vote.

Experts say false information is most effective when it stirs up people's emotions—whether it sparks laughter, sadness, or anger.

"If a post or picture or video makes the viewer feel very strongly, they are more likely to share it," says Sierra Filucci of Common Sense Media. That organization aims to help kids spot false information online.

And, Filucci says, the more a video or post has been liked or shared, the more likely others are to believe it—and to share it without checking the facts.

Designed for Fun

With all this misinformation out there, it can be hard to tell what's true and what's not. Sometimes, the best clue is *where* you're seeing the information.

Think about why people open an app like TikTok. It's probably to watch goofy videos of viral dances, not to do research for a school project. And it's a safe bet you wouldn't go to a news website to find a funny meme. That, says Filucci, is why it's important to understand how some platforms are different from others.

"Places like TikTok or YouTube are designed to be fun and entertaining," she says. "They're not created to communicate accurate information, like news organizations are."

Stop and Think

You may not realize it, but you can play a part in keeping bad information from spreading out of control. Experts say the best way to do that is to be more **skeptical** of what you see online.

"If something seems really strange or really funny or too good to be true, your first step should be to evaluate it," explains Filucci.

Use reliable sources, such as trusted news websites or *.gov* sites, to confirm what you're seeing. Then if you still can't tell if something is true, follow Filucci's simple advice: Don't share it.

—by Jennifer Li Shotz

WORDS TO KNOW

deceptive *adjective.* intended to make someone believe something that is not true

skeptical *adjective.* not easily convinced; having doubts about something

#How to Spot A Fake

With some digging, it wouldn't have been too hard to find the truth about the broomstick challenge.

What You Saw

On February 10, people posted videos of broomsticks standing on their own. They claimed that NASA said it was because of a change in Earth's gravity.

What You Could've Asked

- Why are only brooms affected? Why not anything else?
- How can I find out if this is true before I share it?

How You Could've Found Answers

- Check NASA's website, nasa.gov.
- Search online using keywords like *NASA*, *broomsticks*, and *gravity*.
- Read articles on the websites of respected news organizations.

What You Would've Learned

No reliable articles confirmed a change in Earth's gravity. But many called out this challenge as a hoax.

What's the Truth?

If you stand a broom upright and spread the bristles just right, it can balance on its own on any day.

On February 11, NASA posted the real explanation on its Twitter account.

SPORTS

Making Major-League History

Opening day of the Major League Baseball season is March 26. But the San Francisco Giants have already made history. The team recently hired Alyssa Nakken as an assistant coach, making her the first full-time female coach in the 151-year history of pro baseball.

"It's just nuts to think this hasn't happened before," Nakken says.

Growing up in Woodland, California, Nakken loved playing softball, but she never dreamed she'd one day coach professional baseball. She was a star softball player in high school and went on to become the captain of her college team at Sacramento State University.

Nakken knew she wanted a career in sports and later earned a master's degree in sports management. In 2014, she got a job with the Giants. After working behind the scenes over the next few years, she was promoted to assistant coach in January. Nakken will be on the field before games, working with players on baserunning and fielding. She hopes that seeing her in uniform will inspire more girls to work toward a career in baseball.

"I feel a great responsibility with the younger girls looking up to me," Nakken says. "It's an honor."

Shutterstock.com (baseball stitches); Courtesy of @2020 S.F. Giants/Sara Wildman (Alyssa Nakken); JORGE GUERRERO/AFP via Getty Images (giant geode)

PICTURE THIS

CRYSTAL PALACE

A geode is a rock with a hollow space inside that is lined with crystals. Many geodes are small enough to hold in your hand. But this geode in Pulpí, Spain, is big enough for people to stand inside. Discovered in 1999, it was opened to the public last year.

The giant geode began forming millions of years ago as hot water seeped underground. The water slowly evaporated, leaving behind a clear mineral called gypsum. The gypsum gradually formed crystals that resemble huge jagged pieces of ice.

COUNT Me In!

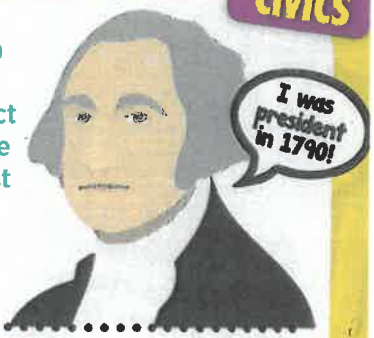
In January, government workers spread out across remote towns in Alaska. They arrived in small planes, then traveled over snow and ice by snowmobiles and even dogsleds. Why? They were there to kick off the 2020 U.S. Census, a nationwide count of all the people living in the country. The first people counted live in a small fishing village named Toksook Bay.

For the rest of the country, the census begins this month. The U.S. Census Bureau will send questionnaires to every household to ask about the number of people who live there, their ages, races, and more. Read on to find out how the federal government uses that information to help make some BIG decisions.

GO ONLINE! Take the 2020 Census Challenge!

Shutterstock.com (numbers, hands, George Washington); Jim McMahon/Mapman® (map)

The U.S. Constitution requires the federal government to conduct a national census once every decade. The first census took place in **1790.**



There are **3** ways to complete the census:

Mail | Internet | Phone

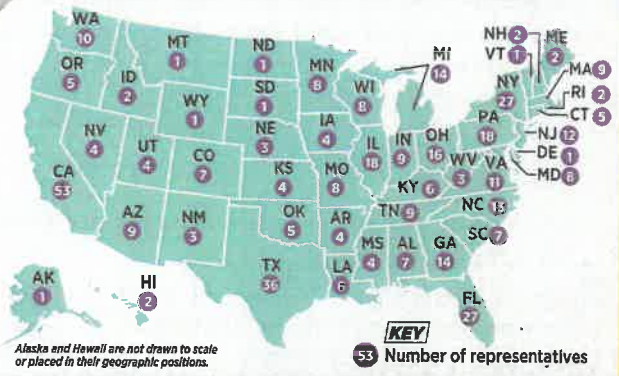
To try to ensure that no one gets left out, census workers will go door-to-door to collect answers from people who don't respond by April 1.

According to the last census, about **309 MILLION** PEOPLE LIVED IN THE U.S. IN 2010.

Census data helps the U.S. government decide how and where to spend about

That money is used to repair roads, build schools and hospitals, and more.

Census results also determine the number of seats each state gets in the U.S. House of Representatives. States with larger populations elect more representatives.



According to the map and text, which state has the second-largest population?

Note: People living in the U.S. territories of American Samoa, Guam, the Northern Mariana Islands, Puerto Rico, and the Virgin Islands are also counted in the census.

NEWS REVIEW

Name: _____

CHART

A GROWING NATION

The U.S. has changed a lot since the first census was taken, in 1790. Today, more people live in the state of Kentucky than lived in the entire country back then! Here's a look at how our nation has grown.

	1790	1900	2010
U.S. Population	4 million	76 million	309 million
Number of States	13	45	50
Most Populous State	Virginia 749,000	New York 7 million	California 37 million
Least Populous State	Delaware 60,000	Nevada 42,000	Wyoming 564,000
President	George Washington	William McKinley	Barack Obama

Note: All numbers are rounded. Source: U.S. Census Bureau

1 **In 2010, the U.S. population was about ____ times as big as it was in 1790.**
Ⓐ 4 Ⓒ 45
Ⓑ 13 Ⓓ 77

2 **Which state had the biggest population when William McKinley was president?**
Ⓐ Virginia
Ⓑ Nevada
Ⓒ New York
Ⓓ California

WRITE ABOUT IT! **Using information from page 7 and this chart, explain how this year's census results might affect residents of California and Wyoming differently.**

Lost Treasure pages 2-3

1 **What happened on *La Noche Triste*?**
Ⓐ The Spanish fled from Tenochtitlán.
Ⓑ The Spanish arrived in Tenochtitlán.
Ⓒ The Spanish conquered the Aztecs.
Ⓓ A gold bar was found buried in Mexico City.

2 **Which detail best supports the idea that the Aztecs built a great *civilization*?**
Ⓐ They were ruled by Montezuma II.
Ⓑ They were a wandering people.
Ⓒ They were defeated by the Spanish.
Ⓓ Their empire thrived for about 200 years.

3 **According to Michael Smith, the Aztec gold bar is important because ____.**
Ⓐ it's the first real evidence of a key historical event
Ⓑ it was created from melted jewelry
Ⓒ the Spanish wanted to steal it
Ⓓ it weighs 4 pounds and measures 10 inches long

Were You Fooled? pages 4-5

4 **What is the main idea of the article?**
Ⓐ The broomstick challenge was a hoax.
Ⓑ Brooms can stand on their own every day.
Ⓒ The spread of misinformation online can be a serious problem.
Ⓓ People often spread misinformation for fun.

5 **Being *skeptical* of information means ____.**
Ⓐ trusting it
Ⓑ sharing it with others
Ⓒ proving it to be true
Ⓓ having doubts about it

6 **The purpose of the sidebar is to explain ____.**
Ⓐ why the broomstick challenge was so popular
Ⓑ how to think more critically about what people post to social media
Ⓒ how to stand a broom on its own
Ⓓ who started the challenge

via Twitter/@Jay Tea (standing brooms); Shutterstock.com (all other photos)

POSTAL INFORMATION: Scholastic News Edition 5/6 (ISSN 1554-2440) is published bi-weekly during the school year except holidays and mid-term, 20 issues, by Scholastic Inc. 2931 East McCarty St., P.O. Box 3710, Jefferson City, MO 65102-3710. Periodical postage paid at Jefferson City, MO 65102 and at additional mailing offices. POSTMASTERS: Send notice of address changes to SCHOLASTIC NEWS Edition 5/6, 2931 East McCarty St., P.O. Box 3710, Jefferson City, MO 65102-3710.

To be used with the March 30, 2020, issue

SCHOLASTIC News

Name: _____

Integrate Information
Common Core R.7

Take Note!

As you watch the "What You Need to Know About the Aztec Empire" video and read the article "Lost Treasure," take notes on the topics below. Then summarize what you learned.

Places:

- **Tenochtitlán:** _____
- **Mexico City:** _____
- **Spain:** _____

People:

- **Hernán Cortés:** _____
- **Montezuma II:** _____
- **Conquistadors:** _____

Details:

- **Canals:** _____
- **La Noche Triste:** _____
- **Aztec civilization:** _____

Dates:

- **1519:** _____
- **1520:** _____
- **1981:** _____

What I learned about the Aztecs:

_____

_____

_____

_____

shutterstock.com (illustrations)

SCHOLASTIC News

Name: _____

Close-Reading Questions

Refer to "Were You Fooled?" to respond to the questions below. Reread the article to find details that support your answers. Remember to write in complete sentences.

1. **What is misinformation? Include an example.**

2. **What are some reasons people spread hoaxes?**

3. **What is the purpose of the section "Stop and Think"?**

SCHOLASTIC NEWS 5/6

ANSWER KEY FOR THE MARCH 30, 2020, ISSUE

Student Edition

Page 2: Map

Sample response: The Aztec Empire spanned present-day Mexico and Guatemala, between the Pacific Ocean and the Gulf of Mexico.

Page 8: News Chart

1. D
2. C

Page 8: News Review

1. A
2. D
3. A
4. C
5. D
6. B

Online Skill Builders

Take Note!

- **Tenochtitlán:** the capital city of the Aztec Empire; more than 200,000 people lived there
- **Mexico City:** Today, the ruins of Tenochtitlán are buried under Mexico City.
- **Spain:** the home of Hernán Cortés and the conquistadors
- **Hernán Cortés:** a Spanish conqueror who arrived in Tenochtitlán and stole from the Aztecs
- **Montezuma II:** the Aztec ruler who allowed Cortés to enter the city; The Spanish took him prisoner, and his death was the beginning of the end of the Aztec Empire.
- **Conquistadors:** conquerors from Spain; They looted Tenochtitlán.
- **Canals:** human-made waterways used for transportation and irrigation of land; Tenochtitlán was set on an island in a lake and had canals for streets
- **La Noche Triste:** "the Sad Night," a name the Spanish gave to the night they fled Tenochtitlán
- **Aztec civilization:** The Aztecs were warriors, farmers, and architects; they had bustling marketplaces, developed a complex calendar, and created a writing system.
- **1519:** Cortés arrived in the Aztec capital.
- **1520:** Montezuma II was killed, and the Spanish fled Tenochtitlán; they returned a year later and conquered the Aztecs.
- **1981:** A construction worker found a gold bar at the site of a new bank in Mexico City.

Fact or False?

Responses will vary.

Be a Quiz Whiz!

1. D
2. D
3. D
4. B
5. D
6. A
7. C
8. A
9. B
10. B

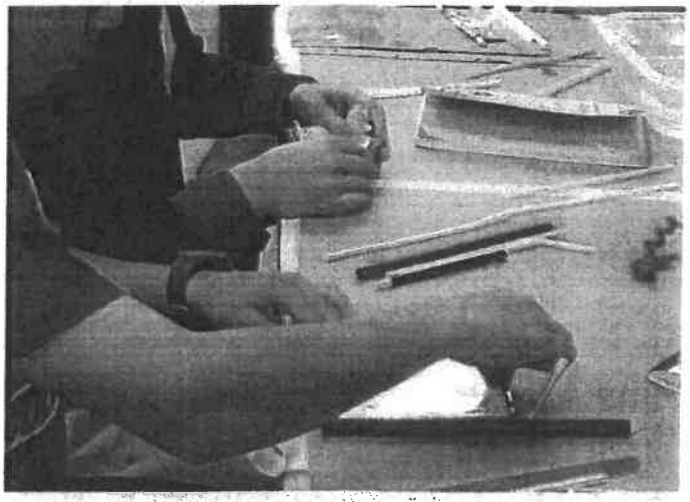
Close-Reading Questions: Lost Treasure

1. The Aztecs built vast temples and palaces, developed advanced methods of farming, and created a writing system using symbols. Additionally, children went to school and studied history, art, and music.
2. When Cortés and his men arrived from Spain, Montezuma II was uncertain about the visitors, but he still invited them to stay in his palace. But then the relationship soured. A key reason is that the Spaniards began stealing Aztec jewelry. Then they took Montezuma II prisoner, conquering the Aztecs after his death.
3. The section is about a gold bar that was discovered in Mexico City in 1981. After years of tests, archaeologists confirmed that the bar belonged to the Aztecs and had probably been stolen.

Close-Reading Questions: Were You Fooled?

1. Misinformation is information that is partly or entirely incorrect, misleading, or deceptive. Misinformation comes in many forms such as a fake news article spread on social media, an altered photo, or a video that presents false information as fact.
2. People may spread hoaxes for fun or to get likes or shares. But other hoaxes are efforts to spread misinformation about important topics such as the environment or science. The goal of these online hoaxes is to influence people's opinions—and even affect how people vote.
3. The section explains how you can play a part in preventing inaccurate information from spreading.

Starter STEM Challenges



6 hands-on engineering design activities

VIVIFYSTEM.COM

Vivify STEM EDUCATION

Table of Contents

THANK YOU!

Thank you for downloading a Vivify product! If you have any questions, please email us at info@vivifystem.com.

ABOUT VIVIFY

Vivify is a team comprised of two Aerospace Engineer friends, Natasha and Claire, who live in Texas. We met as college classmates and roommates at Texas A&M University and later left engineering careers in the Department of Defense and Air Tractor to pursue our passion for STEM education. Learn more of our story here.

Our goal is to bring engineering to life—to vivify learning—for kids of all ages. Please connect with us so we can learn how to better serve your students!

- Natasha & Claire, The Vivify Team

Connect with us for free STEM resources!

Subscribe to our newsletter and receive access to a library of free STEM resources through www.vivifystem.com. Follow us on social media or listen to "The STEM Space" podcast for more resources and ideas. We also welcome you to join "The STEM Space" Facebook group to connect with other educators across the world.

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Note to Teachers

NEXT GENERATION SCIENCE STANDARDS

The Start STEM Challenges follow the NGSS Engineering Design Standards for Elementary and Middle School.

3-5-ETS1-1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5-ETS1-2.	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
3-5-ETS1-3.	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-2.	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3.	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4.	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
4-ESS3-1.	Obtain and combine information from books and other reliable media to describe that energy and fuels are derived from natural resources and their uses affect the environment.

Note to Teachers

ABOUT THIS ACTIVITY

STEM challenges are an amazing way to keep students engaged in learning. They incorporate math and science concepts with creativity, innovation, and critical thinking.

The following are great starter STEM challenges that incorporate the entire engineering design process. Use these during a class, program, or as a take-home activity.

PAPER TABLE CHALLENGE

Build a paper table that is at least six inches high and can hold a heavy book for five seconds.

BUILD A BOAT CHALLENGE

Build an aluminum foil boat that can hold at least 25 pennies without sinking.

MIGHTY MACHINE CHALLENGE

Use the stored elastic energy of rubber bands to build a catapult that can launch an object 20 feet.

EGG DROP CHALLENGE

Drop an egg from 5 feet without cracking it.

BALLOON CAR CHALLENGE

Build a balloon-powered car that will travel 5 feet.

HELPING HAND CHALLENGE

Build a device that lets you grab an object 2 feet away and move to a container 10 feet away.

Note to Teachers

Teacher instructions

1. **Introduce** the engineering design process using the handout provided. Explain to students that real-world engineers use this process to create engineering designs such as rockets, airplanes, skyscrapers, and computers. More great resources: http://pbskids.org/designsquad/parentseducators/workshop/process.html and http://thekidshouldseethis.com/post/whats-an-engineer-the-engineering-process-crash-course-kids

2. **Explain** the activity. Provide students with the STEM Challenge Sheet and explain how they will be using the engineering design process to complete a challenge.

   - Each challenge has specific constraints (or rules) that must be followed. Students should not immediately start building. They must first fully understand the problem and brainstorm ways to use the materials to build a solution.
   - Failure is an important part of the design process. There is not one correct solution for the challenge. Students must be creative as well as persistence during testing to keep trying until their design is successful. An aerospace engineer doesn't build a rocket without doing a lot of testing and re-designing!

3. **Pass** out the student Engineering Mission Sheet. Six different challenges are provided as described on the previous page. Each sheet includes:

   - **Mission**: this is the problem that the student needs to solve.
   - **Materials**: Some challenges require specific materials and others are a suggested list. All materials are cheap and common items.
   - **Engineering Design Constraints**: The rules of the mission.
   - **Design Considerations**: This includes important questions to think about or a connection to an relevant science facts.
   - **Math Connection**: Math problems related to the challenge.
   - **STEM Career Connection**: Connects the challenge to a real-world STEM career, current event or project, and a resource to learn more.

Take-Home Challenge

As a student-driven project, a successful design challenge requires a flexible time frame and relaxed environment to promote creativity and innovation. Unfortunately, a 50 minute class period with 30 other students does not always make the best environment.

The provided challenges can be used as STEM Take-Home Challenges. Students are provided with a Mission Sheet and a Student Handout that guides them through the engineering design process. The challenge, along with relevant math and science concepts, are reviewed in class, and then students are tasked with completing the challenge and recording results. All challenge materials are easily found around the home or you can provide a take-home pack. Parents are notified with a letter which encourages them to participate and support the learning process. Students then report back and share their final designs with the class.

In-Class Challenge

Challenges are best completed in a small team of 2-3 students. A rubric is provided for assessment. The students should not be graded solely on a successful design, but instead on a successfully completion and understanding of the engineering design process.

Note to Teachers

ADDITIONAL RESOURCES

The following are resources for additional tips and information for each challenge.

- **Paper Table:** http://pbskids.org/designsquad/parentseducators/resources/paper_table.html
- **Build A Boat:** http://www.sciencebuddies.org/science-fair-projects/project_ideas/Aero_p020.shtml
- **Mighty Machine:** http://www.cpalms.org/Public/PreviewResourceLesson/Preview/35511
- **Egg Drop:** http://pbskids.org/designsquad/build/soft-landing/
- **Balloon Car:** http://www.sciencebuddies.org/science-fair-projects/project_ideas/Phys_p099.shtml
- **Helping Hand:** http://pbskids.org/designsquad/parentseducators/resources/helping_hand.html

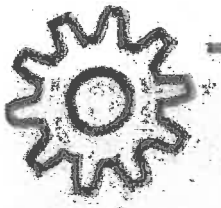
Engineering Design Process

1

Identify the Problem

2

Brainstorm



3

Design

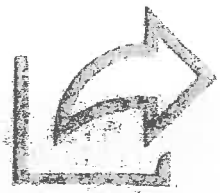
4

Build

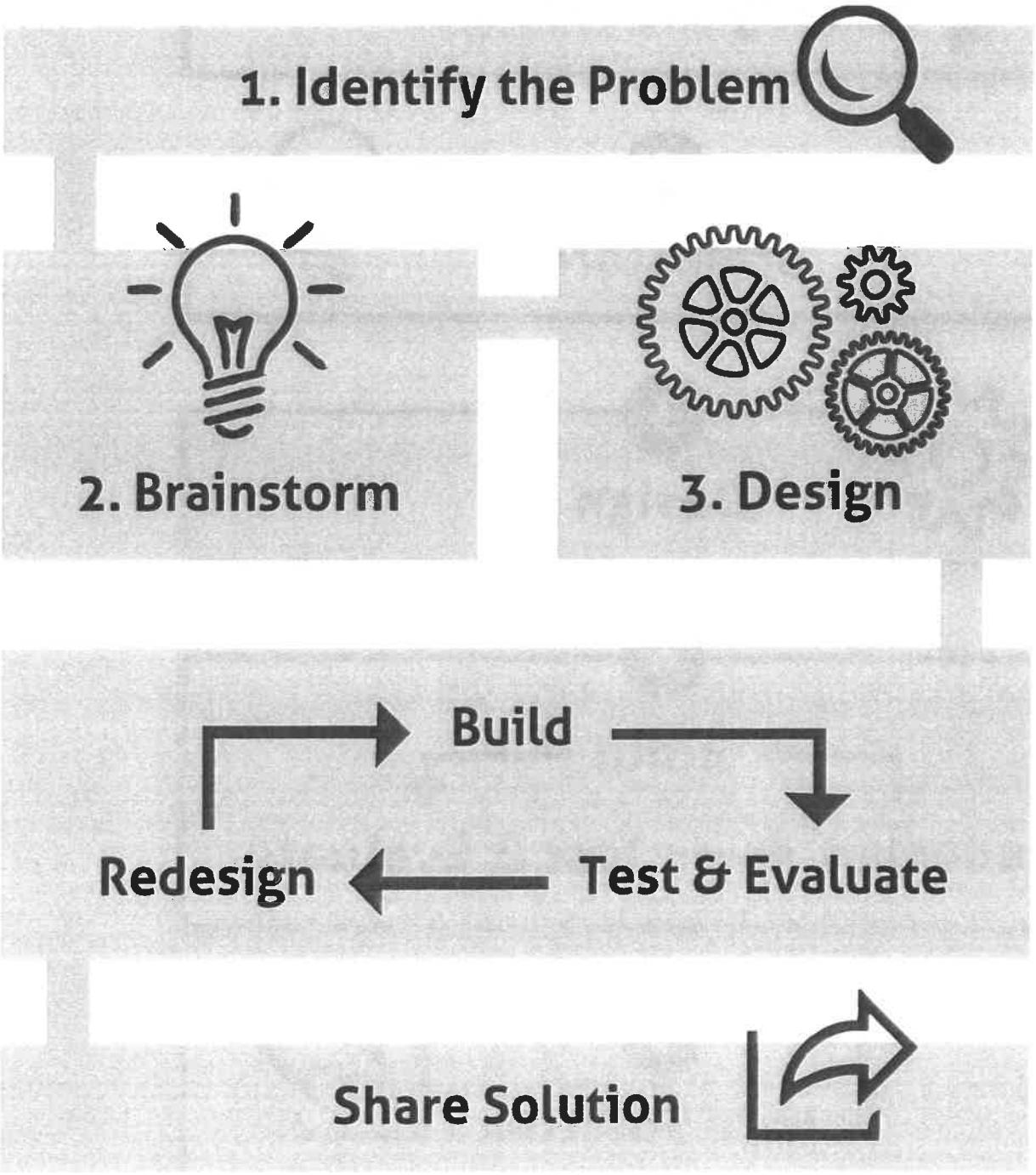
Redesign ← Test & Evaluate

5

Share Solution



Engineering Design Process



Note to Teachers

Teacher instructions- Rubric

The following rubrics are recommended for use with our Engineering Design Challenges. This analytic assessment rubric can be used to assess each student or team in addition to grading their math extension questions. The editable rubric files are also provided to be customized for your specific needs.

During the engineering design process, use the rubric to assess the individual and/or team progress as you initial the bottom of each packet page. Grading can be provided as a whole team or individual score.

STEM Activity Rubric

Activity: _____ Grade: _____ / 15

Student/Team: _____

	POINTS	3 EXCEPTIONAL	2 ACCEPTABLE	1 MARGINAL	0 UNACCEPTABLE
Identify the Problem		Complete understanding of design problem and constraints. Clear understanding of key scientific principals.	Overall sound understanding of design problem and constraints. Clear understanding of key scientific topics.	Limited understanding of design problem and constraints. Some understanding of key scientific topics.	Little or no grasp of problem and constraints. Lack of understanding of key scientific topics.
Brainstorming & Design		Final design achieved after review of multiple ideas for use of materials. Design meets all design constraints.	Alternate approaches identified to some degree. Design meets all design constraints.	Serious deficiencies in exploring use of materials. Design does not consider all design constraints.	Lack of understanding on how materials will affect design and selection is infeasible.
Test & Evaluation		Detailed design notes. Design meets or exceeds desired objectives through systematic testing.	Clear notes for design modifications. Design meets desired objectives.	Limited notes for design modifications. Design barely capable of meeting objective.	Unclear or no notes for design modifications. Design not capable of achieving objective.
Reflection Questions & Team Presentation		Clear understanding of the challenge and in-depth analysis of engineering process and teamwork.	Clear understanding of the challenge and clear analysis of engineering process and teamwork.	Limited understanding of the challenge and clear analysis of engineering process and teamwork.	Incorrect understanding of the challenge and incorrect analysis of engineering process and teamwork.
Teamwork		Active collaboration, effective communication, and impressive effort.	Some collaboration, mostly effective communication, and average effort.	Limited collaboration, some negative communication, and limited effort.	Lack of collaboration, negative communication, and limited effort.

STEM Challenge Sheet

Name: _____ Date: _____

Identify the problem

Describe the goal of the challenge in your own words. Include any important design considerations.

Brainstorm

Gather materials and list them in the box to the right. The engineering design constraints may require specific materials to be used. Think about how you can use each material to solve the challenge.

Materials For My Design

Design

How will you solve the challenge? Sketch at least one design idea, and label the parts of the design and materials used.

Build

Time to bring your design to life! Using your design sketch as a starting point, build your solution. Keep in mind that materials may not work as you predicted. Engineers often have to make several modifications to their original design before they are successful.

STEM Challenge Sheet

Test & Evaluate

Test your design and record results below. Circle if the challenge was a success. Remember that failure is an important part of the engineering process! After each trial, review the results and make changes to improve your design.

Trial	Results of Test	Challenge complete?	Ideas for Improvement
1		Yes / No	
2		Yes / No	
3		Yes / No	
Total trials before success: _____			

Solution

Sketch your final design and label materials used.

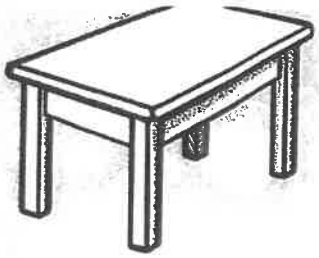
Reflect & Share

Answer the following questions.

1. What challenges did you face during the design process?

2. How does this challenge relate to the STEM Career Connection?

Paper Table Mission



Build a paper table that is at least six inches high and can hold a heavy book for five seconds.

Materials Required

- ☐ Newspaper or paper
- ☐ Scissors
- ☐ Tape
- ☐ Heavy book
- ☐ Ruler
- ☐ Timer

Engineering Design Constraints

1. Table must hold the book for 5 seconds
2. Book must be elevated 6 inches
3. Table is made of only paper and tape
4. Book must weight at least 3 pounds
5. Table must have at least 2 legs at least 2 inches high

Design Considerations

Look around at different table structures for ideas. What shape will you make your table? Will a taller or shorter table hold more weight? How will you make flexible paper strong enough to hold a book? *Hint: Rolling paper into tubes can help distribute the weight of the book.*

Math Connection

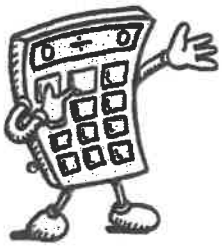
Measure and calculate the surface area of the top of the table:

_____ in^2

Measure and calculate the surface area of the part of the table that touches the ground:

_____ in^2

What is the ratio of top to bottom as a reduced fraction?



STEM Career Connection: Civil Engineering

Civil Engineers design and build large construction projects and systems such as skyscrapers, roads, bridges, airports, dams, and sewer systems.

Cool Project: The tallest building in the world is the Dubai Tower that stands at 2,717 feet! The tower is 163 floors high and must withstand 99 mile per hour winds. Can you calculate how many times higher the tower is than you?

Learn more: Download the *Truss Me!* app to learn how truss structures behave and to understand how they fail through physics-based simulations.

Build A Boat Mission

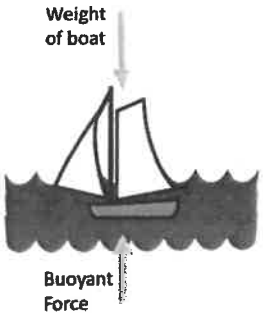
Build an aluminum foil boat that can hold at least 25 pennies without sinking.

Materials Required

- ❑ Bowl with water at least 3 inches deep
- ❑ Aluminum foil
- ❑ Pennies

Engineering Design Constraints

1. The boat must be made out of 6 in x 6 in sheet of aluminum foil. No other supplies may be used.
2. The boat must hold the weight for at least 3 seconds.
3. The boat can not touch the bottom of the container.



Design Considerations

What determines if an object floats or sinks? The boat must be less dense than the water, otherwise it will sink. As pennies are added to the boat, the density of the boat increases until it reaches the density of water and sinks. How can you minimize the density of the boat?

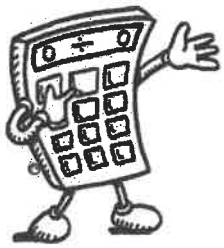
Math Connection

Measure the volume of your final boat design. This can easily be done by filling the boat with dry rice so it is level with the top. Then transfer the rice to a measuring cup. What is the volume?

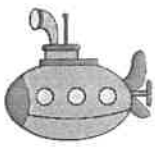
_____

Calculate the weight of pennies held by your boat. Each penny weights 2.5 grams.

_____ grams



STEM Career Connection: Marine Engineering & Naval Architecture



Marine engineers and naval architects design, build, and maintain ships such as aircraft carriers, submarines, sailboats, and tankers. Marine engineers work on the mechanical systems, such as propulsion and steering. Naval architects work on the basic design, including the form and stability of the hulls.

Cool Project: Engineers have developed remotely operated robots that are used for exploring the deep ocean down to 35,000 feet! They can discover new life forms or ancient treasures.

Learn more: Explore more engineering at www.discoverengineering.org including interesting careers and cool games.

Mighty Machine Mission

Use the stored elastic energy of rubber bands to build a catapult that can launch an object 20 feet.

Materials Suggested

- ❑ Plastic spoon
- ❑ Rubber bands
- ❑ Soda or soup can
- ❑ Popsicle sticks
- ❑ Bean, marshmallow, or other small object

Engineering Design Constraints

1. The catapult must use stored elastic energy of rubber bands to launch projectiles.
2. The catapult must have a sturdy base that rests on the ground when launching.
3. Besides rubber bands, any other additional materials may be used for the catapult.

Design Considerations

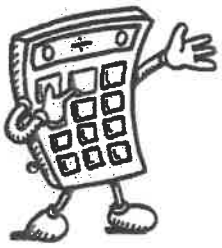
Elastic potential energy is a form of potential energy that occurs when some objects are deformed. When you stretch a rubber band and then release, it snaps back to its original form. How can you harness this energy to launch an object? Another important component is a sturdy base. Consider using a soup can or building a base out of popsicle sticks to support the motion of the catapult.

Math Connection

Calculate the average distance of three trials with the catapult:

_____ inches

What happens when you launch the projectile from approximately 45 degrees versus 90 degrees?



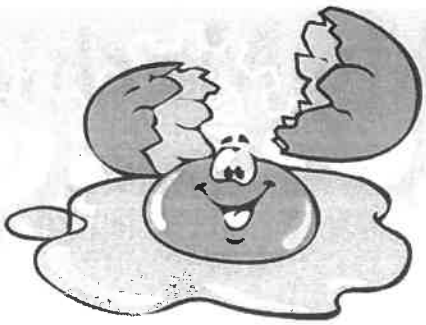
STEM Career Connection: Mechanical Engineering

Mechanical engineers research, design, and test tools, engines, machines, and other mechanical devices. They may design things such as a roller coaster, surgical robots, prosthetic legs, or a solar-powered car.

Cool Project: One of the world's tallest and fastest roller coasters is the Kingda Ka at Six Flags Great Adventure. This ride includes a jaw-dropping 418 foot drop (over 40 stories) and a top speed of 128 mph!

Learn more: Visit PBSKids.org for more STEM fun! Try out a Design Squad Challenge, use math to save the world in Cyberchase, or protect the planet with The Greens.

Egg Drop Mission



Drop an egg from 5 feet without cracking it.

Materials Suggested

- ❑ Rubber bands
- ❑ Balloons
- ❑ Popsicle sticks
- ❑ Hardboiled eggs
- ❑ Paper cups
- ❑ Straws
- ❑ String
- ❑ Tape
- ❑ Scissors

Engineering Design Constraints

1. The design must keep a hardboiled egg from cracking from a five foot drop.
2. Five feet is measured from the bottom of the lowest part of the design.
3. Any materials may be used for the design.

Design Considerations

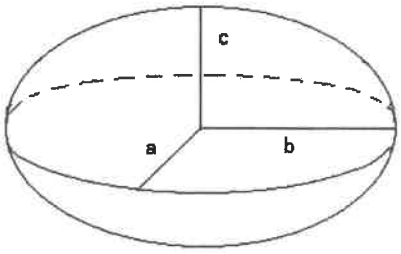
Shock absorbers soak up the energy of an impact. Examples include airbags, springs in a mattress, and your knees when you jump. What materials can you use that will absorb the most energy of impact? Objects such as balloons, cotton, foam, and packing materials are soft and springy to absorb impact. For your design, think about the container used to hold the egg, a landing frame, and the shock absorbing material.

Math Connection

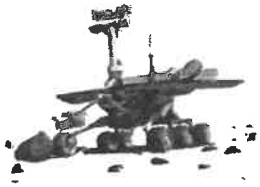
Can you determine the volume of the egg? Use the following formula that calculates the volume for an ellipsoid:

$$V = \frac{4}{3}\pi\, a\, b\, c = \_\_\_\_\_\ in^3$$

Lay your egg along a ruler and measure the long and short length. B = long length divided by 2. A and C = short length divided by 2.



STEM Career Connection: Materials Engineer

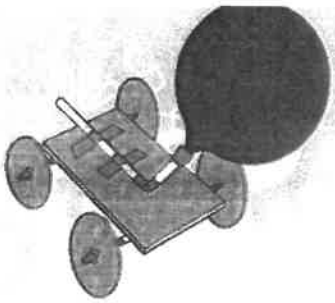


Materials engineers develop materials that other engineers use for their designs. They may develop new types of glue, lighter materials for airplanes, or strong materials for buildings. Their materials are used for heat shields in space, prosthetic limbs, sunscreens, computer hard drives, and baking dishes.

Cool Project: NASA engineers built 3 rovers that used an airbag landing system to land on Mars. The airbag-wrapped rovers hit the surface going 50 mph. One rover bounced 50 feet on impact!

Learn more: Visit www.spaceplace.nasa.gov to explore astronomy and space engineering.

Balloon Car Mission



Build a balloon-powered car that will travel 5 feet.

Materials Suggested

- ☐ **Power:** Latex balloons
- ☐ **Car body:** Plastic bottle, plastic cup, cardboard
- ☐ **Wheels:** CDs, bottle caps, empty rolls of tape
- ☐ **Axles:** Wooden pencils, skewers
- ☐ **Other materials:** plastic straws, glue, tape, paper clips, scissors, rubber bands

Engineering Design Constraints

1. The car must be propelled forward by the air escaping the balloon.
2. The car must be study and not fall apart when in use.
3. The car must travel at least five feet.
4. The car must travel in approximately a straight line.

Design Considerations

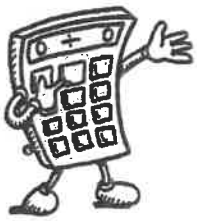
Have you ever blown up a balloon and let it go? The air rapidly escapes the balloon making it fly away. Your challenge is to harness this energy to propel a car forward!

The balloon-powered car has three main parts: the body, the wheels, and the axles. The axles connect the wheels to the body and allow them to spin. Think about what materials you will use for each part and how they will connect together.

Math Connection

Let's calculate the average speed of your balloon car. The equation for this is:

$$average\ speed = \frac{total\ distance}{total\ time}$$



Measure the total distance traveled in inches and divide by the total time in seconds.

What is your average speed? _____ inches per second

Convert to feet per second: _____ feet per second

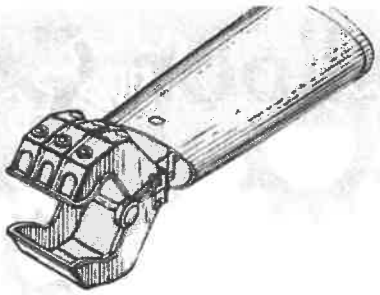
STEM Career Connection: Industrial Engineer

Industrial engineers determine the most effective way to use people, machines, materials, information, and energy to make a product or service.

Cool Project: Industrial engineers helped design the Walt Disney World theme parks to maximize enjoyment for visitors including easy access to rides, food, and entertainment. 52 million people visit the park each year!

Learn more: Download the TinkerBox app to play a fun physics and engineering puzzle game!

Helping Hand Mission



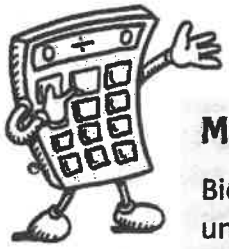
Build a device that lets you grab an object 2 feet away and move to a container 10 feet away.

Materials Suggested

- ☐ Brass fasteners
- ☐ Cardboard
- ☐ Hole punch
- ☐ Rubber bands
- ☐ Scissors
- ☐ Duct tape
- ☐ String
- ☐ Toothpicks
- ☐ Wooden skewers
- ☐ Objects to pick-up: balls, cotton balls, soda cans, paper cups

Engineering Design Constraints

1. The device must grab the object – it may NOT scoop it up.
2. The arms must extend at least 2 feet.
3. The device must be carried and dropped into a container 10 feet from the original location.
4. Any materials may be used for the design.



Design Considerations

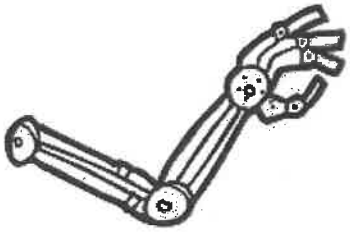
Think about things people use to grab objects: cooking tongs, chopsticks, tweezers, and pliers. These all have two parts or arms that go around the object to be moved. How will your device move and squeeze these arms together? What materials do you need to make the jaws grip and hold the object?

Math Connection

Biomedical engineers need a thorough understanding of the human body including the heart. Let's take a closer look at your heart. Find your pulse and measure the number of beats in one minute for each exercise. Can you graph the results?

- Sitting: _____ beats per minute
- Standing: _____ bpm
- After 10 squats: _____ bpm
- After 10 jumping jacks: _____ bpm

STEM Career Connection: Biomedical Engineer



Biomedical engineers use their knowledge of engineering and the human body to solve problems in medicine such as creating replacement body parts or designing medical instruments.

Cool Project: Biomedical engineers are developing nanobots-- tiny robots capable of swimming in the human bloodstream. These devices may be able to non-invasively find and kill cancer cells.

Learn more: Visit www.enablingthefuture.org to learn how people all over the world are using 3D printers to create printed hands for those in need. Over 1500 hands have been delivered!

WANT MORE STEM?

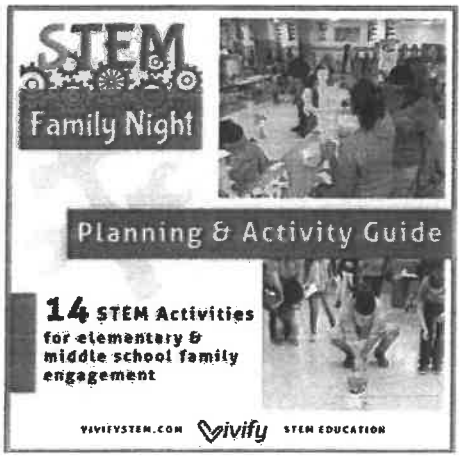
For a complete list of all of Vivify STEM resources broken down by standards, topics, and grade levels, go here: http://bit.ly/VivifyResourceGuide

bit.ly/VivifyMars

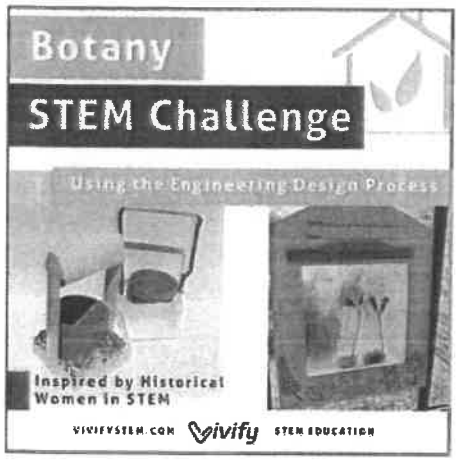
bit.ly/Vivifyspacebundle

bit.ly/icebreakerbundle

bit.ly/Vivifycatapult



bit.ly/STEMfamilynight



bit.ly/Vivifybotany

Vivify's Overview of STEM Education

Successful STEM education is an empowering interdisciplinary approach that brings math and science concepts to life through problems that mimic the complexities and excitement of the real world. STEM revolves around the Engineering Design Process that embraces failure, relies on teamwork, and requires critical thinking and creativity. While exciting, educators often become intimidated as a search for curriculum leads to an overwhelming range of activities from index towers to robotics competitions. At Vivify, we believe that not all STEM is created equal. Educators should adopt a 3 Stages of STEM approach by progressively building towards more complex projects.

To learn more about the 3 Stages of STEM, go here: http://bit.ly/stemstages

Name _____

HMH KIDS DISCOVER
Skills

Summarize

DIRECTIONS **Read the information and think about how summarizing can help you understand what you read. Then apply what you learn.**

Why It Matters

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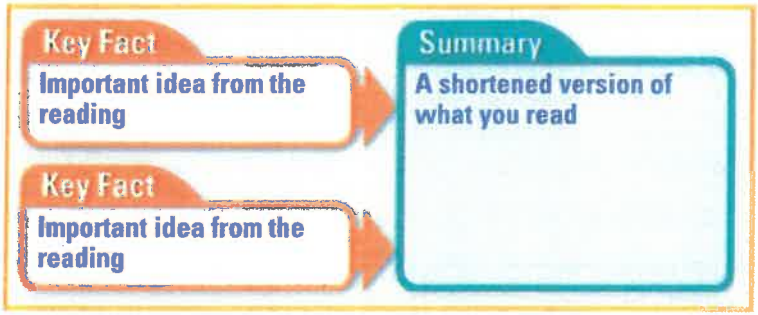

✔ *A summary includes only the most important ideas from what you read.*

✔ *Always use your own words when you summarize.*

Practice the Skill

Read the paragraphs. Then write a summary of the second paragraph.

Facts Settlers came to North America from different European countries, but Spain established the first permanent settlement started by Europeans in what is now the United States. In 1565, Spanish colonists founded St. Augustine in Florida.

Summary (In 1565, Spain founded St. Augustine, the first permanent European settlement in what is now the United States.)

Most settlers who came to North America in the 1600s were English. One reason was that England had more people than it could feed. Poor people and orphans were often sent to America—sometimes against their will.

Name _____

Summarize (continued)

Apply What You Learned

Read the passage and answer the questions.

Young Colonists

Many children came to North America from England without their families. Some were orphans with few people to care for them. Others were the children of poor families. Many parents in England could not earn enough money to feed their children. Children fled to cities to beg for food.

In the Virginia Colony, tobacco plantations needed workers. The owners of the Virginia Company saw an opportunity to put poor English children to work. They asked government leaders to allow the company to take children to the Virginia Colony as indentured servants. As indentured servants, the children were required to work for the company for a fixed term, usually seven years. After they completed their service, they would receive some basic supplies, some food, and their freedom.

Many children did not survive long enough to gain their freedom. The climate and living conditions in North America were very different from those in England. Sickness killed many within their first two years of service. However, many poor children and adults saw indentured service as their only option available to them. If they could survive their period of service, they could gain a fresh start in a new land.

Summarize

1. **Why did many orphans and poor children become indentured servants?**
2. **Why did the Virginia Company want to bring children to Virginia?**
3. **How would you summarize the life of indentured servants in America?**

Name _____

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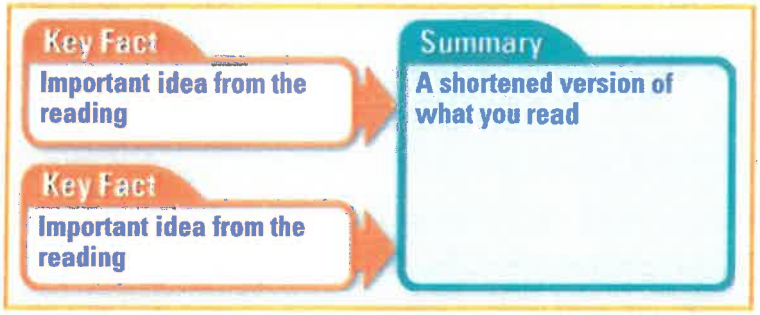

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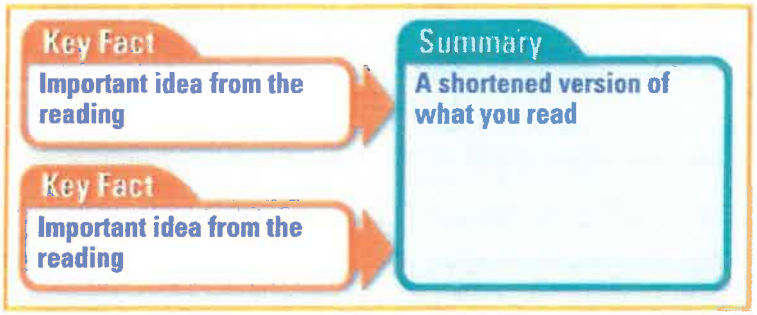

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