Invention Upgrades

FOCUS QUESTION

How do people build on others' ideas in creative new ways?

NOTICE AND WONDER

Look at the three texts you will read in this lesson. What do you notice? What do you wonder? Discuss your ideas with a partner.

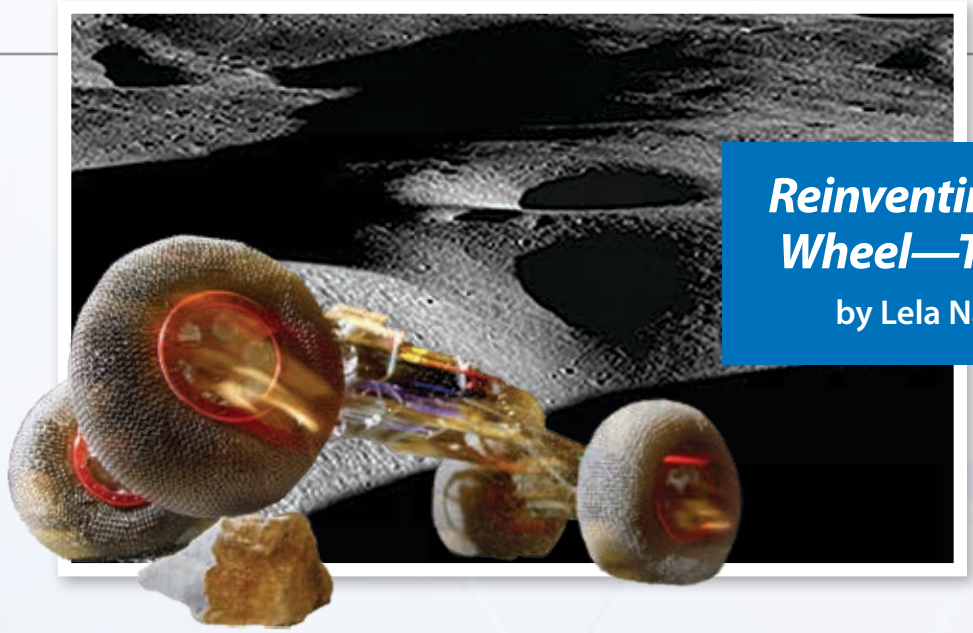
WORD PAIRS

Draw a line to match words with similar meanings. Then, on the lines below, write a sentence using one of the pairs of words.

future	dream
upgrade	someday
imagine	improve

___ has a similar meaning to ___.

___ thinks ___. I agree/ disagree because ___.



Reinventing the Wheel—Twice!

by Lela Nargi

Need a Lift?

by Maria Parrott-Ryan

Going the Distance

by Jessica Jackson

SESSION 1 READ

Reinventing the Wheel– TWICE!

by Lela Nargi

1 Learning to ride a bicycle is exciting, but it can also seem a bit scary at first. The wheels may wobble and cause riders to lose their balance. In fact, riders may fall down a lot before they have their first smooth, successful ride. Could someone improve bicycle wheels so there would be more fun and less falling?

2 In 2004, a group of inventive college students decided to do just that. They redesigned the bicycle wheel to help new riders keep their balance. The students replaced the regular front wheel of a bicycle with their invention, called a gyrowheel. Inside the gyrowheel is a motorized disk that spins. The whirling of this round, flat piece of metal creates a strong **force** that keeps the wheel upright. So, the wheel is balanced no matter how slowly the rider is pedaling. No more falling!

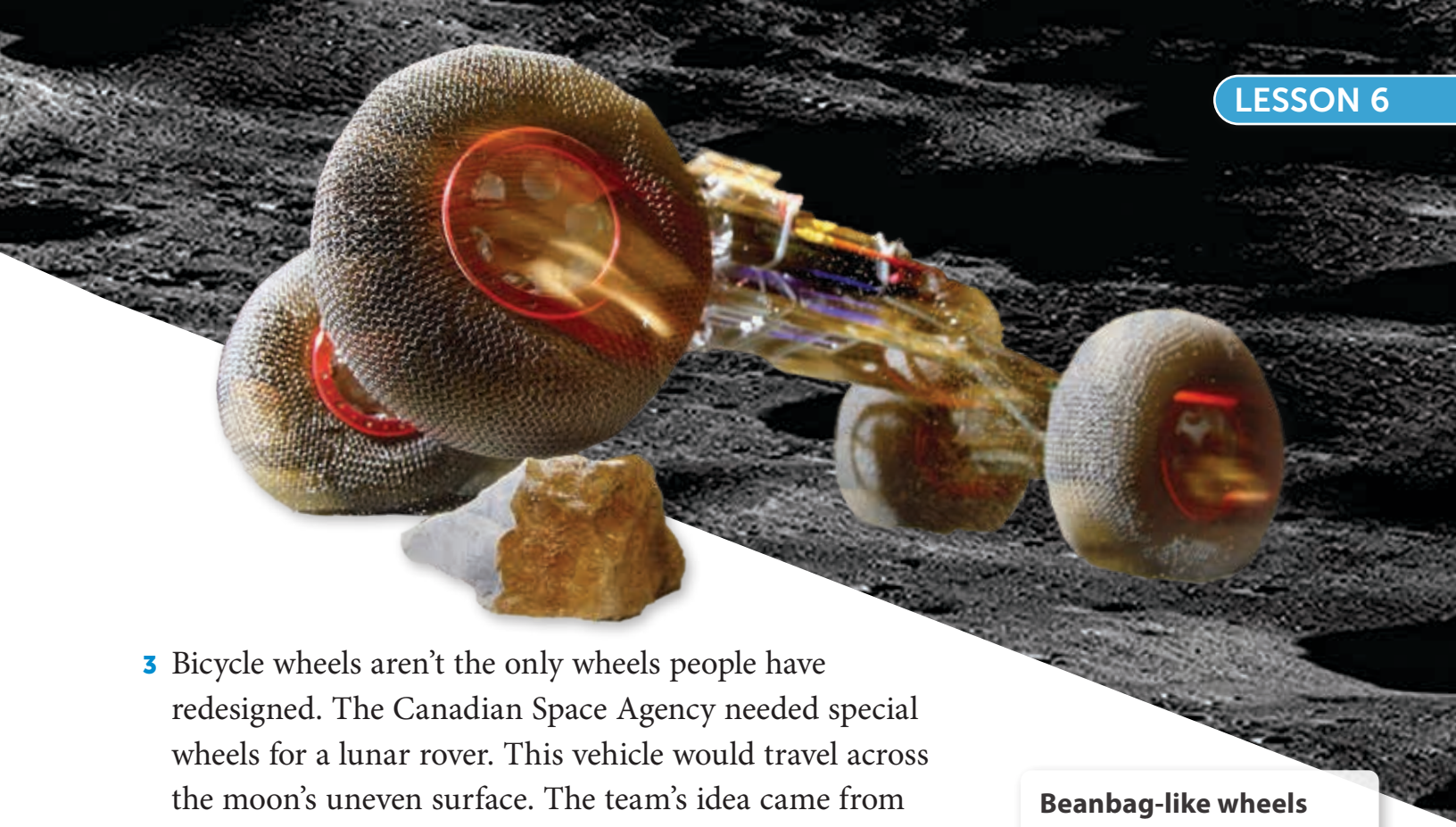
force = push or pull on an object

Stop & Discuss

How is the gyrowheel helping new bicycle riders?

Underline two sentences that tell you.

A spinning disk inside the gyrowheel helps keep the wheel from wobbling.



Beanbag-like wheels help a lunar rover travel over the moon's surface.

3 Bicycle wheels aren't the only wheels people have redesigned. The Canadian Space Agency needed special wheels for a lunar rover. This vehicle would travel across the moon's uneven surface. The team's idea came from beanbag chairs, those cloth bags filled with small, round pieces of foam.

4 The beanbag wheels the team created are made of steel mesh on the outside. This weblike material can hold up in the extreme temperatures of the moon, which swing from –208°F to 250°F (–133°C to 121°C). Small pieces of plastic fill the rover's wheels, which are soft and mushy just like beanbag chairs. This sponginess helps the wheels roll smoothly across the moon's uneven surface. It also means that the wheels can easily climb over tall boulders without jolting the equipment inside the rover. There are no bounces or bumps.

5 The wheel is a very important invention that has been redesigned many times. The very first wheel, which was probably made of stone, would never have made it to the moon or even onto a bike. It's a good thing people have continued working on new versions of the wheel. Like these teams of inventors, someday you might redesign something to solve a "wheel"—make that a *real*—problem!

Stop & Discuss

Why does a lunar rover need special wheels?

Support your response with details from the text.

The special wheels help the lunar rover ___.

SESSION 2 PRACTICE

Determine Word Meanings

- You can figure out the meanings of unfamiliar words by looking inside words for word parts.
- **Word parts** include base words, prefixes, and suffixes.

Reread/Think

Look at the words below from "Reinventing the Wheel—Twice!" Use word parts to figure out their meanings. Write your ideas in the chart.

Word	Word Parts	Meaning
successful (paragraph 1)	**success/ful** • -ful = full of	
inventive (paragraph 2)	**invent/ive** • -ive = quality or trait	
redesigned (paragraph 2)	**re/design/ed** • re- = again • -ed = in the past	
replaced (paragraph 2)	**re/place/ed** • re- = again • -ed = in the past	
sponginess (paragraph 4)	**spongi/ness** • -ness = quality or state of being	

Talk

Choose one of the words from your chart. Explain how you figured out its meaning and how it helps you understand the text. Share your ideas with your group.

I figured out that ___ means ___ because ___.

___ helps me understand the text because ___.

Write

Describe one of the wheel upgrades featured in "Reinventing the Wheel—Twice!" Explain how the new version made the wheel better. Use at least two words from your chart in your response.

WRITING CHECKLIST

- ☐ I correctly used at least two words from the chart in my response.
- ☐ I described one of the inventions featured in the text.
- ☐ I used complete sentences.
- ☐ I used correct spelling, punctuation, and capitalization.

SESSION 3 READ

Need a Lift?

by Maria Parrott-Ryan

1 Skyscrapers of the future may not look anything like the buildings of today. In fact, they may be twice the height of any building that exists now. For example, the Empire State Building in New York City has 102 floors. A future skyscraper could have 200 floors! That skyscraper would *have* to have amazing elevators.

2 Wait. Elevators? Okay, maybe they aren't the most exciting things to imagine. But think about it: Would you want to climb the stairs to the 200th floor? Advanced elevators that use newer technology are important for planning these futuristic skyscrapers.

Stand Tall

3 Cities of the future will be a lot taller than they are today. Why? Taller buildings provide more space for people to live and work in a small area. There are other reasons, too. Some cities want **landmark** buildings that people around the world will know about. Also, some builders want the challenge of designing these super structures.

4 But builders have another challenge. They need to figure out how to move people safely and quickly to such great heights—and that's where elevators come in. The basic elevator technology that was in use a hundred years ago will not get people to the top of the newest, tallest buildings. Luckily, elevator **engineers** aren't waiting for the future to well, *elevate* elevator design. They've figured out some solutions already.

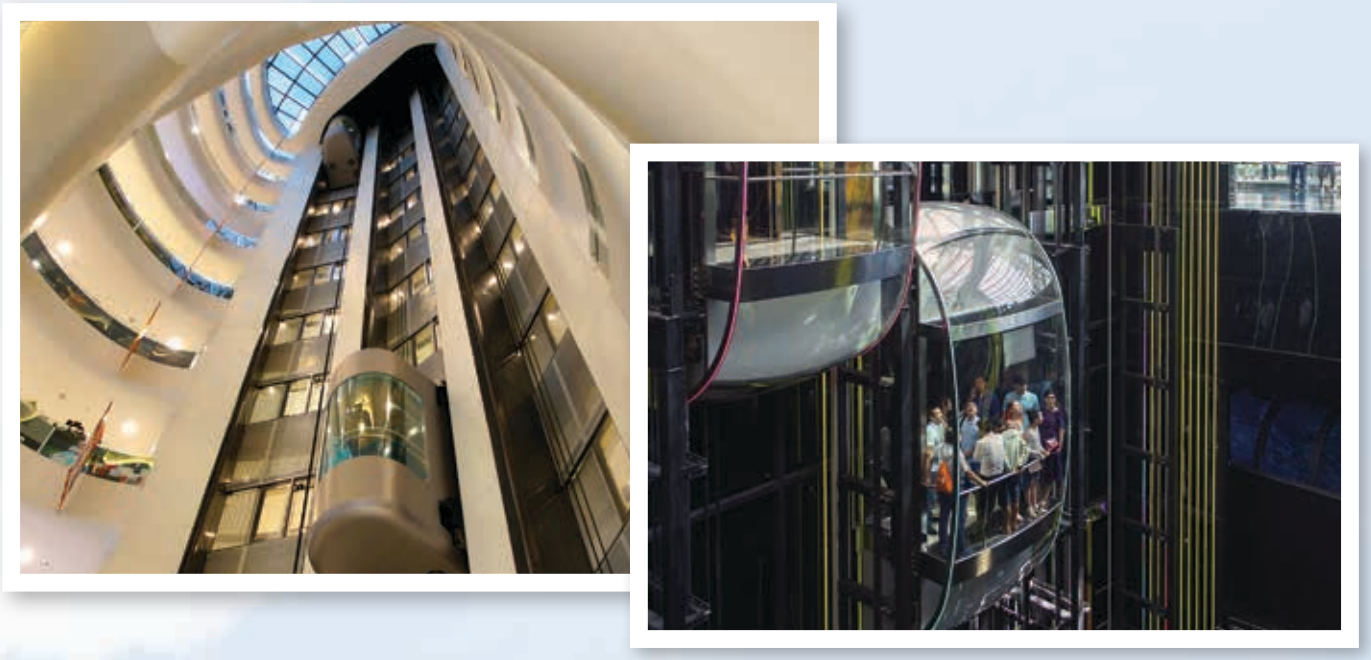
landmark = a well-known building or structure

engineers = people who design machines

Stop & Discuss

Why do some people want to build even taller buildings than we have today?

Underline three reasons.



Buildings of the future will need more advanced elevators.

Higher! Faster!

5 One new invention will allow buildings to soar taller than ever before. Today's elevators use steel cables, or cords. But steel is heavy, and the weight of the cables limits how high they can pull an elevator car, which is the part people ride in. One elevator company has found a solution to this problem. It has invented a cable made of a special material that is lighter and stronger than steel. The new cables can pull an elevator much higher. Now, taller skyscrapers can be built.

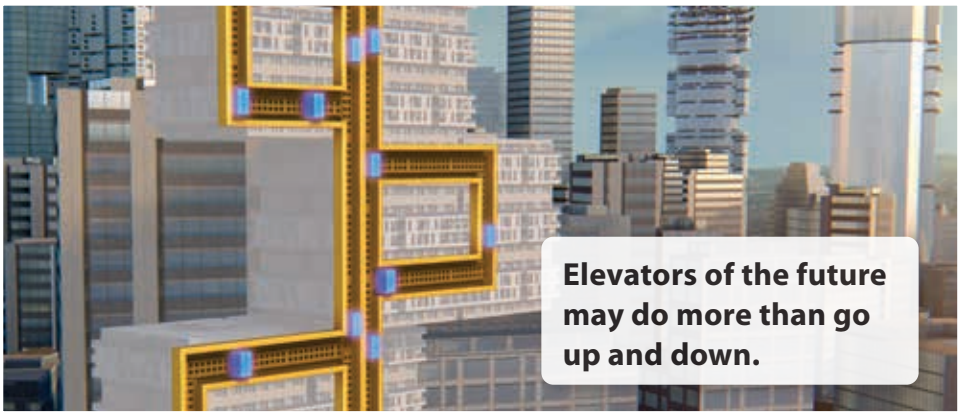
6 But the higher elevators go, the longer the trip. So, engineers are making elevators that go faster. Most elevators today only go about 200 feet per minute. Engineers are aiming for record-breaking speeds of 4,000 feet (about 1,200 meters) per minute. That speed would get you to the top of the world's highest building in less than 60 seconds!

Stop & Discuss

Why will very tall buildings of the future need new types of elevators?

Discuss your ideas with a partner.

SESSION 3 READ



Elevators of the future may do more than go up and down.

Up, Down, and . . . Sideways?

7 One new elevator system doesn't use cables at all. Instead, it uses magnets to "float" cars above a track that is similar to a train track. This is called *magnetic levitation* because the magnets push against each other and lift the cars above the track. In addition to making elevators faster, this new technology offers exciting possibilities to reimagine a building's shape. These elevators would not be limited to moving up and down inside straight, narrow shafts. Instead, the new elevators could move *sideways*. Elevator shafts could be designed as loops, with multiple cars going around and around in a circle. With these new elevators, skyscrapers wouldn't have to be built straight up-and-down. Think of the spectacular shapes architects and engineers could dream up!

8 The skyscrapers of the future may reach a mile or more into the air. They may have creative new shapes. And they will likely take you on the wildest elevator ride ever!

Stop & Discuss

How could magnetic levitation change elevators and buildings?

Discuss your ideas with a partner.

Determine Word Meanings

- Figure out the meaning of an unfamiliar word by looking around the word for context clues. **Context clues** are words or phrases in a sentence or paragraph that help you understand the meaning of an unfamiliar word.
- You can use context clues, word parts, or both to figure out the meaning of a word.

Reread/Think

Reread "Need a Lift?" Use context clues and any word parts you know to figure out the meanings of the words below. Write your ideas in the chart.

Word	Context Clues and Word Parts	Meaning
advanced (paragraph 2)		
cables (paragraph 5)		
aiming (paragraph 6)		
levitation (paragraph 7)		
multiple (paragraph 7)		

SESSION 4 PRACTICE

Talk

Explain how you figured out the meaning of one of the words in your chart using word parts, context clues, or both.

The context clue ___ helped me figure out that ___.

The word part ___ helped me figure out that ___.

Write

Explain why engineers might one day use magnetic levitation instead of steel cables in elevators. Use at least two words from your chart in your explanation.

WRITING CHECKLIST

- ☐ I used two or more words from my chart correctly.
- ☐ I explained why some engineers will use magnetic levitation instead of steel cables.
- ☐ I used complete sentences.
- ☐ I used correct spelling, punctuation, and capitalization.

GOING THE DISTANCE

by Jessica Jackson

1 You've finished writing an email to your friend. To send the message, you just press a button and *whoosh*, it's delivered instantly. But back in the 1700s, when the U.S. postal system was created, people communicated with one another over long distances by writing letters and sending packages. Mail carriers delivered these items in stagecoaches, or horse-drawn wagon carts. Letters and packages could take weeks to arrive.

2 Over time, mail service has progressed by getting faster and faster. For instance, with the invention of the automobile in the early 1900s, mail delivery times were cut in half! This made corresponding with friends and family easier. Soon after, airplanes began transporting mail from one part of the country to another, making even better time.

3 Today, mail carriers drive trucks to make deliveries in towns and cities. In some places, mail carriers walk from home to home, dropping off mail. Driving and walking may soon be things of the past, though. The U.S. postal system has a plan to take local mail delivery to the sky!

4 The idea is to use drones, a kind of aircraft that can deliver mail without pilots on board. With the ongoing improvement of technology, engineers are designing drones that are perfect for carrying and delivering packages. These drones have four to eight fast-spinning propellers, the long blades that lift and move them in the air. The drones also have computer **software** that guides them to the correct destination.

software = instructions used by a computer

5 So, how would the drones work? Here's the basic idea. First, an operator (the person who controls the drone) loads it with the package and sets the flight path. Because of computer programming, the drone knows the delivery address and how to get there. Then it lifts off, moving through the air. Finally, when the drone reaches the correct location, it releases the package. The drone then returns to the operator to start a new delivery.

6 Besides being a useful assistant, drones can do things that mail carriers can't. Drones can avoid traffic jams and stoplights. They can whiz to areas that are too hard to get to. And unlike the horses that pulled mail-wagon carts in the 1700s and 1800s, drones don't require rest or need breaks for food and water. Still, the U.S. postal system's drones aren't ready to take flight just yet. Engineers are still working on them, so it will be a while before this technology becomes an everyday reality in your neighborhood.

Respond to Text

Reread/Think

Reread "Going the Distance." Choose the best response to each question.

1. Read this sentence from paragraph 2 of the text.

> This made **corresponding** with friends and family easier.

What does the word *corresponding* mean?

A. visiting often

B. telling stories

C. writing letters

D. working closely

2. Which context clue from paragraph 4 helps the reader understand the meaning of *propellers*?

A. "deliver mail without pilots on board"

B. "perfect for carrying and delivering packages"

C. "long blades that lift and move them in the air"

D. "computer software that guides them"

3. Read this sentence from paragraph 4 of the text.

> The drones also have computer software that guides them to the correct **destination**.

What does the word *destination* mean?

A. answer

B. end point

C. launch pad

D. package

SESSION 5 PRACTICE

Reread/Think

4. Read this sentence from paragraph 6 of the text.

> Engineers are still working on them, so it will be a while before this technology becomes an everyday **reality** in your neighborhood.

What does the word *reality* mean?

A. something that scientists design

B. something that actually happens

C. something that takes a long time

D. something that is common in cities

Write

Read this sentence from the text.

> Over time, mail service has **progressed** by getting faster and faster.

First, define the word *progressed*. Then, describe how mail service has progressed using information from the text. Use at least three examples from the text in your response.

WRITING CHECKLIST

- ☐ I defined the word *progressed*.
- ☐ I described how mail delivery has progressed over time.
- ☐ I used at least three examples from the text.
- ☐ I used complete sentences.
- ☐ I used correct spelling, punctuation, and capitalization.

Respond to the Focus Question

How do people build on others' ideas in creative new ways?

Reread/Think

Look back at the texts in this lesson. Choose the two invention upgrades you think are most interesting. Explain how these invention upgrades are improvements over earlier versions.

Talk

With your team, brainstorm three inventions that could be upgraded. Then, with a partner, describe the invention you would like to upgrade and how you would improve it.

One invention I would like to upgrade is ___.

To make it better, I would ___.

Write

Create a sign advertising your new invention upgrade. In your advertisement, describe how your upgrade works and explain why it is an improvement over the existing process or technology.