STEM

science | technology | engineering | math

Introduction

The STEM Essentials modules were designed to be used in a variety of classroom settings. They can be used as whole class discussions, with small groups of interested students, or even with individual students who need a new challenge. The goal of these activities is to give students exposure to a spectrum of STEM fields and careers. By giving students an opportunity to hear about and learn about STEM careers the hope is that it will spark one student's interest to learn more about a specific topic, one student will discover hidden or unknown skills and talents, or one student will set higher goals and realize the opportunity that is in front of him/her.

We each look at the world in a different way or from a different perspective. Think about the sky. Some students will look at the sky and want to paint a picture depicting the beautiful colors of a morning sunrise or the deep vivid colors of a sunset. Others will want to write a poem or a song to express how it makes them feel. Still others will look at the sky and want to meditate on the meaning of life. Some students would want to study the clouds to see if they could predict the weather. And then there are students who don't want to just look at the sky, they want to explore it. . .to be a part of the final frontier. Think about these many responses—and we all looked at the same sky. That is what STEM Essentials does---it is providing the opportunity to challenge students to respond to topics, each in their own individual way.

Besides the teaching support found below, there are also additional readers that have been referenced at the end of each module. These materials are available for purchase from McGraw-Hill and continue the study for students who are interested. At the end of each grade span you will find a listing of the top 20 Engineering disciplines. This can be a resource to guide students interested in specific topics.

Technology A Closer Look

Title	Using the STEM Lessons	Making a STEM Connection
Technology A Closer Look	**Lesson 1** *We Use Tools* **pp.** *4–7*	Use resources from ***Then and Now*** to expand upon this lesson. ***Then and Now*** *Cars Then and Now* *Computers Then and Now* *Getting Around Then and Now* *Then and Now*
	Lesson 2 *Materials and Their Uses* **pp.** *8–11*	Use resources from ***Then and Now*** and ***Our Natural Resources*** to expand upon this lesson. ***Then and Now*** *Cars Then and Now* *Computers Then and Now* *Getting Around Then and Now* *Then and Now* ***Natural Resources*** *Recycle, Reduce, Reuse!* *Recycling Glass* *Use It Again!* *Save Paper, Save Trees* *What Happens to Your Trash?* *Simple Ideas to Save the Earth*
	Lesson 3 *Parts Work Together* **pp.** *12–15*	Use resources from ***Technology That Helps*** and ***Our Natural Resources*** to expand upon this lesson. ***Technology That Helps Us*** *Mr. Bell and the Telephone* *Telephones Then and Now* *Technology That Helps* *What Will You Be?* ***Our Natural Resources*** *Recycle, Reduce, Reuse!* *Recycling Glass* *Use It Again!* *Save Paper, Save Trees* *What Happens to Your Trash?* *Simple Ideas to Save the Earth*

Technology A Closer Look

Title	Using the STEM Lessons	Making a STEM Connection
Technology A Closer Look	**Lesson 4** *Whose Idea Was That?* **pp.** *16–19*	Use resources from ***Our Natural Resources, Space,*** and ***Flying Machines*** to expand upon this lesson. ***Our Natural Resources*** *Recycle, Reduce, Reuse!* *Recycling Glass* *Use It Again!* *Save Paper, Save Trees* *What Happens to Your Trash?* *Simple Ideas to Save the Earth* ***Space*** *Let's Visit Space* *Ready, Set, Go!* *Meet Mae Jemison* *Star Sailor* ***Flying Machines*** *Born to Fly* *The Flying Machines* *The Pilots* *It Can Go Up*
	Lesson 5 *From Idea to Invention* **pp.** *20–23*	Use resources from ***Our Natural Resources, Space,*** and ***Flying Machines*** to expand upon this lesson. ***Our Natural Resources*** *Recycle, Reduce, Reuse!* *Recycling Glass* *Use It Again!* *Save Paper, Save Trees* *What Happens to Your Trash?* *Simple Ideas to Save the Earth* ***Space*** *Let's Visit Space* *Ready, Set, Go!* *Meet Mae Jemison* *Star Sailor* ***Flying Machines*** *Born to Fly* *The Flying Machines* *The Pilots* *It Can Go Up*
Science Fair Handbook	Can be used with any lesson to further explore STEM fields and careers. This book is available for purchase from McGraw-Hill. ISBN 0-02-285258-1	

Lesson 1 We Use Tools

Objectives

- Explain that all the tools and ideas we use to work and solve problems are called technology
- Identify the effects of technology on society

1 Introduce

▶ Assess Prior Knowledge

Explore what children already know about technology by asking:

- **How do tools like vacuum cleaners and cars help people?**
- **What tool would you use to wash your clothes? What tool would you use to make toast?**
- **What kinds of technology have you used so far today?**

Read aloud the title on page 2. Have children identify the tools they see in the photos *(shovel, hammer, scissors)*. Guide children in contributing more examples of tools, such as phones, bikes, clothes, and dishes. Afterward, explain that all tools are examples of technology.

2 Teach (Student pages 2–8)

▶ Discuss the Main Idea

Stress that technology changes over time by asking:

- **What helpful tools have you used today? What helpful tools would you have used 100 years ago?**

▶ Use the Visuals

Focus on the box labeled "Tools Then and Now," page 3. Point out the differences between the tractors at left and right. Help children understand that technology began when people first used things in nature as tools. Over time, people invented better tools using new materials. Fire was one of the first tools. People used it to keep warm and cook food. Today people heat their homes with electricity. They cook food over stovetops, in microwave ovens, and on barbecue grills.

Quick Check

Tools help people do work. People make tools to solve problems.

Read aloud the title on page 4. Scan the visuals. Explain that technology depends on scientific knowledge. People use what scientists know to make tools.

Quick Check

Children may use the information in the chart on page 5 to answer the question.

As you read the text and chart on page 5, note that technology can solve problems but can also create them. Stress the cause and effect relationship between technology (e.g., cars) and societal/environmental problems (cars burn gasoline, which causes pollution).

Technology in Action

A Tool to Look Inside

Explain that the class will read an article about an X ray machine. Read the title and text on pages 6 and 7. Discuss the photos and captions. Reinforce the idea that tools used by doctors and dentists are examples of technology. Allow children who have had an X ray to share their experiences.

Talk About It

Have children turn to a partner and discuss the question on page 7. Children can then share information with the class.

Tech Activity

partners 20 minutes

Objective To understand how people design and create tools

Plan Ahead Gather the materials needed.

Tips Tell children to cut paper so that it resembles broom bristles. After children complete the activity, discuss the process. Point out that people who invent tools often start by making a model of their idea.

Draw Conclusions Help children realize that the materials used in the activity differ from the kind of materials used in making a broom you might buy in a store. Ask: How is the broom you made different from one you might buy in a store?

STEM Ask students to think of a chore or task they do each day (or week). Is there a way to make it easier or a way to improve it? Is there a tool that you use everyday that could be improved or made better? What would you recommend? Have students draw a picture or make a model of their improvement suggestions.

3 Close (Student page 9)

Think, Talk, and Write

Answer the questions as a group. Read each question aloud before asking children to respond.

Answers:

1. *tool*
2. *X ray*
3. *Children should respond by naming a tool and telling what problem the tool was designed to solve.*
4. *Children can refer to the chart on page 5 when responding to this question. They can choose to list harmful effects of technology or draw a picture that tells about a problem created by technology.*

Art Link Invite children to share their drawings with the class. Make a class book of the drawings.

Extend

Extra Activity Copy and distribute Student Worksheet, **Lesson 1** on page 5 of this booklet.

Language Arts Link

Problem/Solution Chart Identify a number of tools and the problems they solve. Make a problem/solution chart on poster board. Add to the chart periodically.

Problem	**Solution** (tool)
Keeping milk fresh.	Store in a refrigerator.

Differentiated Instruction

Leveled Activities

EXTRA SUPPORT Have each child draw a tool that he or she uses regularly. Help children think of tools to draw. Assist them in labeling their drawings.

ENRICHMENT Write the word *tool* and its definition on the board (*something that helps people do work*). Discuss a few examples of tools, such as a truck, telephone, and spoon. Talk about how people use these tools.

STEM Students who enjoyed this activity may want to know that they have been engineers. They may be interested in learning more about Industrial Engineering or Mechanical Engineering.

Name _____ Date _____

We Use Tools

Make a tools scrapbook.

1. Look through old magazines and newspapers.
2. Cut out pictures of 5 different tools.
3. Glue each picture to a sheet of construction paper.
4. Label each tool.
5. Think up a title for your book and design a front and back cover on the other two sheets of paper.
6. Staple your book together and add it to the classroom library.

You need

- magazines and newspapers
- 1 pair of scissors
- glue
- 7 sheets of colored construction paper
- markers
- stapler

Lesson 2 Materials and Their Uses

Objectives

- Identify the difference between natural resources and human-made materials
- Recognize that people choose different natural resources and human-made materials to create things based on their properties

1 Introduce

▶ Assess Prior Knowledge

Discover what children know about natural and human-made materials.

- **Did your breakfast cereal grow in a garden?**
- **Do people make corn in factories?**

As children share ideas, help them understand that Earth gives us materials called natural resources, which people use to make things.

2 Teach (Student pages 10–16)

▶ Discuss the Main Idea

Read the heading and text on pages 10 and 11 with children.

- **What are the two main kinds of natural resources?** *(living and nonliving)*

▶ Use the Visuals

Model how to read the chart on pages 10 and 11. First, read the label "Using Natural Resources." Then, read the headings "Resource" and "Product." Explain that the pictures in the first row show living and nonliving natural resources. The pictures in the second row show things made from these natural resources. Allow children to help read the chart using the speech pattern outlined above. Discuss how a chart helps organize information for the reader. *(Wood is something found in nature. It can be used to make furniture.)*

Quick Check

After children identify wooden objects (desktops, chairs, pencils, floors) in the classroom, invite them to name wooden objects found in the home.

Read the text on page 12 with the students. Discuss various things made from cotton (socks, shirts, bed linens, tablecloths). Look at the photo at the bottom of the page. Stress that the materials people use in making things are chosen for their properties.

- **What are some of the properties of cotton?** *(soft, fluffy)* **Of wood?** *(smooth and strong)*
- **Why is cotton the wrong material to use in making a bridge? What material might be a better choice?** *(wood)*

Draw attention to the photos on page 13. Have children predict the material that was used to make the items *(plastic)*. Read the first paragraph to confirm or disprove children's predictions.

Plastic is a human-made material, but it is made from oil, which is found in nature. Explain that oil is a limited natural resource, which means the oil will not last forever. Explain that to recycle means to use a material again. Tell children that recycling plastic helps to conserve oil.

Quick Check

Cotton is a natural material. It grows on a plant. Plastic is a human-made material. It is made in a factory.

Technology in Action

Making Money

Point out that words like *first*, *then*, and *lastly* are sequence words.

- **What happens first in making coins?** *(metal is melted)*
- **What happens before the coins are put in bags?** *(the metal is stamped and checked)*

Talk About It

Infer Have children turn to a partner and discuss the question on page 15. Children can then share information with the class.

Tech Activity

small group 20 minutes

Objective To identify and compare the properties of various materials.

Plan Ahead Divide the class into small groups and have each group collect five items.

Tips Be sure that the items collected have different properties, such as hard, soft, smooth, rough, and fuzzy.

Explore More Have children collect items outside, in nature. Then classify each object based on the properties listed in the chart. Which properties were hard to find in nature?

STEM Ask students, Can you take one item from your chart and use it in a completely different way? For example, look at a paperclip. Open it up and use it to hang a picture from or use it to make a necklace.

3 Close (Student page 17)

Think, Talk, and Write

Students should answer questions independently.
Answers:

1. *natural resources*
2. *properties*
3. *Soft, fluffy cotton is the right choice for making clothing and other items, such as cotton balls. Cotton isn't the right choice for making structures that require strong, hard materials.*
4. *Children's writing should indicate that foods come from living things, such as chickens (eggs), flour (bread), corn (cereal), and cows (milk).*

Art Link

Connecting Properties Have children share their drawings with the class. Discuss and list the many different materials used in making toys.

Extend

Extra Activity Copy and distribute the **Lesson 2** worksheet on page 9 of this booklet.

Language Arts Link

Materials Rhyme Write the following rhyme on the board and ask children to read it with you.

Which should I use to make a boat,
Wood from a tree or hair from a goat?
Which should I use to make a shirt,
Cotton from a plant or sticks and dirt?

Can you imagine a boat made of hair,
Or a shirt made of sticks and mud? Beware!
Using the right materials is important, you see,
So it's best to choose them carefully!

Encourage children to write their own lines. For example,

Which should I choose to make a chair?
Wood from a tree or a hair from a bear?

Differentiated Instruction

Leveled Activities

EXTRA SUPPORT Pair ELL children with native English speakers. Have partners tell each other, in their own language, the materials needed to paint a picture.

ENRICHMENT Write the word *material* and its definition *(something from which a thing is made)* on the board and discuss its meaning. Then have children collect materials needed to complete a crafts project.

Name _____ Date _____

Materials and Their Uses

People use paper and plastic bags every day. Work with a group to find out which bag will hold up in wet conditions.

You need

- 1 small plastic bag with handles
- 1 small paper bag with handles
- 4 cups of water
- 6 golf balls
- paper towels to mop up any spills

Experiment

1. Place the bags on a table.
2. Pour 2 cups of water into each bag.
3. Wait 5 minutes.
4. Pour out any water in the bags.
5. Return the bags to the table.
6. Place three golf balls into each bag.
7. Be careful. Lift each bag off the table.
8. Observe. Which bag had the property of staying strong even when wet?

the plastic bag

Lesson 3 Parts Work Together

Objectives

- Recognize that a system is a group of parts that work together unless a part of the system is broken or missing
- Understand that people (and machines) make things in a step-by-step process

1 Introduce

▶ Assess Prior Knowledge

Explore what children already know about systems by asking:

- **What objects do you see around the classroom?**
- **What parts do you see in the objects mentioned?**

As children share ideas, help them conclude that most objects are made up of different parts.

2 Teach (Student pages 18–23)

▶ Discuss the Main Idea

Read aloud the text on pages 18 and 19.

- **In what ways is a highway system similar to a truck?** *(both have parts that work together, both take people where they need to go)*

Stress the idea that the parts that make up an object work together to allow the object do what it was designed to do.

▶ Use the Visuals

Look at the photos on page 18. Have children identify the wheel as part of the truck pictured. Point out that the wheel does a job. Guide children to express the idea that a missing or broken wheel would cause the truck to not work properly.

Now turn to the photo on page 19 and identify the highway as a system. Allow children to name the parts *(vehicles, roads)* of the system. Reiterate that a truck can be compared to a highway system. How are they alike? *(both have parts that work together, both take people where they need to go)* How are they different? *(a highway system has many more parts than a truck)*

Quick Check

If the question stumps students, turn to page 20 and read about another system, the computer.

As you read page 20, turn to a school computer for added visual support. Help children identify the parts of a computer system and restate the idea that these parts work together, as a whole, to do all kinds of tasks. Ask children what would happen if the printer were broken. *(They could input information but not print it out.)*

Quick Check

Reasons may include burnt-out or missing lightbulb, loose bulb, unplugged lamp, broken switch, power outage.

As you read about the parts of a lamp on page 21, help children recognize the cause and effect relationship between electricity and light.

Technology in Action

Put Parts Together

Children should realize that wagon parts shown on page 22 make up the wagon on page 23 (bottom right).

- **Which part of a wagon do you pull to make it move?** *(handle)*
- **What does the axle do?** *(lets the wheels spin)*

Talk About It

Although you can't pull a handle-less wagon, how else might you get it to move? *(push it)*

Perhaps children might think of a way to make an improvised handle.

Tech Activity

individual 1 hour

Objective To provide children with a firsthand experience to reinforce the idea that people put objects together step-by-step

Plan Ahead Solicit children's parents or local stores for empty shoe boxes and plastic coffee lids. Punch holes in coffee lids and shoe boxes beforehand.

Tips Make sure the four holes punched in each shoe box are in the same position so that when the lids are attached, they will hang evenly—and far enough below the shoe box to allow them to roll easily.

Explore More Encourage children to test their wagon by loading it with lightweight objects and pulling it across the floor. If they run into problems, have them brainstorm ways to make the wagon work better.

3 Close (Student page 25)

Think, Talk, and Write

Students can complete the exercise as a group or individually, with the teacher assisting by reading each question aloud and ensuring that the students understand how to proceed. **Answers:**

1. *system*
2. *computer*
3. *No. The truck is missing a wheel.*
4. *Make sure children describe a simple object that means something to them.*

STEM Challenge students to think about how using different sized lids would change the outcomes in Tech Activity students just completed. Would using larger or smaller lids allow the "wagon" to go faster or hold more?

Art Link

Diagramming Brainstorm common human-made and natural objects—bike, car, tree, flower. Then have each child draw an object of choice. Finally, encourage children to do their best in labeling the parts that make up the object. Discuss what might happen if a part were broken or missing. Display the diagrams.

Extend

Extra Activity Copy and distribute Student Worksheet, **Lesson 3** on page 13 of this booklet.

Social Studies Link

Assembly Line Make cheese and tomato sandwiches.

In Advance Make sure there are no students with food allergies.

Materials About 2 loaves of bread, a pound of cheese, 5 tomatoes (sliced), paper plates and napkins, plastic gloves used in food preparation.

Steps

- Model making the sandwich. Your demonstration should include placing the finished product on a plate with a napkin and setting it aside. (Note: List the steps in writing as each one becomes a station on the line.)
- Determine the number of lines you'll need by dividing the number of children by the number of steps. Make one sandwich for each worker on the line.
- Set up stations, placing supplies nearby. Children should wear plastic gloves.
- Ask children about the time saved in making the sandwiches on an assembly line.

Differentiated Instruction

Leveled Activities

EXTRA SUPPORT Explain that people have body parts. Point to different parts of your body, and help children name each one aloud.

ENRICHMENT Encourage children to draw a person and label the figure's body parts. Assist with spelling, or allow children to dictate as you write.

Name _____ Date _____

Parts Work Together

A system depends on all of its parts. If one part is taken away, the system cannot work. Complete the table below by writing down things in your classroom that are systems. Write down what part you could remove and what would happen to each system if that part were missing. The first one has already been done for you.

Classroom System	Parts of the System	Part Removed	Effect on the System
computer	mouse, printer, keyboard	keyboard	you would not be able to type

Lesson 4 Whose Idea Was That?

Objectives

- Recognize that people invent things to help people work and play
- Understand that there may be more than one way to solve a problem

1 Introduce

▶ Assess Prior Knowledge

Discover what children know about the birth of an invention.

- **What is an idea?**
- **How do people come up with ideas?**
- **How do people use their ideas?**

As children participate in the discussion, point out that sometimes an idea leads to an invention. Paper, telephones, cars, televisions, and computers are examples of inventions.

2 Teach (Student pages 26–32)

▶ Discuss the Main Idea

Stress that people invent things to fill needs by asking:

- **Why was the invention of the telephone important?** *(It helped people communicate over long distances.)*

Point out that by helping people communicate over long distances, the telephone filled a need, solved a problem, and made life easier.

▶ Use the Visuals

Read the text and scan the photos on pages 26 and 27. Point out that today's telephones are faster, more portable, and easier to use than the telephone that Bell invented.

Quick Check

Telephones allow us to talk to our friends and families, get help in emergencies, and even buy things.

Read the text and scan the photos on pages 28 and 29. Have children compare the ways people have communicated through the ages. Help children realize that over time, new scientific knowledge and new materials can improve inventions that were developed in the past. Emphasize that the same invention can come in many different designs by having children compare the shoes they're wearing with those of their classmates.

Quick Check

The typewriter made writing faster and easier to read.

Technology in Action

Turn It On!

Stress that it took many tries before Edison got his idea to work. Invite volunteers to tell about the different kinds of lighting they have in their homes. Examples might include overhead lights, table lamps, desk lamps, night lights, porch lights, and flashlights.

- **Ask: What are some of the ways lights help people?**

Talk About It

Have children turn to a partner and discuss the question. They can then share their thoughts with the class. Children may point out that today's lightbulbs are available in many different shapes, sizes, and colors. They can give off a lot of light or just a little.

Tech Activity

Objective To understand how an inventor might work on an invention

Plan Ahead Set up workstations near a sink to help contain any mess. Keep lots of paper towels handy to mop up spills.

Tips During the activity, explain that huge machines make paper from wood pulp using a similar method. Ask: How long would it take the class to make enough paper for a 100-page book? How long might it take a machine?

Explore More Make a class book using the homemade paper. Have students compare the class-made paper with store-bought paper. How are they alike? How are they different? Plan a class trip to a papermaking factory.

3 Close (Student page 33)

Think, Talk, and Write

Read the questions/exercises aloud to the group. Students should work as a group or independently. **Answers:**

1. *communicate*
2. *electricity*
3. *stone tablets, typewriter, computer*
4. *Children can choose to write about or draw an invention. To stimulate children's imagination, suggest that they think of a problem they would like to solve using an invention.*

Art Link

Cave Drawings Invite children to share their drawings with the class.

Extend

Extra Activity Copy and distribute Student Worksheet, **Lesson 4** (found on page 17 of this booklet) for additional activities.

Math Link

Inventions Scavenger Hunt Have children find and count the number of electric lights, phones (cell and land lines), computers, and electronic games in their homes. Under the four headings, tally the number of items each child reports. Use the tallies to make a bar graph entitled *We Use Inventions*.

Differentiated Instruction

Leveled Activities

EXTRA SUPPORT Assist children in reviewing the lesson. Have them make a list of the inventors and inventions they read about.

ENRICHMENT Challenge children to draw and label a design for a new invention.

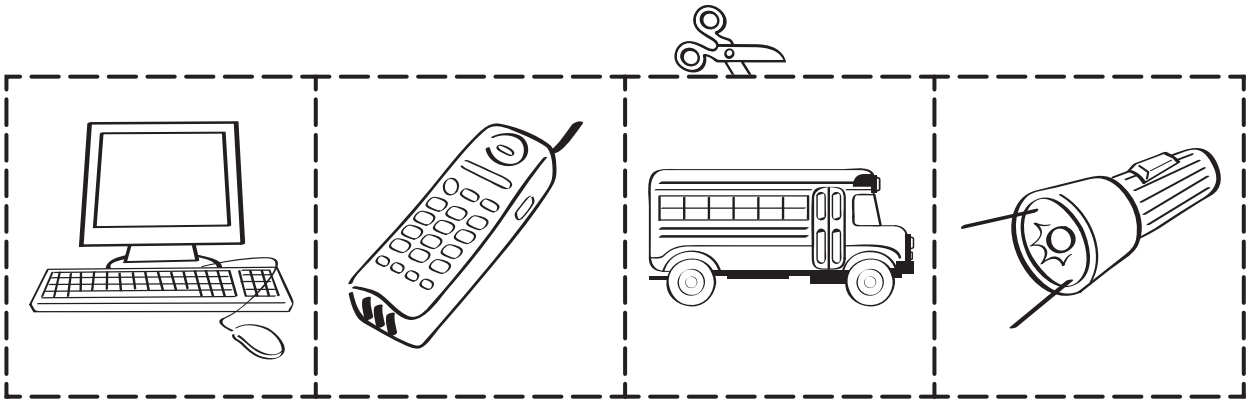
STEM Ask students to identify an object that they use everyday and think of ways it can be improved. For example, how could you make a better student chair for the classroom? Encourage students to make a drawing and/or write up a description of the new improvements.

Name _____ Date _____

Whose Idea Was That?

Cut out the pictures of inventions at the bottom of the page. Glue them in the boxes that match.

	Call a friend using this invention.		Go to school in this invention.
	Use this invention to help you see in the dark.		Send an e-mail using this invention.



Lesson 5 From Idea to Invention

Objectives

- Understand that inventors follow a step-by-step process in creating, designing, and testing an invention
- Recognize that if a model doesn't work, it can be revised and retested

1 Introduce

▶ Assess Prior Knowledge

Discover what children already know about how inventors work by asking:

- **What is a design?**
- **When might an inventor make a design?**

As children share their thoughts, help them realize that inventors have to try out or test their ideas, because just having an idea doesn't mean that it will work.

2 Teach (Student pages 34–40)

▶ Discuss the Main Idea

Stress that inventors follow a step-by-step process in creating an invention by asking:

- **If an inventor had an idea for solving a problem, how would he or she know the idea would work?** *(The inventor would have to design and test a model of the invention.)*

▶ Use the Visuals

Follow the sequence from idea to design by studying the visuals on pages 34 and 35. Help children realize that inventors often think up several solutions to a specific problem. They design a model of the solution that they think will work best.

Quick Check

Encourage children to visualize the characteristics (size, activity level) of a hamster before answering the question.

Turn to pages 36 and 37 to see which model was revised and retested.

Quick Check

Children's answers might include size, shape, and comfort level.

Technology in Action

Testing! Testing!

Read the feature together. Explain that by testing an invention such as a toy, the inventor can make sure the invention works, that it has no serious problems, and that it is right for use by a certain age group.

- **Ask: Would you like to be a tester of toys? Why or why not?**

Talk About It

Have each child turn to a partner to discuss the question. Children can then share their discussions with the class.

Tech Activity

individual

$1\frac{1}{2}$ hours

Objective To test materials that could be used to design a juice box

Plan Ahead Keep ice in the freezer until just before needed. Cover the work area with newspaper to minimize damage from water or have children set their wrapped ice cubes in a plastic tray to catch drips.

Tips Afterward, discuss which material worked best to keep the ice cube cool. Ask: Which material would you use in making a juice box? Why?

STEM Interested students may want to explore this more and try additional materials. What materials would be good recommendations for packaging frozen treats? What could be done to make a frozen ice cream or juice bar melt slower?

Students who enjoyed this activity may want to know that they have been engineers. They may be interested in learning more about HVR&AC (Heating, Ventilating, Refrigerating, and Air-Conditioning) Engineering or Packaging Engineering (a branch of Materials Engineering).

3 Close (Student page 41)

Think, Talk, and Write

Read sentences aloud to the group before asking children to respond. **Answers:**

1. *solution*
2. *design*
3. *Children's writing should indicate that Aimee thought about how to solve her problem, drew pictures of her ideas, decided which idea seemed best, made a model, tested the model, noted problems, and improved the design until she had a workable hamster tote.*
4. *This carrier would not work because the hamster could chew or break through the wax paper.*

Art Link

Design a Toy Encourage children to design a new toy or improve on an old one. Have them explain what they like about their new toy (or improvement). Display artwork in a special "invention corner."

Extend

Extra Activity Copy and distribute Student Worksheet, **Lesson 5** (found on page 21 of this booklet) for additional activities.

Writing Link

Toy Ad Write a toy ad with students. Discuss and use such words and phrases as *laboratory-tested*, *safe*, *fun*, and *educational*.

Differentiated Instruction

Leveled Activities

EXTRA SUPPORT Invite children to discuss with an English-proficient classmate Aimee's problem and how she solved it.

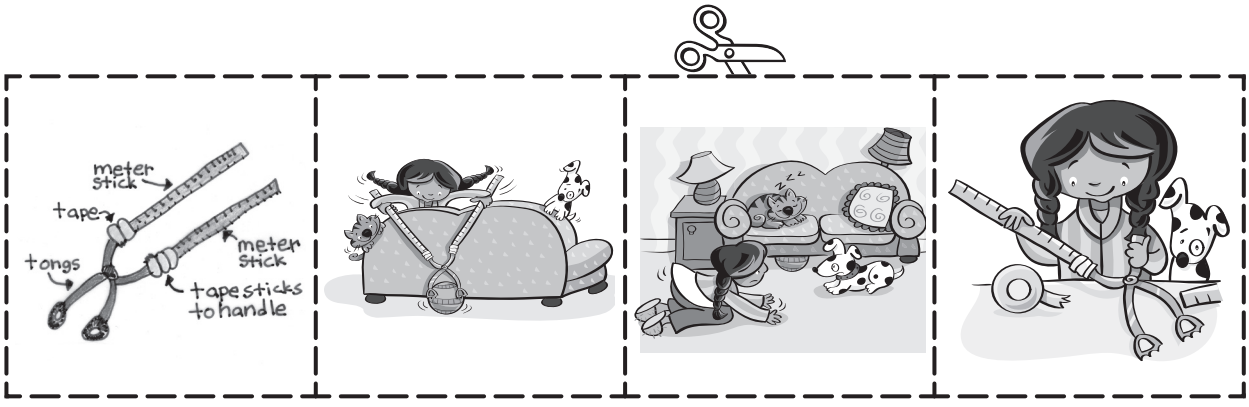
ENRICHMENT Challenge children to design a carrier for a larger animal, such as a cat.

Name _____ Date _____

From Idea to Invention

Cut out the pictures at the bottom of the page. Then glue them in boxes that match.

	First, you identify a problem.		Third, you make a model of the idea.
	Second, you draw an idea to solve it.		Finally, you test your model.



Then and Now

Title	Using the Leveled Reader	Making a STEM Connection
Cars Then and Now This book summarizes the history of the car since its invention. ☐ This book supports Lesson 1 in ***Technology A Closer Look.*** **Reading Levels** GR D Benchmark 6 Lexile BR	**Before Reading** Have students discuss what they know about what cars were like in the past. Can you imagine a car without windshield wipers? What other features do you think are really needed and which are nice to have? **During Reading** As students read through the book ask them to focus on how the first cars were different from cars we use today. **After Reading** Have students share how the assembly line changed the way cars were made.	**Engineering Connection** Engineers that work on automobiles are never satisfied with keeping cars the way they are. They are always trying to improve on the latest car model—to have something better and newer. • **How have cars been improved since they were first invented?** • **Can you think of an improvement that you would like to make to a car? Why is this improvement needed? What problem would it solve?** • **What new feature would you recommend and what would be the benefit to the person buying the car?** Draw or write about what this car might look like. **STEM Careers** Students who enjoy this kind of study may be interested in more information on one of these fields of Engineering: Chemical, Computer, Electrical, HVR&AC, Industrial, Manufacturing, Materials, or Mechanical Engineering.
Computers Then and Now This book traces the history of computers from the first calculating machines and designs for computing machines to the present wireless, pocket-sized marvels. ☐ This book supports Lesson 1 in ***Technology A Closer Look.*** **Reading Levels** GR P Level 38 Lexile 620	**Before Reading** Look at the computers on the front cover of the book. Draw a Venn diagram to record some of the similarities and differences that students suggest as they look at the pictures. **During Reading** As students read the book, encourage them to think about: **What would the world be like without computers?** Add to the Venn diagram started at the beginning of the lesson by asking students to compare today's computers with the early computers they just read about in the book. **After Reading** Have students share how computers have changed the way we live.	**Engineering Connection** New technology developments and new requirements from users have pushed engineers working on computers to constantly change and improve their products. Products with new uses and new capabilities are changing so quickly that by the time you leave the store with a product it is often already outdated. • Look at the computers on pages 8 and 9. **How do these compare with the computers of today?** • **What new feature or capability would you create for a computer? What would the benefit be to the user, or what problem would it be solving?** **STEM Careers** Students who enjoy this kind of study may be interested in more information on Computer Engineering, Software Engineering, or Industrial Engineering.

Getting Around Then and Now
This book compares modes of transportation used today and in the past.

This book supports Lesson 1 in ***Technology A Closer Look.***

Reading Levels
GR G
Benchmark 12
Lexile 450

Before Reading Review the following vocabulary to activate prior knowledge: *travel, faster, slower.*
Ask:
Is it faster to travel by airplane or by car?
What is the fastest way you have traveled?

During Reading Ask students to look at the timeline on page 7. Remind them that a timeline shows what happened at different times. You start reading a timeline on the left. **Around 1800 the steamship was invented. What was invented next after the steamship?** (the steam train) **What came next?** (bicycle)

After Reading Ask students to summarize main points of this story. Ask? **How did people travel many years ago?** (Answers will include—on foot (walking), by bicycle, on horseback, by horse and buggy, covered wagon, and so on) **What do you think will be a new way of traveling in the future?** (Answers may include—segways, mini-trains, rockets, and so on)

Engineering Connection Talk about the transportation options around your city/town or state and what vehicles make up that transportation system.

- **How many different ways, using different kinds of transportation, can we use to come to school?** Typical answers include--cars, buses, bikes, walking
- **How many different ways can people get to work everyday?** Typical answers include—cars, buses, trains, subways, bikes
- **How many different ways do we have to go somewhere on vacation?** Typical answers include—cars, trains, planes, ships.

Discuss that every street, every traffic light, every park, everything in your city or town has been planned by a City Engineer or City Planner—usually someone specializing in Transportation Engineering.

- **What are the biggest needs in your city?**
- **What would you recommend for transportation that would make traveling around your city easier? How would this idea make travel easier?** Create a drawing/diagram to show the impact of these improvements.

STEM Careers Students who enjoy this kind of study may be interested in more information on Mechanical Engineering, Transportation Engineering, or Materials Engineering.

Then and Now
This books compares life in earlier times to life today and helps students develop and understanding of yesterday, today, and tomorrow, now, then, and long ago.

This book supports Lesson 1 in ***Technology A Closer Look.***

Reading Levels
GR M
Benchmark 28
Lexile 590

Before Reading Review the following vocabulary to activate prior knowledge: *then, now, yesterday, tomorrow.*
Ask:

- **Have you listened to older people tell about when they were children? Did they wear the same kinds of clothes you do? What kind of games did they play? What did they do at night after dinner?**
- **Which bicycle shown on the cover would you ride? Why?**

During Reading Look at page 3. This picture is from a long time ago. **What are the people doing?** milking cows

Look at page 5. This picture is from a long time ago. **Where are the children?** at school

After Reading Have volunteers summarize main points of this story. You can have them turn to specific pages and use the photos as a springboard to explain what we do now that is the same or different from years ago.

Engineering Connection Talk about how things change and yet how they stay the same. For example, look at the picture of the classroom on page 5.

- **What is different from your classroom today?** Sample answer—Still learning similar content but presented differently, students' clothing, desks are wood, teacher's drawing on a chalkboard
- **What is still the same?** Sample answers—Writing on a board, reading books, teacher there as an instructor/guide, students at desks, learning similar content, doing experiments/activities
- **How do you think classroom will look when you are older? What do you think will change?**

Talk about the two bikes shown on the cover. Then talk about ways we get around today—include newer means such as scooters, segways, shoes with wheels built in, and so on.

- **How have things changed?**
- **What do you think would be the next new invention that would make it easier to get around?**

STEM Careers Students who enjoy this kind of study may be interested in more information on Industrial Engineering, Manufacturing Engineering, or Mechanical Engineering

Technology That Helps Us

Title	Using the Leveled Reader	Making a STEM Connection
Mr. Bell and the Telephone This book tells about Alexander Graham Bell's life and how he and his assistant invented the first electric telephone. ☐ This book supports Lesson 5 in ***Technology A Closer Look.*** **Reading Levels** GR K Benchmark 20 Lexile 610	**Before Reading** Create a word web with the word *invention* in the middle. Ask students to brainstorm different kinds of inventions. Talk about who might have invented the items and why they might have been invented. **During Reading** As students read the text encourage them to think about how Mr. Bell got ideas for his inventions. **After Reading** Have students look at the cell phone pictured on page 14. **How does this phone compare with ones students are using today?**	**NOTE: You may want to use these two books in conjunction with each other to expand upon the concept of communication inventions.** **Inventioneering Connection** • **How did people communicate before telephones were invented?** Sample answers—smoke signals, drum beats, lanterns, pony express, and telegraph New technology developments and new requirements from users have pushed engineers working on telephones to constantly change and improve their products. Products with new uses and new capabilities are changing so quickly that by the time you leave the store with a product it is often already outdated. • Look at the telephones on the cover of the book or on page 10. **How do these compare with the cell phones you are using today?** • **What new feature or capability would you create for a cell phone? What would the benefit be to the user, or what problem would it be solving?** • **Can you think of another invention that changed our lives as much as telephones? What was it and what change did it bring?** **STEM Careers** Students who enjoy this kind of study may be interested in more information on Electrical Engineering or Industrial Engineering.
Telephones Then and Now This book shares how telephones have changed our lives and how phones today are still changing.	**Before Reading** Give each student a self-stick note and ask them to write one fact they know about telephones on each note. Discuss the notes as each is placed on the board. **During Reading** Ask students to imagine what life would be like without telephones. Then have students read to see what people used before the telephone was invented.	

Technology That Helps This book explains what people with physical challenges need and what has been created for them.

This book supports Lesson 3 and 5 in ***Technology A Closer Look.***

Reading Levels
GR M
Benchmark 28
Lexile 690

Before Reading Write the word invention on the board and discuss its meaning. Explain that inventions are often based on a need, a new technology, or products made because of scientific research.

Have students share inventions that they feel have helped their lives or made their lives better.

Discuss the term special needs and what problems would come from having trouble hearing, seeing, speaking, or walking.

During Reading Explain the word sign and that sometimes we see a word that we know, but it is used in a different way than we normally see it.

After Reading Have students summarize and identify the main idea of the story.

Engineering Connection As we read in the book, most inventions grow out of a need. Someone sees a need and invents something to fix it or take care of the need.

Think about people who are deaf, blind, or have a physical challenge.

- **What else could be invented to help people with special needs communicate?**
- **Where would communication, or the ability to communicate, be incredibly important?** Sample answers may include—In case of emergency the need to call 911, to communicate symptoms at the hospital, to understand prescriptions and the correct way to take medications, at an airport going through security; reporting an incident to the police; and so on.

STEM Careers Students who enjoy this kind of study may be interested in more information on Biomedical Engineering or HVR&AC (Heating, Ventilating, Refrigerating, and Air-Conditioning) Engineering.

What Will You Be? This book explores several careers and encourages students to begin thinking about what they might do when they are older. ☐ This book supports Lesson 4 and 5 in ***Technology A Closer Look.*** **Reading Levels** GR H Benchmark 14 Lexile 490	**Before Reading** You may have students share different jobs that their parents currently do or as a class, create a list of many different jobs that students know. You might share how and why you became a teacher. **During Reading** Look at pages 2 and 3. Here the shortened term "vet" is used in place of veterinarian. Students may need help with "author" on pages 4-5; "chef" on pages 6-7, or "architect" on pages 8-9. **After Reading** Have students summarize the story. You may want to assign pairs of students to learn more about some of the jobs you listed above. Create additional pages for a class book that share information about other careers	**Engineering Connection** Even though students are young it isn't too early to begin planting the seeds for STEM careers. As we've read, most inventors didn't set out to be inventors. They have curiosity or an inquiring mind. They problem solve. They see a need or a problem and look for a solution. • **What would you like to be when you are older? Why does this sound fun or interesting to you?** • **Is there a problem you would like to fix or a disease that you would like to cure? Think about how one person can make a difference.** **STEM Careers** Interested students may benefit from more information on any of the main disciplines in engineering. It is good for students to be exposed to different careers and to understand the opportunities they have.

The following book is also recommended to extend the concepts presented in this module. This book is available for purchase from McGraw-Hill.

- ***Alexander Graham Bell*** This biography introduces students to Alexander Graham Bell and his most famous invention, the telephone. (ISBN—978-0-02-199754-1)

Our Natural Resources

Title	Using the Leveled Reader	Making a STEM Connection
Recycle, Reduce, Reuse! This book encourages the reader to recycle, reduce, and reuse by giving simple examples of each.  This book supports Lesson 2 in ***Technology A Closer Look.*** **Reading Levels** GR C Benchmark 8 Lexile 340	**Before Reading** Talk about the cover of the book and what activities the students are participating in. Read through the title and see if any of the words are familiar with students. Allow them to share their experiences with recycling. **During Reading** Point to the words on the title and note that all three words begin with *"re"*. Explain that *re-* can mean "again." Ask, **What happens when people reuse something?** (They use it again.) **After Reading** As a class talk about some of the things you can do better to recycle, reduce, and reuse items.	**NOTE: You may want to use these three books in conjunction with each other to expand upon the concept of recycling.** **Engineering Connection** • Pose a problem to your students about how you can reduce the amount of trash your class or your school creates everyday. You may want to have someone from the janitorial staff share about the amount of waste that is collected each day and what that waste usually consists of to determine what would make the most impact. Keeping projects real-world and relevant is a good way to engage students. • If you don't already have a school program, you may want to start up a recycling center at your school to collect cans or papers, or start a campaign to create or expand upon a local recycling program in your area. If there is a current issue with this in your location, encourage students to offer ideas and suggestions • You may want to talk with local malls or restaurants to see if they have a recycling program. If they don't, ask how your class could help get one started. • Write a class letter to city council, state representatives, or owners of area malls/restaurants encouraging them to start a recycling program and give suggestions for what could be done and the benefits to all. **STEM Careers** Students who enjoy this kind of study may be interested in more information on Agricultural and Biological Engineering, Chemical Engineering, or Environmental Engineering.
Recycling Glass This book shares how many things we use every day are made of glass.  This book supports Lesson 2 in ***Technology A Closer Look.*** **Reading Levels** GR K Benchmark 20 Lexile 600	**Before Reading** Ask students if they recycle in their homes and community. If applicable, point out ways that your school recycles. Ask what the difference is between trash and recyclables. This book focuses on recycling. Discuss reasons why individuals and communities don't recycle. **During Reading** On page 7 it says that glass is sorted by color at the recycling center, but it doesn't say why. Ask students to draw a conclusion from what they have read so far as to why this would be the process. Encourage students to reread pages 8 and 9 to understand the recycling process. **After Reading** Ask students what words they found tricky to read. Ask them to summarize the story. Ask: **What would happen if everyone recycled?**	

Use it Again! In this book students discover that when they use old thing and make them new again, they are helping Earth.  This book supports Lesson 2 in ***Technology A Closer Look.*** **Reading Levels** GR E Benchmark 8 Lexile 330	**Before Reading** Remind students of an art project for which they used old items, such as boxes or cardboard tubes, to create something new. Ask students to explain what would have happened if these old items had been thrown away. Agree that they would become trash. Have students consider all of the trash people make. Ask: **Why might it be a good idea to reuse old objects?** Talk about the difference between trash and recyclables and that this book focuses on reducing the amount of trash disposed of each day. **During Reading** Have students keep a list of ideas of what they can do with old things, besides just throwing them away. (Use things over and over, fix old things, give old things away, make old things into something new) **After Reading** Have students work in small groups or pairs to retell the story and give examples of something they can do at home or at school to keep from throwing so many things away each day.	

Save Paper, Save Trees This book explains how paper is made and how it is recycled

This book supports Lesson 2 in ***Technology A Closer Look.***

Reading Levels
GR G
Benchmark 12
Lexile 470

Before Reading Display the cover of the book and read the title aloud. Ask: **What do you think the title means?** Have students predict if this book is fiction or nonfiction and explain why.

Preview each page, prompting students to tell what they see and make and confirm predictions. Ask: **What are the trees used to make? What do we use that is made from paper? What are some things you can do to recycle paper?**

During Reading Have students set a purpose for reading.
Pages 2-4: Have students read to find out where paper comes from
Pages 6-7: Have students read to find out how people help save trees. Remind them to reread if something doesn't make sense or sound right to them.
Pages 10-11: Ask students how they think they can save paper.
Pages 12-15: Have students read to find out other ways to save paper and what conclusions they can draw about saving trees.

After Reading Have students retell the information from the story.

NOTE: You may want to use these three books in conjunction with each other to expand upon the concepts of reducing and reusing.

Engineering Connection

- As a class talk about ways you can save paper by reducing the use whenever possible. Make a list of ways your class and school could reduce paper usage. Students may want to make posters to remind the student body or posters to point out the recycle bins. Morning announcements or a skit are also fun ways for student to get the message out.
- Work with your art teacher to find projects that students can make that reuse paper products---such as paper towel rolls, toilet paper rolls and so on.
- Encourage students to get their families to recycle newspapers, junk mail, or any paper they have. Inform families of local programs and locations of recycling receptacles in your area.
- Work with your art teacher to see if there is a local foundry or art studio where you can take old pieces of metal or glass to create something new from the old materials. The old materials can be melted down and reformed or recast into new items such as sculptures, vases, dishes, and so on.

STEM Careers Students who enjoy this kind of study may be interested in more information on Agricultural and Biological Engineering or Environmental Engineering.

What Happens to Your Trash? This book focuses not only on trash, but also on conservation. ☐ This book supports Lesson 2 and 3 in ***Technology A Closer Look.*** **Reading Levels** GR H Benchmark 14 Lexile 450	**Before Reading** Ask students what they do with their trash and if they sort it. Ask what they think happens to trash after it leaves their homes. Talk about vocabulary used in this book such as: *landfill, recycle, conservation, compost,* and *reuse* **During Reading** Point out the charts on pages 4, 8 and 13. Explain that charts can give more information about the topic. Tell students that if they only read the text and ignore the charts, they will miss important information. **After Reading** Ask students to use the photos in the book to help them retell information.	
Simple Ideas to Save the Earth This book shares the importance of conservation and why these leaders took action to help, as well as how everyone can help care for Earth. ☐ This book supports Lesson 2 and 3 in ***Technology A Closer Look.*** **Reading Levels** GR O Benchmark 34 Lexile 700	**Before Reading** Brainstorm as a class a list of ways to work together to keep your classroom and/or school clean. Then talk about ways to keep the world outside your school clean. Discuss how different parts of the world need to be cared for in different ways. For example, **If you lived near a beach (or big city or forest), what natural resources would be a concern?** **During Reading** Point to the word *conservation* on page 13. This comes from the root word *conserve* (to protect from harm; to preserve, save, or keep) and *–tion* (act of). **After Reading** Have students retell the book's information to another class.	

The following books are also recommended to extend the concepts presented in this module. These books are available for purchase from McGraw-Hill.

- ***Let's Recycle!*** This book explains the "how" and "why" of recycling. (ISBN—978-0-02-284643-5)
- ***Make It New*** This book explores recycling and names items that can be recycled. (ISBN—978-0-02-285841-4)

Space

Title	Using the Leveled Reader	Making a STEM Connection
Let's Visit Space This book describes what it's like to take a trip through space at a planetarium.  This book supports Lesson 3 and 5 in ***Technology A Closer Look.*** **Reading Levels** GR K Benchmark 20 Lexile 400	**Before Reading** Ask students what they know about science museums and/or planetariums. Depending upon your students' knowledge and experience of planetariums, you may need to describe them in more detail. **During Reading** Have students think about the difference in what can be seen in a planetarium's theater and what can be seen in a regular display or in a book. How do they compare? **After Reading** Ask students to describe a planetarium for someone who has never visited one. What would the viewer expect to see?	**NOTE: You may want to use these four books in conjunction with each other to expand upon the concepts of space exploration.** **Engineering Connection** In small groups you may want to talk about these four books. Ask students: • Have you ever been "first" at doing something in your family---maybe the first to fly in an airplane, the first to get your ears pierced, and so on. **How did it feel?** No one in your family could tell you exactly what it would be like. **How do you think the first astronauts felt?** • **What do you think it would be like to travel through space? What would it be like to train for space travel? How would you know what to do to prepare or what you would need to take?** • **Would you want to be an astronaut? Why or why not?** • **Where is some place you would like to explore? Why does it sound interesting to you?** **STEM Careers** Students who enjoy this kind of study may be interested in more information on Aeronautical/ Aerospace Engineering. Computer Engineering, or Mechanical Engineering.
Ready, Set, Go! This book looks at how astronauts prepare for a space flight.  This book supports Lesson 2 in ***Technology A Closer Look.*** **Reading Levels** GR E Benchmark 8 Lexile BR	**Before Reading** Brainstorm with students a list of things they do each morning to get ready for school. Make a sequence chart to list how student get ready on weekday morning. (first, next, last) **During Reading** Point to the word first on page 4. Ask students to tell the meaning they know for this word. Elicit that here, first is a time-order word that tells when something happens. Ask students to find other time-order words in the text *(next, then, finally).* **After Reading** Help students use the photographs to retell how astronauts get ready for space	

Meet Mae Jemison This book shares Mae Jemison's dream of becoming an astronaut and her journey from the role of astronaut to teacher. ☐ This book supports Lesson 4 and 5 in ***Technology A Closer Look.*** **Reading Levels** GR E Benchmark 8 Lexile 260	**Before Reading** Have volunteers tell what an astronaut is and what they do. Look at a copy of the book and have students tell whether they think the book is fiction or nonfiction. Ask them to explain why they think as they do. **During Reading** Remind students to look for the differences between past and present tense. For example, on page 15 it states: She wanted to be a teacher. Now, she is. The action in the first sentence has already happened and the action in the second sentence is happening now. **After Reading** Ask for volunteers to summarize what they read. Then have students compare and contrast you, their teacher, with Mae Jamison. Ask students to share a dream they have for when they grow up.	
Star Sailor This book is about becoming an astronaut—how they are selected, how they train, and what they do in space. ☐ This book supports Lesson 3 and 5 in ***Technology A Closer Look.*** **Reading Levels** GR M Benchmark 28 Lexile 710	**Before Reading** Create a K-W-L chart about the topic of space exploration. Have students share what they know about what *astronauts* (*astro-* which means "a star or stars" and *–naut* which means "sailor") do and how they train. **During Reading** Ask students to make notes about the traits of a good astronaut and the training that astronauts receive before they go on missions. **After Reading** Have each student share something that they learned from this book.	

The following book is also recommended to extend the concepts presented in this module. This book is available for purchase from McGraw-Hill.

- ***Journey into Space*** This book provides a brief look at the history of flight and space exploration. (ISBN—978-0-02-285871-1)

Flying Machines

Title	Using the Leveled Reader	Making a STEM Connection
Born to Fly This story (pages 33-40 in the Decodable Reader Adventures All Around) introduces two brothers, Orville and Wilbur Wright.  This book supports Lesson 4 and 5 in ***Technology A Closer Look.*** **Reading Levels** GR H Benchmark 14 Lexile 300	**Before Reading** Talk about what life was like before there were airplanes. Ask students how they think people traveled long distances. **Do you think the airplane was an important invention? How did it change the way we travel?** **During Reading** Point out the photo on page 34 of Orville and Wilber Wright. Students may have heard them called "the Wright Brothers'. You may want to talk about the homonyms—*Wright, write, and right*—which may be confusing, especially to ELL students **After Reading** The Wright Brothers had a goal. Ask students to retell the goal in their own words. Why would working with your brother (or sibling) make it easier or harder to achieve a common goal?	**NOTE: You may want to use these four books in conjunction with each other to expand upon the invention of flying machines.** **Engineering Connection** • The first two books in this module introduce the Wright Brothers and the background that led to the invention of the airplane. Discuss how the brothers' background and work experience/knowledge aided them in their quest to fly. List the characteristics you see the brothers. (for examples, curious, questioning, inquisitive, goal setting, determined, perseverance, and so on) • The second two books in this module take a closer look at flying machines and what it takes to fly them. Ask interested students what skills are needed to make a good pilot. Encourage them to do some simple research and share with the class what they learn about being a pilot. • Make a class list of different jobs that require a pilot license. (examples: TV helicopter, LifeFlight, Police helicopter, sight-seeing planes, commercial airlines, postal service, armed forces, and so on), Students who are interested may also enjoy researching what it takes to fly a hot-air balloon, blimp, glider and so on to compare and contrast. • **What effects do you think the Wright brothers' invention had on the way we travel today?** **STEM Careers** Students who enjoy this kind of study may be interested in more information on Aeronautical/ Aerospace Engineering or other related fields of Engineering such as: Computer, HVR&AC, Materials, Mechanical, or Transportation.
The Flying Machine This book introduces students to Orville and Wilbur Wright and traces the lives of these famous inventors.  This book supports Lesson 3 and 5 in ***Technology A Closer Look.*** **Reading Levels** GR I Benchmark 16 Lexile 520	**Before Reading** Show students the picture on page 3. This is a picture of Orville and Wilbur Wright. Compare this picture with the one on page 34 of Born to Fly (previous book in this package). Have students look at the photos of the airplanes on the cover and page 1. Compare these with today's airplanes. **During Reading** Take about the dates in the 1900s. This will be so long ago that it is hard for students at this age to grasp. If you have studied the number 100 at this point in the year, you could talk about these dates being more than 100 years ago. **After Reading** As a class, discuss: **How have airplanes changed over the years?**	

The Pilots This book explains a pilot's job, discusses the training needed to become a pilot, and provides information about the different types of planes that pilots fly. ☐ This book supports Lesson 4 and 5 in ***Technology A Closer Look.*** **Reading Levels** GR J Benchmark 18 Lexile 530	**Before Reading** You may want to talk about Orville and Wilbur Wright—they were both inventors and pilots. How do you think a control panel from today, as seen on pages 2 and 5, compares with the control panel in the first airplane? **During Reading** You many want to talk about the word *simulator* (page 6) as this word may be unfamiliar to students. *Simulate* (imitate or substitute for) and *–or* (person or thing who does). **After Reading** After reading the story have students make a list of the things they would like most about being a pilot. You may also want to create a word web with *"flying machines"* as the center. Encourage students to add as many different examples as they can think of or find when researching.	
It Can Go up This book is about the way that people travel through the sky. ☐ This book supports Lesson 3 and 5 in ***Technology A Closer Look.*** **Reading Levels** Rebus Lexile BR	**Before Reading** This book moves students from talking just about airplanes to other flying machines including a jet airplane, helicopter, hot air balloon, single-engine plane, blimp (air ship), hand glider (Delta plan), and rocket/shuttle. **During Reading** The reader level of this book is for a beginning reader. For students who are ready for more, encourage them to make up their own copy for the pages which can either be shared orally or in writing. **After Reading** You may want to take a survey to see how many people have ridden in each kind of flying machine or have students vote to find which would be the favorite way to travel.	

Top 20 Engineering Disciplines

Below is a list of the top 20 Engineering Disciplines. Engineering is a diverse and challenging field of study. With more than 25 major branches of engineering and 100 specialties, there is something for everyone who pursues the field.

Aeronautical / Aerospace Engineering - Aeronautical/aerospace engineers design and develop technology for commercial aviation, national defense and space exploration. They may help design and manufacture military aircraft, missiles, helicopters, and spacecraft. Within this field, they may specialize in the structure of the aircraft, aerodynamics, guidance and control, propulsion and design, manufacturing, or a certain type of aircraft. Commercial airliners, military aircraft, space shuttles, satellites, rockets, and helicopters are all within reach for talented aeronautical engineers, who may also be referred to as astronautical, aviation or rocket engineers.

Agricultural and Biological Engineering - Biological and agricultural engineering, two closely integrated disciplines often called biological systems (biosystems), bioresources, or natural resources engineering, are concerned with finding solutions for life on a small planet. Our swelling world population places great demands on our limited natural resources, and biological and agricultural engineers work to ensure that we have the necessities of life: safe and plentiful food to eat, pure water to drink, clean fuel and energy sources, and a safe, healthy environment.

Architectural Engineering - Architectural engineers apply engineering principles to the design and technical systems of buildings - mainly their structural, mechanical, plumbing and lighting/ electrical design. Engineers need to be aesthetic as well as technical, creative as well as practical. They need to know if what looks good on paper is also technically possible.

Biomedical Engineering - The objective of biomedical engineering is to enhance health care by solving complex medical problems using engineering principles. Those who specialize in this field want to serve the public, work with health care professionals, and interact with living systems. This broad field allows a large choice of sub-specialties. Many students say they choose biomedical engineering because it is people-oriented. The field includes many branches: biomechanical, bioelectrical, biochemical, rehabilitation, clinical, and genetic engineering. There are also many sub-specialties within biomedical engineering such as surgical lasers, telemedicine, nuclear medicine, and clinical computer systems.

Chemical Engineering - Everything that our senses enjoy consists of chemicals in one way or another. Chemical engineers have worked on creating the purple rose that has no thorns, the caramel on a caramel apple, and even your tennis shoes. The chemical engineering profession has improved water and waste systems, created new drugs and drug delivery systems, and improved the crop yields for farmers. Most chemical engineers work in manufacturing, pharmaceuticals, healthcare, design and construction, pulp and paper, petrochemicals, food processing, specialty chemicals, microelectronics, electronic and advanced materials, polymers, business services, biotechnology, and the environmental health and safety industries.

Civil Engineering - Traditionally, civil engineers planned and designed such things as roads, bridges, high-rises, dams, and airports. Because of population growth and a booming economy, however, the civil engineer now also designs new things such as underwater tunnels, new and better wastewater treatment plants, solutions for highway congestion, and special tracks for the magnetic levitation trains of the future.

Computer Engineering - Computer engineering deals with the many aspects of computer systems. These engineers may design computer systems, networks, operating systems, or software. They may design the future automobile dashboard computers that will monitor engine functions. Engineers in this field design computer chips, circuits, equipment, and systems; plan computer layouts; and formulate mathematical models to solve technical problems on computer. They design, develop, and test computer hardware and peripheral equipment. They also design, develop, and maintain software programs and software systems.

Electrical Engineering - The developments of electrical and electronic engineers are everywhere. There are thousands of electrical devices and systems available today that electrical engineers have somehow touched. Anything you plug into the wall – stereos, computers, microwaves, televisions, power tools, air-conditioners, and major appliances – has been touched by an electrical engineer. Even things you can't plug into the wall – satellites, cellular phones, and beepers – have been designed, manufactured, or modified by electrical engineers. Electrical engineers also work in areas that generate, transmit, and distribute electrical power to consumers.

Environmental Engineering - Environmental engineering focuses on the development of a sustainable future, preventing pollution, assessing the environmental impact of everything, water distribution systems, recycling methods, sewage treatment plants, and pesticide prevention. This fast-growing field offers a challenging and satisfying chance to protect the health and safety of people and our environment. These earth-friendly professionals concern themselves with preventing and fixing problems caused by industrialization. They concentrate on delivering better environmental conditions for the public through knowledge, research, a caring attitude, and common sense.

Heating, Ventilating, Refrigerating, and Air-Conditioning Engineering - Heating, ventilating, refrigeration, and air-conditioning (HVR&AC) engineers have dramatically improved our lives. HVR&AC engineers develop systems to create and maintain safe and comfortable environments. Airplanes, trains, schools, cars, and computer rooms are only a handful of the environments that depend on HVR&AC engineers.

Industrial Engineering - Industrial engineers figure out how to improve everything. They work with people to help them do things better. Industrial engineers save employers money by streamlining systems, often making the workplace better for employees too. They improve productivity and quality while saving time and money. Industrial engineers work on all type of businesses. They see the big picture and focus on what makes a system perform efficiently, safely, and effectively to produce the highest quality.

Manufacturing Engineering - Just as the mechanical engineer designs parts, the manufacturing engineer designs the processes that make them. Wherever there's a production process to be designed and managed, you'll find manufacturing engineers at work. They work with plant managers, production supervisors, CNC programmers, quality managers, product designers, and R&D staff on issues ranging from evaluating new technology and choosing equipment and suppliers to leading industry-wide standards development to reorganizing a plant into a more efficient production system.

Materials Engineering - Materials engineers design, fabricate, and test materials. They may work to make automobiles lighter and more fuel efficient by creating stronger and lighter metals. They may help to create artificial knees and elbows using special polymers, or they may design new materials for the space ship. A materials engineer can work with any type of material – plastic, wood, ceramic, petroleum or metals –and create completely new synthetic products by rearranging molecular structure.

Mechanical Engineering - Mechanical engineers is one of the broadest and most diverse disciplines. Mechanical engineers design, develop, and manufacture every kind of vehicle, power system, machine, and tool: jet engines, steam engines, power plants, underwater structures, tractors for food production, hydraulic systems, transportation systems, medical devices, sports equipment, smart materials, materials and structures for space travel, measurement devices, and more. Any type of machine that produces, transmits, or uses power is most likely the product of a mechanical engineer.

Metallurgical Engineering - Metallurgical engineers turn raw materials into useful products. Metallurgical engineering includes processing mineral and chemical resources into metallic, ceramic or polymeric materials; creating new high strength or high performance materials; or developing new ways to refine and process materials for new consumer applications.

Nuclear Engineering - Nuclear engineering falls into three major areas of benefit to mankind: nuclear medicine, agricultural uses and pest control, and nuclear energy. Nuclear engineers search for efficient and beneficial ways to use the power generated from splitting an atom, and they research peaceful ways to use nuclear energy and radiation.

Naval Architecture, Marine Engineering, and Ocean Engineering - Naval architecture, marine engineering, and ocean engineering are professions that integrate disciplines such as materials science and mechanical, civil, and electrical engineering. These engineers and architects design, build, operate, and maintain ships such as aircraft carriers, submarines, tankers, tugboats, sailboats, and yachts. They also develop underwater structures, underwater robots, and oil rigs. They develop transportation systems, plan new uses for waterways, design deep-water ports, and integrate the land and water transportation systems and methods. They are concerned with discovering, producing, and transporting offshore petroleum as sources of energy and developing new ways to protect marine wildlife and beaches against the unwanted consequences of offshore oil production.

Software Engineering - Software engineering is on the cutting edge of technology. Software enables us to use computers. It is the translator between humans and computers. Without software, a computer would be nothing but ones and zeros. The current demand for software engineers far exceeds the supply. The largest employers of software engineers include familiar names such as Microsoft, Motorola, Autodesk, Netscape, Adobe, Symantec, Nintendo, and Corel. However, there are thousands of software manufacturers that hire software engineers.

Structural Engineering - Structural engineering focuses not only on the design and development of structures, such as houses, coliseums, bridges, and shopping malls, but on the design and development of materials that will create these structures. The structural engineering profession offers exciting challenges and potential for growth. Each day brings new and more sophisticated materials that will change the shape and the future of structures. Structural engineers must be creative and resourceful. They must visualize the framework of a structure and determine what forces will produce what loads upon it. Many structural engineers in California design buildings that are able to sustain ground-shaking (earthquake) loads.

Transportation Engineering - Transportation engineering is a branch of civil engineering that aims to allow people and goods to move safely, rapidly, conveniently, and efficiently. Transportation engineers design streets, highways, and public transportation systems. They design parking lots and traffic flow patterns that will prevent major congestion at busy intersections, shopping malls, and sporting events. They are involved in planning and designing airports, railroads, and busy pedestrian thoroughfares.

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