Week 8

5th Grade Language Arts

Name:

Teacher:

Monday - Assignment 1 - Argumentative Text

* Required

Please read pages 572 and 573 in your textbook and select three features of argumentative text. Hint: Use your anchor chart on page 573. * 3 points

- [ ] Reasons with supporting facts and details
- [ ] Introduction: claim or opinion statement
- [ ] Because I want to
- [ ] Conclusion: arguments appeal to audience's logic and emotions
- [ ] Everyone should always agree with me

Submit

Monday, Week 8 Assignment 2-Vocabulary Preview

Please use your book (pages 575 - 589) or a dictionary to write the correct definition in a complete sentence. Then use thesaurus.com to find 2 synonyms or make up your own.

Word	Correct Definition	Synonyms (2)
Geological (page 577)		
Habitat (page 578)		
Debris (page 580)		
Advocates (page 581)		
Valve (page 587)		

Tuesday Week 8 Story Quiz

* Required

What solution does the author present to the issue of humans managing nature? Hint: Read paragraphs 37-38. *

Your answer

Submit

Wednesday Argumentative Texts

On page 577, what is the author's claim regarding careful management of nature?

- ○ People can control the weather.
- ○ Management can reduce human tragedy and still allow diverse ecosystems to thrive.
- ○ Fires do not cause damage in nature.
- ○ People should not try to carefully manage nature.

Submit

Thursday Writing

* Required

Write one paragraph about a natural disaster you experienced or have heard about. Try to include the 5 "W"s (who, what, where, when, why). *

Your answer

Submit

Friday Week 8 Quiz

* Required

Many people live in areas that could be damaged by a wildfire or a flood. Why would people feel the need to manage natural process and disturbances? Check all that apply. *

- [ ] It makes them feel important.
- [ ] They want to protect themselves.
- [ ] They want to protect their property.
- [ ] The pizza delivery person can get to houses more quickly.

Submit

Learning Goal

I can learn more about the theme *Systems* by reading a text that helps me analyze arguments.

Argumentative Text

An **argumentative, or persuasive, text** tries to convince a reader to think or act a certain way. Authors use facts either to support an argument or to oppose an argument. Argumentative texts include

- A **claim**, or clear position that the author defends
- **Reasons** that support the claim
- **Facts and details** that support the reasons
- Comments on an opposing claim, or **counterclaim**
- **Appeals** to readers

TURN and TALK How do argumentative texts differ from informational texts? With a partner, compare and contrast characteristics of argumentative texts with those of informational texts. Use the anchor chart to help guide your discussion.

If a text tries to convince you to do or believe in something—it's argumentative!

Be a Fluent Reader Fluent readers read with accuracy, which means they pronounce words properly and do not add, skip, or replace words in text.

When you read text aloud, you may come across unfamiliar words or difficult sentences. To read them accurately

- look for letter sounds and spelling patterns you already know
- apply rules you have learned for letter sounds and pronunciations
- reread the sentence to make sure you did not add, skip, or replace any words

Argumentative Text Anchor Chart

Purpose: To persuade

Introduction

- Claim, or opinion statement

Reasons

- Supporting facts and details

Counterclaim

- Statement of opposing claim

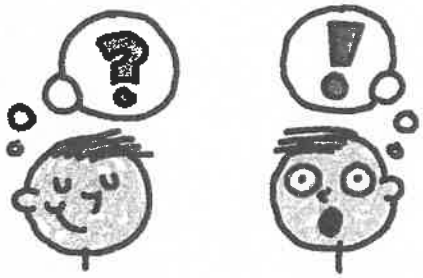
Rebuttal

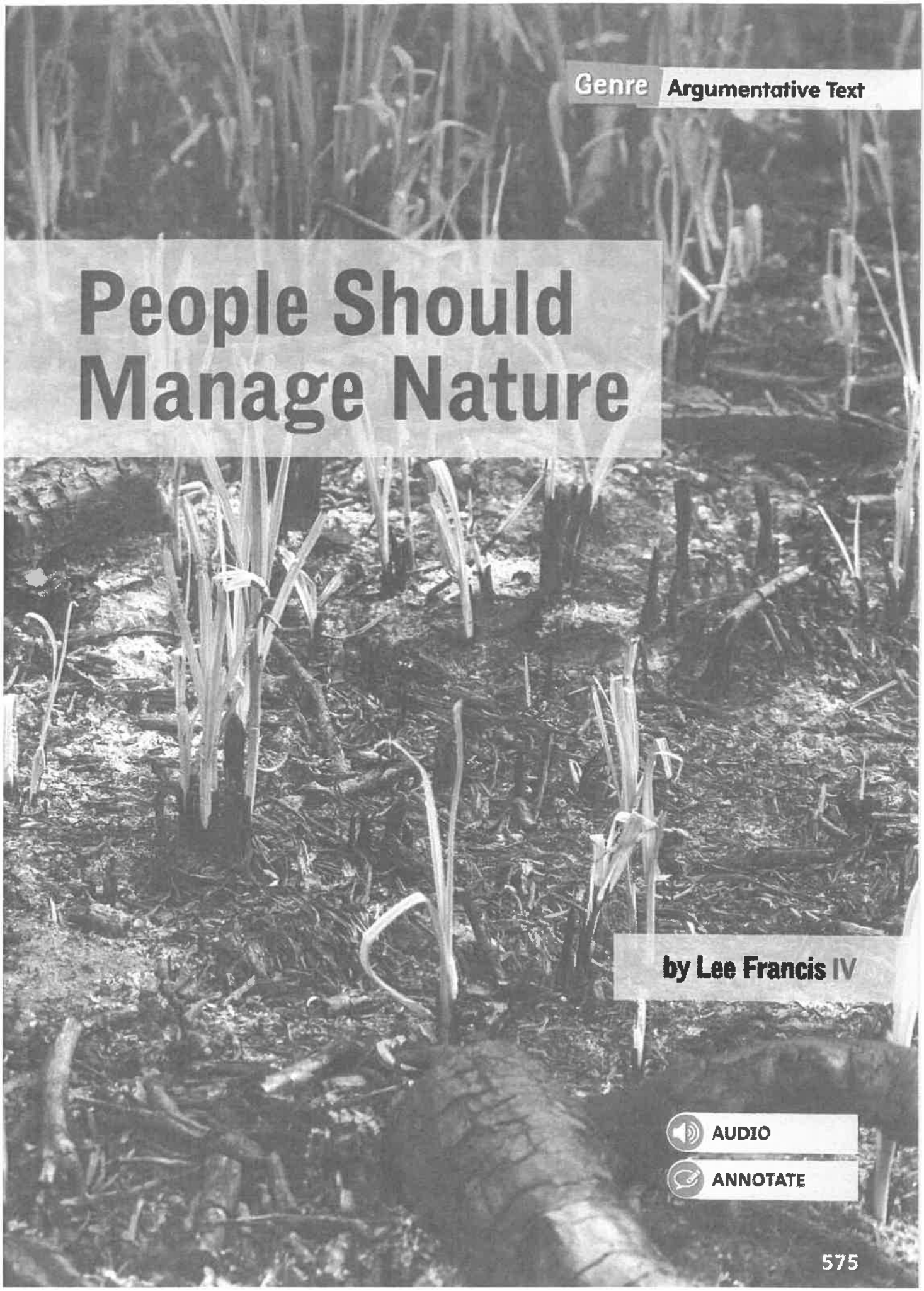
- Shows weakness of the counterclaim

Conclusion

Arguments appeal to audience's

- Logic
- Emotions, or feelings





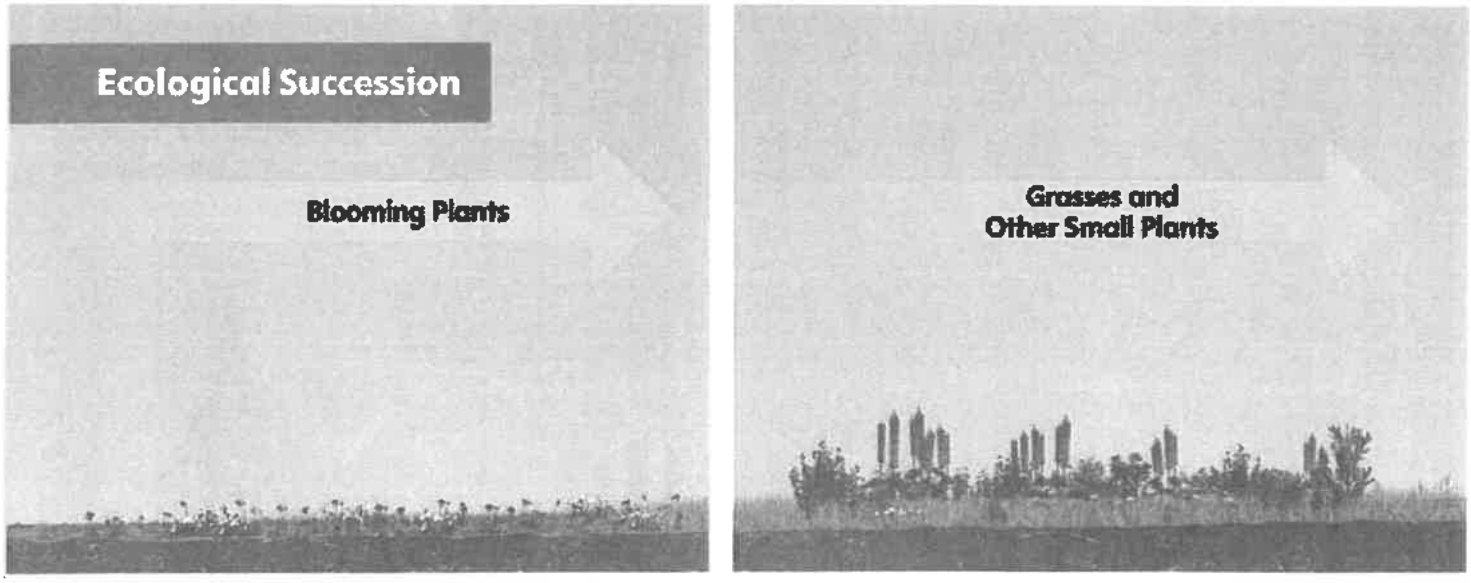
Genre Argumentative Text

People Should Manage Nature

by Lee Francis IV

AUDIO

ANNOTATE



CLOSE READ

Make Connections

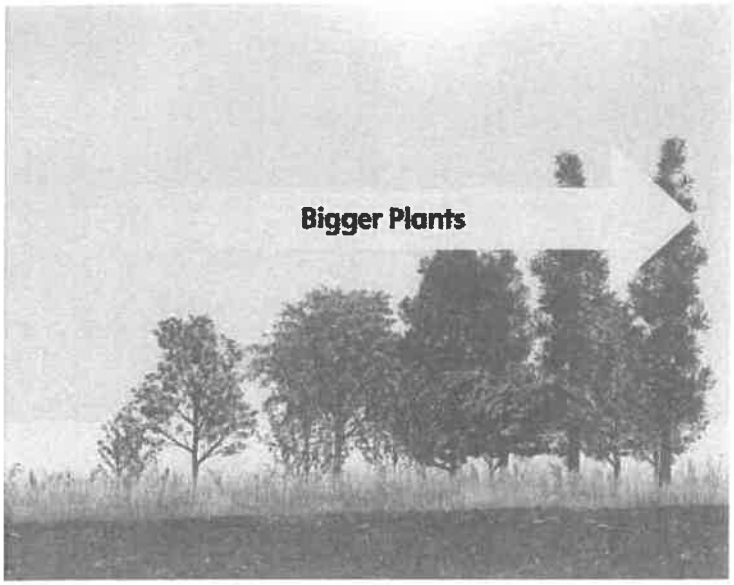
Highlight evidence that helps you determine the cause of natural disturbances.

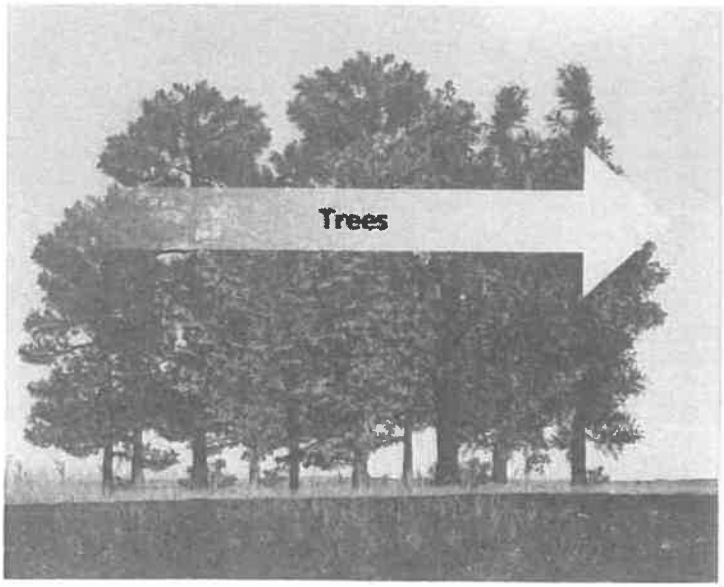
Make a connection about a natural disturbance that you know of or have read about. What caused it?

1 A wildfire burns through an old forest. A flood sweeps across a coastal area. A mudslide buries a wide patch of jungle. When the disaster has passed, the landscape has changed. Many plants and animals are gone. The ones that remain begin to shape their new ecosystem, which includes all the living and nonliving things in the area.

2 A natural disaster is a type of disturbance, or temporary condition that causes major changes in an ecosystem. After a disturbance, plants that remain sprout from seeds or roots in the soil. Other plants move into the area. Over time, shrubs and trees grow, shading out smaller plants. Insects make their homes in decaying plant matter. Small mammals burrow in the ground. Birds return and nestle among the leaves. What once was quite barren becomes rich with life again.

3 Cycles of disturbance and regrowth are common in nature. Many plants and animals have characteristics that help them survive these types of changes. Their populations may suffer losses. But they can eventually bounce back from fire and flood. So when it comes to disturbances, some may argue that we should let nature take its course.





4 However, disturbances can be catastrophic when humans are involved, and humans live in almost all natural areas on Earth. A large natural disaster can kill people and damage property. That is why it is essential that humans practice careful management of nature. Management can reduce human tragedy and still allow diverse ecosystems to thrive.

CLOSE READ

Analyze Argumentative Texts

Underline the author's claim.

Ecological Succession

5 Cycles of disturbance and regrowth are part of ecological succession. That's the natural process of change in an ecosystem over time. In simple terms, this is what happens during ecological succession: blooming plants appear first, followed by grasses and other small plants, then bigger plants, shrubs, and finally trees. Each step allows the next step to happen.

6 Ecological succession happens after a disturbance such as a forest fire. The fire doesn't last long, but it causes significant change. Other natural disturbances include mudslides, floods, droughts, avalanches, and heavy winds or tornadoes. Natural disturbances are the result of environmental elements, weather, and geological processes.

Question for Reflection:

What does your local ecosystem look like? In what ways do people control it?

geological relating to the study of Earth's physical properties

CLOSE READ

Analyze Argumentative Texts

Underline details on both pages that introduce an opposing viewpoint, or counterclaim, to the author's claim.

Then underline details that argue against the counterclaim.

habitat a place where a plant or animal normally lives or grows

Fires and Ecological Succession

7 Wildfires offer a good example of how ecological succession works. Wildfires occur in forests, grasslands, shrub lands, and even in wetland areas, such as marshes and swamps. Wildfires frequently break out during the dry season. They are often the result of a lightning strike.

8 Wildfires play a role in many forest ecosystems. Some plants, such as the jack pine tree, need a fire's heat to release their seeds. Fire can also clear away old growth and underbrush, creating a habitat for new plants. This enhances biodiversity, or the variety of plants and animals in a specific area. Long before humans began to settle near or in forest areas, forests developed naturally in response to wildfires.

Fire: People and Nature

9 Today, many people live in or near forests and other areas where wildfires can start. If the fires spread too fast and too far, they can be deadly. In the United States, local, state, federal, and tribal governments have established fire management policies. These policies focus on saving human lives. They also try to balance saving human property with protecting the environment.

10 Fire management has changed over time. Initially, management focused on eliminating all wildfires.

However, this strategy led to many problems. A more successful approach controls wildfires while still allowing some cycles of disturbance and regrowth.

11 In the United States, managing wildfires became a top priority in 1910, following the Big Blowup, one of the largest wildfires in the nation's history. The Big Blowup actually started as a series of smaller fires; officials estimated there were hundreds of them that started in late summer. Months of dry weather were followed by a sudden bout of storms. Lightning, as well as sparks from a train, started numerous fires. Whipped together by hurricane-force winds, the fires burned 3 million acres in Montana, Idaho, and Washington State in two days. The fires killed at least 85 people. Smoke reached all the way to New England, more than 1,900 miles from Montana. Soot reached the country of Greenland, more than 2,700 miles away.

12 The Big Blowup finally ended with the help of 4,000 soldiers-turned-firefighters and a heavy rainfall. Afterward, lawmakers in Montana, Idaho, and Washington, under pressure from the public, began pushing the U.S. Forest Service to adopt a new policy of suppressing, or immediately putting out, any and all forest fires. The policy soon went into effect. Under the new rules, all wildfires were to be put out no later than 10 A.M. the day after they started.

13 Forest Service Chief Henry Grave was in office during and after the Big Blowup. He said that this tough new approach was the best way to protect U.S. forests, the people, and businesses nearby, as well as the nation's economy. (Fighting fires of this size is hugely expensive. In addition, lumber companies wanted to protect timber so they could sell it.)

CLOSE READ

Make Connections

Highlight reasons that explain why stopping wildfires became a priority in the United States after the Big Blowup.

Do you think wildfire management is helpful or hurtful to our society? Make connections and discuss your answer with a partner.

Question for Reflection:
Have you seen examples of ecological succession in your area? What did you notice?

CLOSE READ

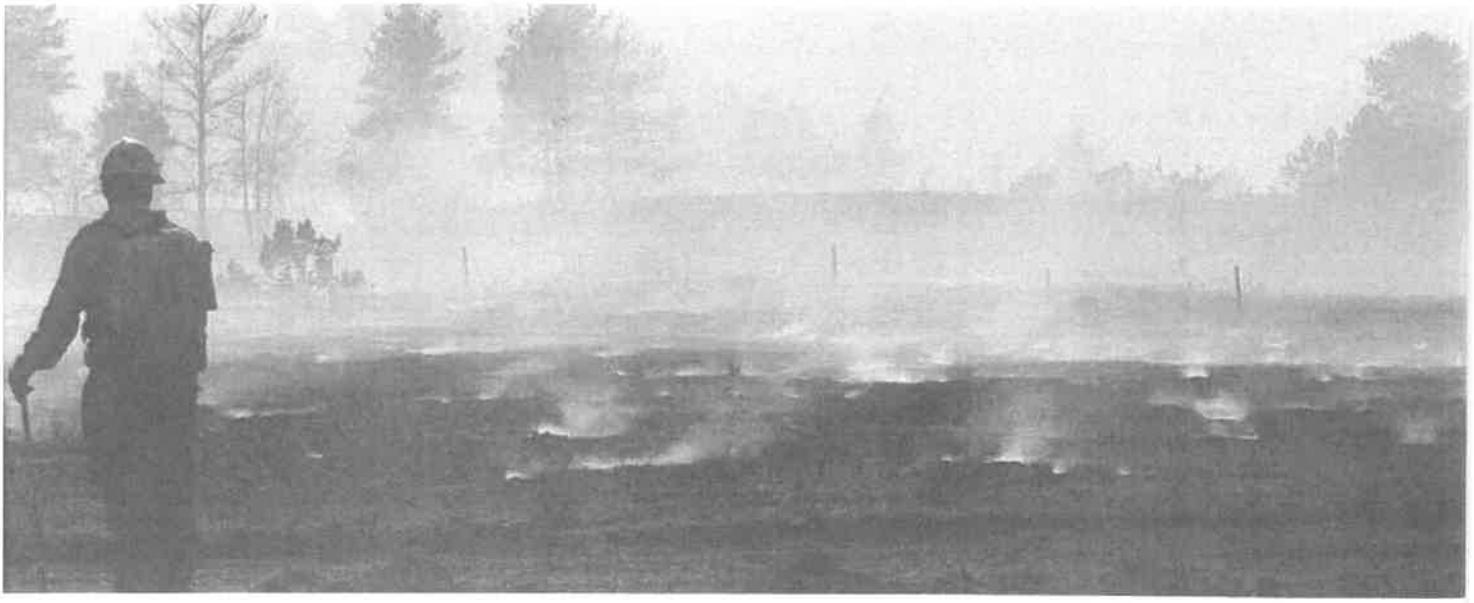
Analyze Argumentative Texts

Underline details that attack the counterclaim that aggressive interventions eliminate fires altogether.

14 The Forest Service received government funding to build new roads into the wilderness so firefighters could quickly reach a blaze. It built lookout towers so workers could see over vast stretches of forest. It hired highly trained fire crews. Later it added smokejumpers, people who jump out of planes to put out fires; bulldozers to drop dirt on fires; and planes to spray flame retardant over forests. Flame retardant helps keep wood and other materials from catching fire. The goal was to use technology and labor to eliminate fire entirely.

15 The policy of complete fire suppression turned out to be a devastating mistake. People failed to understand the essential role that wildfires play in forest ecosystems. Aggressive fire suppression interrupts the cycle of disturbance and regrowth that makes forests thrive. Such forests become more, not less, likely to burn. When forests are so carefully protected, they grow thicker. Trees grow closer together. Dead and fallen trees, no longer cleared by periodic wildfires, litter the forest floor. This debris can easily catch and spread fire. And that can mean less frequent but much larger and more destructive wildfires.

debris the remains of something that has been destroyed



16 That's what happened in 2000. During spring and summer of that year, a long dry spell and a buildup of debris led to massive wildfires. The fires burned more than 6.6 million acres, mainly in western states. That's more than double the average per decade in the United States. Then, in 2006, almost 10 million acres burned across the country.

17 After wildfires, people also cause problems by attempting to "clean" the forest. Workers log and clear trees in burned areas. They sometimes even take trees that are still living. This is known as salvage logging. Advocates say that it will help a burned forest bounce back faster. However, many experts say logging and clearing robs these areas of essential nutrients and resources that will help regrowth. The process not only removes trees but also disturbs organisms in the ground. Heavy equipment compacts the soil. That can lead to erosion and runoff, the draining of water from soil. Erosion and runoff, in turn, can affect nearby water sources. The ashy sediment that the runoff water carries can harm plants and fish in streams, rivers, and lakes. It also harms the animals that eat those plants and fish.

CLOSE READ

Make Connections

Highlight details that tell what happens when people try to "clean" the forest after a fire.

Make a connection to what you know about the world that helps you understand what happens when people mismanage nature.

advocates people who support a cause or policy

Analyze Argumentative Texts

Underline a reason in paragraph 18 that supports the author's main claim. Then underline facts that support the reason.

18 Over the past few decades, the Forest Service has rethought its approach to wildfires. It has taken a hard look at the results of scientific research as well as the clear failure of its no-burn policy. Now the Forest Service uses controlled burns to help maintain forest ecosystems. Controlled burns mimic the natural process of wildfire disturbance. They also reduce the buildup of wood that can cause massive and uncontrollable wildfires. Controlled burns protect people while also promoting ecological renewal. This type of careful management benefits both people and forests.

Question for Reflection:
Have you seen the aftermath of a fire? What did you notice? Can you think of ways humans could help without further disturbing the area?

Barrier Islands and Ecological Succession

19 Barrier islands are long, sandy islands along ocean coastlines. Geological processes built these islands, and ocean waves and winds shape them every day. Steady waves deposit sand to form long beaches. Strong waves during storms sometimes submerge whole islands. Currents erode sand on one end of a barrier island. These currents carry the sand and deposit it on the island's other end. This can cause the whole island to move slowly down the coast. Clearly, disturbance is constant on barrier islands. Because of this, ecosystems remain in the first few stages of succession. Ocean forces often "reset" these ecosystems.

20 Each barrier island ecosystem has distinct features. Beaches on the ocean side remain sandy with no plants. Algae live between particles of sand. The algae provide food for burrowing animals, such as crabs. Winds blow sand toward the middle of a barrier island, forming dunes. Grasses and other low plants take hold on these dunes. Their roots help to stabilize the sand. Salt marshes and mud flats develop on the protected side of a barrier island. Cordgrass grows in these areas. Many fish, sea turtles, and wading birds live within the submerged cordgrass.

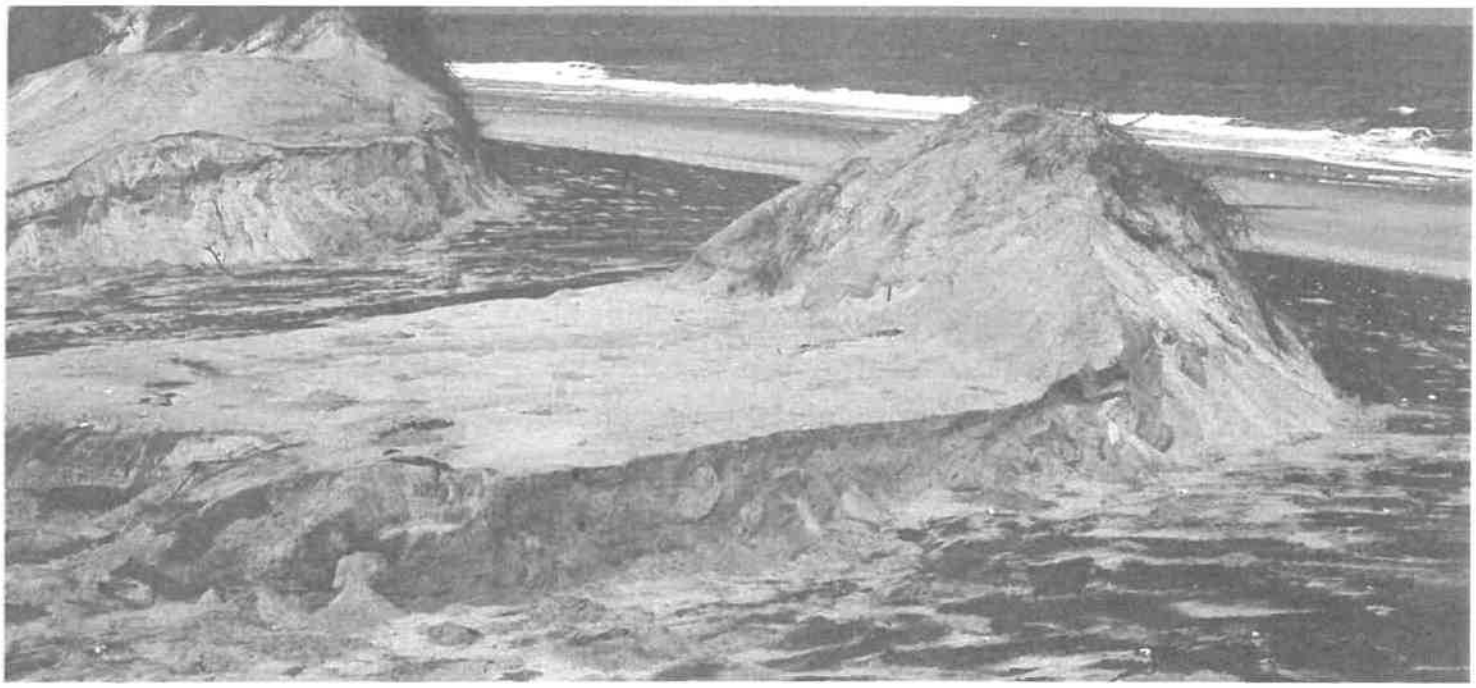
21 Tidal activity floods low areas of a barrier island daily. Constant winds blow saltwater onto these islands. These conditions make it hard for shrubs or trees to grow. Larger woody plants only grow on larger islands. Wide dunes on these islands protect the plants. Trees and shrubs on barrier islands are usually evergreen. Their tough leaves provide protection from windy and salty conditions.

22 Small barrier islands have very little fresh water. Plants must get water from rain. Animals either use saltwater or get fresh water from plants. Larger islands have freshwater ponds in areas away from shore. The island of Assateague is a large barrier island along the coasts of Maryland and Virginia. Freshwater ponds on this island support frogs and toads, red fox, deer, and even wild horses. The horses are descendants of domestic horses brought to the island by European colonists.

Vocabulary in Context

Context clues are words and phrases that surround an unfamiliar word and help you determine the word's meaning. Look at the word *conditions* in paragraph 21.

Underline context clues to help you determine the meaning of *conditions*.



CLOSE READ

Make Connections

Highlight details that help you make connections to what you have read in other texts about the process of erosion.

23 Storms are particularly damaging to barrier islands. The strong winds of tropical storms blow away sand dunes. Strong waves remove beach sand. Salt marshes and mud flats that were protected by dunes and beach are then vulnerable. Diverse animal populations in these areas may disappear. All ecosystems on a very small barrier island can be damaged by a storm such as a hurricane.

24 Some natural features of a barrier island prevent sand from completely disappearing during a storm. Storm waves move across the whole island in a process called overwash. These waves move sand from the ocean side to the land side. The sand collects on the land side and does not wash away. Scientists have verified that overwash protected sand on Santa Rosa Island in Florida during Hurricane Opal in 1995.

25 Plant life on a barrier island can also prevent the loss of sand. Roots of plants hold sand as waves crash ashore. Roots and leaves shelter dunes from heavy winds. When sand is protected, all barrier island communities can thrive.

CLOSE READ

Barrier Islands: People and Nature

26 Lovely beaches and dunes attract people to barrier islands. They are popular tourist spots, and they support many permanent human communities. Galveston Island in Texas has had people living on it for over 1,300 years. Its current population is over 50,000 people. But barrier island communities face challenges. Natural disruptions from storms can kill people and ruin property. On Galveston Island in 1900, nearly 10,000 people were swept away or killed in a huge storm. This led officials to build a seawall for protection.

Analyze Argumentative Texts

Underline evidence that supports the idea that people should manage nature to prevent disasters.

27 A seawall is a structure made of concrete or rocks. It is built on the coast to keep communities safe from tides and large waves. A seawall changes the coastline of a barrier island. Instead of sand, waves encounter a hard, unmovable surface. Seawalls and other hard structures can interrupt the flow of sand down the ocean side of a barrier island. This can change ecosystems on that island and on other islands near it.

28 In 1933, engineers built two jetties between Fenwick Island and Assateague Island, off the coast of Maryland. These rocky structures allowed boats to move between the islands. But the north jetty stopped the flow of sand to Assateague Island. The south jetty caused waves to quickly erode the beach on Assateague. The change in the movement of sand actually moved part of the island closer to shore.

CLOSE READ

Analyze Argumentative Texts

Underline details that help you identify the author's intended audience, or readers.

29 Structures like jetties and seawalls improve safety and access for people on barrier islands. And some may argue that this type of management also protects many barrier island ecosystems. Hard structures meant to prevent waves from reaching upland areas also protect dune ecosystems. When dunes are protected, so are mud flats and salt marshes on the land side of the island. Management can actually slow down the rate of cycles of succession. These ecosystems can then remain stable over a longer period of time.

Question for Reflection:

How might people help minimize changes to barrier islands rather than make them worse?

CLOSE READ

30 Unfortunately, seawalls or jetties can damage the beach ecosystem. Sand can erode more quickly when these hard structures interfere with normal wave movement. So, many communities on barrier islands pay for beach nourishment. Beach nourishment widens a beach by adding sand from other areas. A community interested in beach nourishment generally consults with the U.S. Army Corps of Engineers. The Corps helps the community come up with a good plan. The community then hires skilled contractors to perform the work.

Analyze Argumentative Texts

Underline a reason that supports the author's main claim. Then underline facts that support that reason.

31 During beach nourishment, workers use a floating machine called a dredge to suck up sand from underwater. The workers then steer the dredge toward the center of the beach. They attach a long pipeline to the dredge that stretches to the beach. The end of the pipeline is fitted with a Y-valve, that is then fitted with two more sections of pipeline. This valve allows workers to control the flow of sand to different sections of the beach. As sand is pumped onto the shoreline, bulldozers spread it out.

valve a structure that controls the flow of materials

32 Beach nourishment is expensive. The process of pumping and moving sand is loud and disruptive to beach communities. Having heavy equipment working on a beach interferes with tourism. It is also only a temporary solution to the long-term problem of erosion.

33 However, beach nourishment does restore the important beach ecosystem to a barrier island. This ecosystem prevents waves from damaging roads and homes close to the beach. It expands habitats for barrier island animals. It also enhances recreation and tourism on the island.

CLOSE READ

Analyze Argumentative Texts

Underline evidence that supports the author's point on the previous page.

Fluency

Read paragraphs 34–38 aloud with a partner. When you come to a word you do not know, sound out the letters in the word. Use context clues to help you determine the meaning of the word.

34 Restoration of the beach ecosystem has been shown to protect barrier islands from hurricane damage. Officials from the National Oceanic and Atmospheric Administration observed that islands with beach nourishment kept their sandy beaches after hurricanes in 2005 and 2008. Other similar islands experienced heavy erosion. On those islands, beaches and dunes were removed by violent waves and wind. Salt marshes on those islands then became vulnerable to future storms.

35 Restoration of barrier islands in general helps to protect coastal communities from hurricanes. The Barataria Bay island chain off the coast of Louisiana is being restored with funds from the Coastal Wetlands Planning, Protection, and Restoration Act. These islands are a first line of defense when a hurricane hits. They absorb energy from the storm, sparing communities on the mainland.

CLOSE READ

36 Ecosystems on barrier islands can benefit greatly from human management. After violent natural events, such as hurricanes, human intervention can restore these ecosystems. Barrier island management also helps human communities. It enhances species diversity on the islands and improves safety. In these ways, management is much more beneficial than just letting natural cycles act on barrier islands.

Make Connections

Highlight a solution the author provides to the argument about humans managing nature. Connect this solution to solutions in other argumentative texts you have read.

Conclusion

37 Disruptions are common in nature. Some, such as fire and mudslides, are relatively rare. Others, such as wind and waves, are constant in certain ecosystems. Catastrophic disruptions can reset ecosystems to an early stage of succession. These systems were formed to handle these types of disruptions. However, modern human communities were not, and people now live within nearly all ecosystems.

38 To protect lives and property, we must manage nature. If done thoughtfully, management can actually protect and enhance ecosystems. We can slow down cycles of natural disturbance, increasing stable habitats for many plants and animals. We must respect and understand cycles of nature. But with ecological understanding, we can manage nature so that all of life benefits.

 DO: 1-12

6.2 Pattern Rules

Example 5: Given the rule "+ 2" and starting with zero, give the next three numbers for the rule.

Directions: Start with zero and add 2. Do this three times.
0, 2, 4, 6

Answer: 0, 2, 4, 6

Example 6: Given the rule "÷ 3" and starting with 270, give the next three numbers for the rule.

Directions: Start with 270 and divide by 3. Do this three times.
270, 90, 30, 10

Answer: 270, 90, 30, 10

Follow the directions for the rule given and the number to start with for each problem. Give the next three numbers after the number given. The first one has been done for you.

1. Rule: − 7
   Start with 80.
   80, 73, 66, 59

2. Rule: × 2
   Start with 1.

3. Rule: + 18
   Start with 0.

4. Rule: ÷ 2
   Start with 100.

5. Rule: + 3
   Start with 15.

6. Rule: − 5
   Start with 75.

7. Rule: + 4
   Start with 20.

8. Rule: − 11
   Start with 88.

9. Rule: ÷ 5
   Start with 5,000.

10. Rule: + 6
    Start with 10.

11. Rule: − 2
    Start with 22.

12. Rule: + 14
    Start with 0.

13. Rule: × 4
    Start with 2.

14. Rule: + 10
    Start with 100.

15. Rule: − 15
    Start with 75.

16. Rule: × 3
    Start with 1.

17. Rule: − 20
    Start with 100.

18. Rule: + 100
    Start with 37.

7.3 Order of Operations

In long math problems with $+, -, \times, \div, ()$, you have to know what to do first. Without following the same rules, you could get different answers. If you will memorize the silly sentence, Please My Dear Aunt Sally, you can memorize the order you must follow.

Please — "P" stands for parentheses. You must get rid of parentheses first.
Examples: $3(1+4) = 3(5) = 15$
$6(10-6) = 6(4) = 24$

My Dear — "M" stands for multiply. "D" stands for divide. Start on the left of the equation and perform all multiplications and divisions in the order in which they appear.

Aunt Sally — "A" stands for add. "S" stands for subtract. Start on the left and perform all additions and subtractions in the order they appear.

Example 1: $12 \div 2(12-9) + 3 - 1$

Please	Eliminate **parentheses.** $12-9=3$ so now we have	$12 \div 2 \times 3 + 3 - 1$
My Dear	**Multiply** and **divide** next in order from left to right.	$12 \div 2 = 6$ then $6 \times 3 = 18$
Aunt Sally	Last, we **add** and **subtract** in order from left to right.	$18 + 3 - 1 = 20$

Simplify the following problems. [odds only]

1. $6 + 8(16 \div 4) - 4$
2. $3(4+2) - 6$
3. $3(6-3) - 2$
4. $49 \div 7 - 3 \times 2$
5. $4 \times 8(4+2)$
6. $2 \times 3 \div 6 \times 4$
7. $10 \times 4 - (72 \div 8)$
8. $7 + 8(14-6) \div 4$
9. $(2+8-8) \times 4$
10. $4(8-5) \times 3$
11. $8 + 4 \times 2 - 6$
12. $3(4+6) + 3$
13. $(140 \div 7) + 27 \div 3$
14. $82 - 1 + 4 \div 2$
15. $1 - (2-1) + 8$
16. $12 - 2(7-2) + 17$
17. $18 \div (6+3) - 1$
18. $10 + 3 - 2 \times 3$
19. $14 \div 2(35 \div 5) + 5$
20. $7 \times 4 - 9 \div 3$
21. $4 + (7+2) \div 3$

PEMDAS Rules

Evaluate the problem in the following order:

1) P - Parentheses

2) E - Exponents (Powers and Square Roots)

3) MD - Multiplication and Division (Left to Right)

4) AS - Addition and Subtraction (Left to Right)

You can remember the order by saying :

Please	Excuse	My	Dear	Aunt	Sally
a	x	u	i	d	u
r	p	l	v	d	b
e	o	t	i	i	t
n	n	i	s	t	r
t	e	p	i	i	a
h	n	l	o	o	c
e	t	i	n	n	t
s	s	c			i
e		a			o
s		t			n
		i			
		o			
		n			

Name : _____ Score : _____

Teacher : _____ Date : _____

Order of Operations

1) $12 + ((13 - 5) + 2^2)$

2) $10 + (6 + (3 + 6)^2)$

3) $((9 - 5) - (24 \div 12)^2)$

4) $(7^2 + (15 \div 5 + 2^2))$

5) $(3^2 + (10 \div 2 + 2^2))$

6) $3 + (3 \times (9 - 2)^2)$

7) $((10 - 6)^2 + 2) + 6^2$

8) $14 + ((9 - 2) \times 3^2)$

9) $((6 + 6)^2 + 7) - 4^2$

10) $((10 + 7) - (16 \div 2)^2)$

Evens only

7.4 Substituting Numbers for Variables

These problems may look difficult at first glance, but they are very easy. Simply replace the variable with the number the variable is equal to and solve the problems.

Example 2: In the following problems, substitute 10 for a.

Problem	Calculation	Solution
1. $a + 1$	Simply replace the a with 10. $10 + 1$	11
2. $17 - a$	$17 - 10$	7
3. $9a$	This means multiply. 9×10	90
4. $30 \div a$	This means divide. $30 \div 10$	3
5. a^3	$10 \times 10 \times 10$	1000
6. $5a + 6$	$(5 \times 10) + 6$	56

Note: Be sure to follow the rules for the order of operations.

Example 3: In the following problems, let $x = 2$, $y = 4$, and $z = 5$.

Problem	Calculation	Solution
1. $5xy + z$	$5 \times 2 \times 4 + 5$	45
2. $xz + 5$	$2 \times 5 + 5 = 10 + 5$	15
3. $yz \div x$	$(4 \times 5) \div 2 = 20 \div 2$	10

In the following problems, $t = 7$. Solve the problems.

1. $t + 3 =$
2. $18 - t =$
3. $21 \div t =$
4. $3t - 5 =$
5. $t + 1 =$
6. $2t - 4 =$
7. $9t \div 3 =$
8. $t \div 7 =$
9. $5t + 6 =$
10. $(t - 7) \div 6 =$
11. $4t + 5t =$
12. $6t \div 3 =$

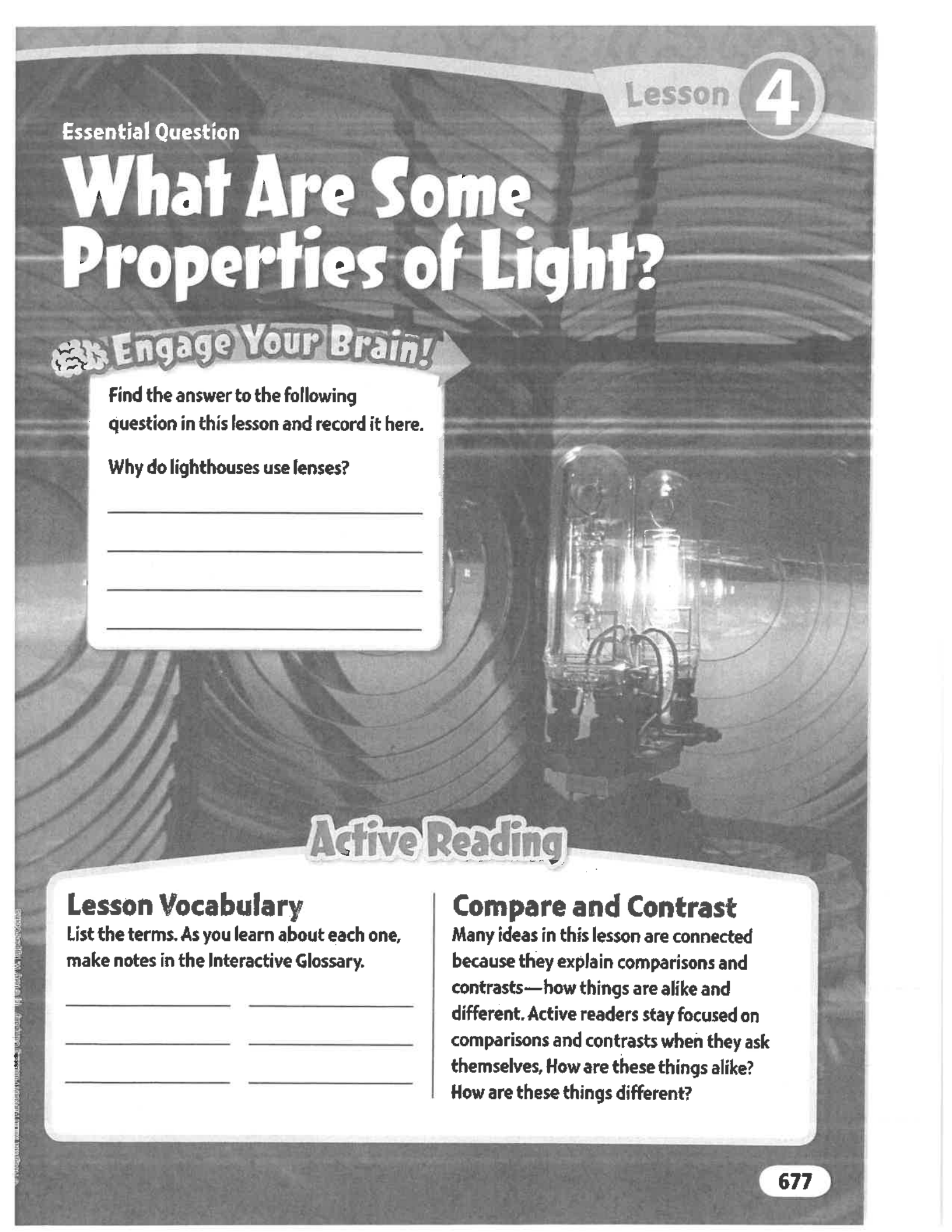
In the following problems $a = 4$, $b = 2$, $c = 5$, and $d = 10$. Solve the problems.

13. $4a + 2c =$
14. $3bc - d =$
15. $(a \times c) \div d =$
16. $d - 2a =$
17. $a - b =$
18. $abd =$
19. $5c - a =$
20. $cd + bc =$
21. $6b \div a =$
22. $9a + b =$
23. $5 + 3bc =$
24. $d + d + 1 =$

Lesson 4

Essential Question

What Are Some Properties of Light?



Engage Your Brain!

Find the answer to the following question in this lesson and record it here.

Why do lighthouses use lenses?

_____

_____

_____

_____

Active Reading

Lesson Vocabulary

List the terms. As you learn about each one, make notes in the Interactive Glossary.

_____ _____

_____ _____

_____ _____

Compare and Contrast

Many ideas in this lesson are connected because they explain comparisons and contrasts—how things are alike and different. Active readers stay focused on comparisons and contrasts when they ask themselves, How are these things alike? How are these things different?

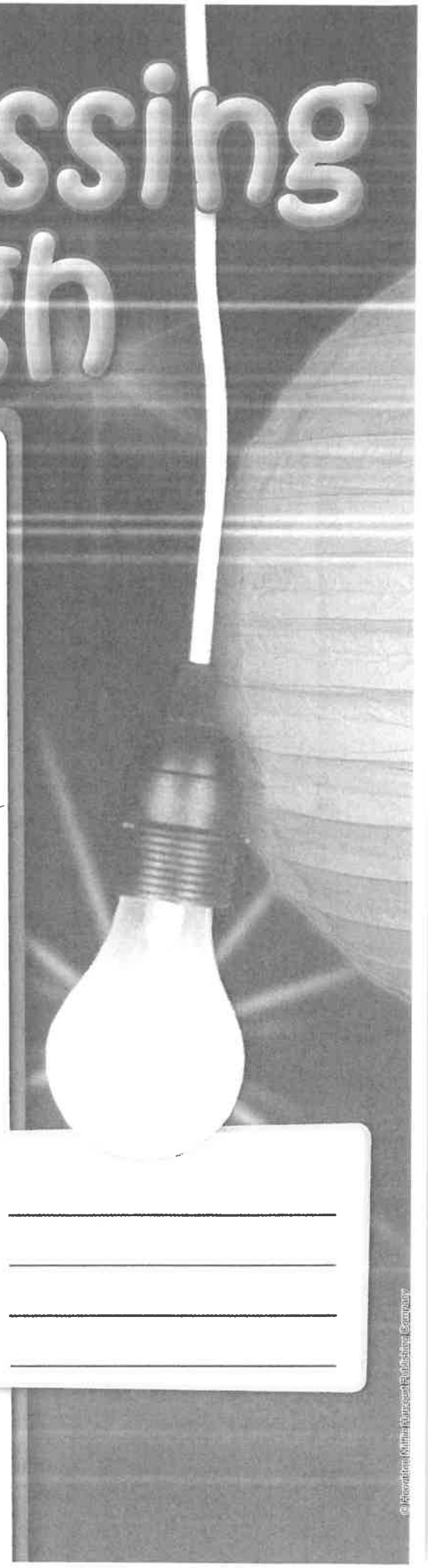
Just Passing Through

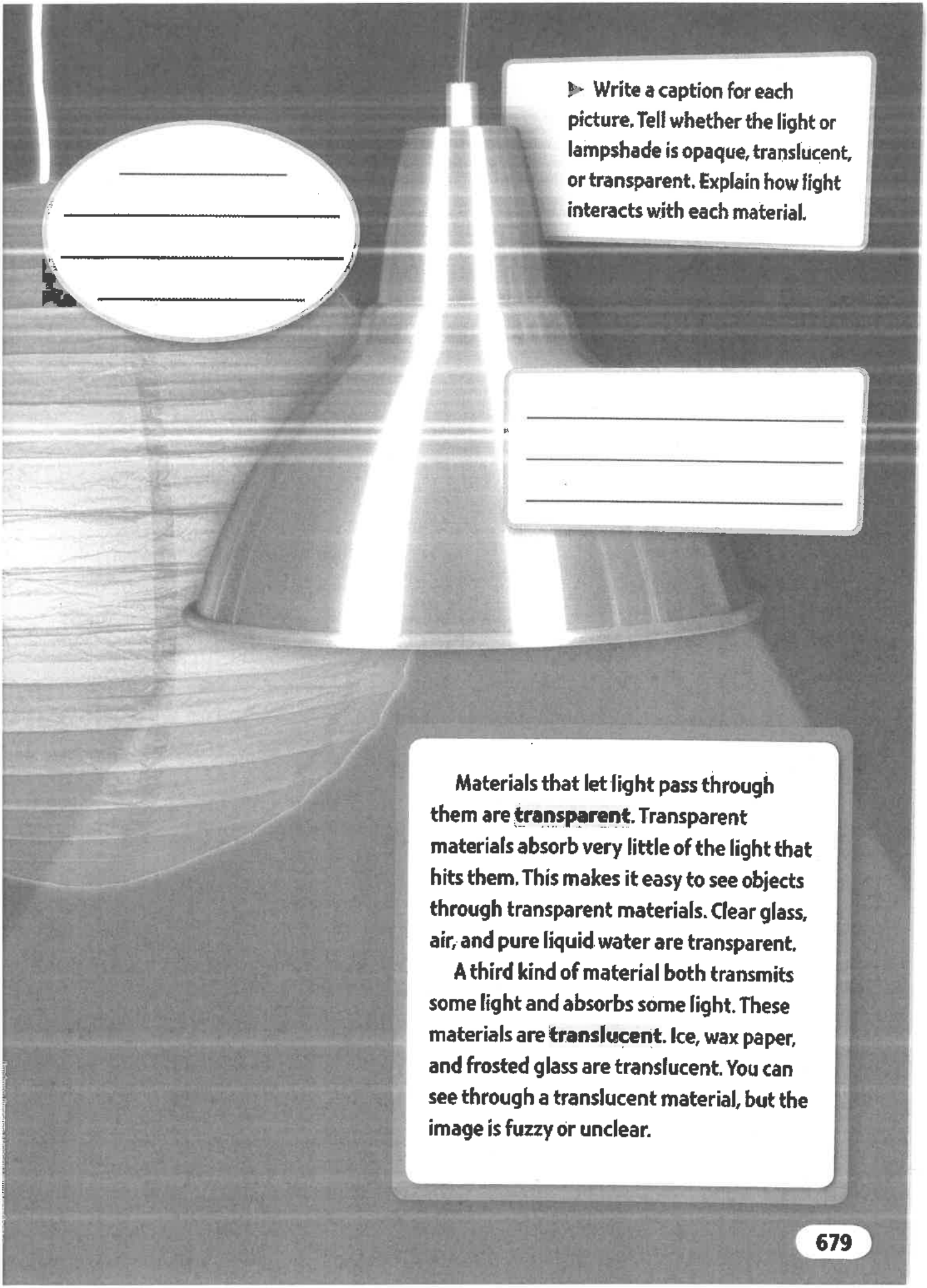
Light acts differently when it strikes windows, thin curtains, or brick walls. How does each material affect the light that strikes it?

Active Reading As you read these two pages, underline sentences that provide details about how light acts when it strikes different materials.

Light travels outward in all directions from its source until it strikes something. Light behaves in different ways depending on the kind of matter it meets. Most objects absorb some of the light that hits them. The amount of light absorbed depends on the material the object is made of.

Opaque materials do not let light pass through them. Instead, the material absorbs light—light enters the material but doesn't leave it. When a material absorbs light, the energy from the light is transferred to the material. Many solid objects are opaque because they are made of materials such as metal, wood, and stone that do not allow light to pass through. Objects that are opaque cause shadows to occur because the objects absorb or reflect all of the light that hits them.





▶ Write a caption for each picture. Tell whether the light or lampshade is opaque, translucent, or transparent. Explain how light interacts with each material.

Materials that let light pass through them are **transparent**. Transparent materials absorb very little of the light that hits them. This makes it easy to see objects through transparent materials. Clear glass, air, and pure liquid water are transparent.

A third kind of material both transmits some light and absorbs some light. These materials are **translucent**. Ice, wax paper, and frosted glass are translucent. You can see through a translucent material, but the image is fuzzy or unclear.

Mirror, Mirror

Did you look at yourself in a mirror as you got ready for school? The properties of light enabled you to see your image.

Active Reading As you read these two pages, draw boxes around the words or phrases that signal when things are being contrasted.

The bouncing of light off an object is known as **reflection**. When light traveling from an object strikes a smooth, shiny surface, such as a mirror, all of the light hitting the surface from one direction is reflected in a single new direction. Your eyes detect the reflected light, and you see a clear, reversed image of the object—a reflection. In contrast, you can't see an image in something with a rough surface, such as cloth or wood, because the roughness causes light to reflect in many directions.

The smooth surface of the water acts like a mirror. Light rays are reflected back in a way that enables you to see a clear, reversed image.

The backpack appears yellow because its material reflects yellow light and absorbs all other colors of light.

▶ **Compare the surfaces of the metal container and the paper bag. The smooth surface reflects light in a single direction back to your eyes. The rough surface reflects light in all directions. Identify the material that would produce the better reflection.**

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How an object reflects light also determines what colors you see. As light strikes the surface of an object, the object absorbs certain colors of light and reflects others. A ripe strawberry absorbs nearly all colors of light, but it reflects red light. So, your eyes see the strawberry as red. Grass reflects green light while absorbing all other colors.

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▶ **When we look at these fruits and vegetables, we see a variety of colors.**

Choose one fruit or vegetable. Explain why it's the color it is.

_____

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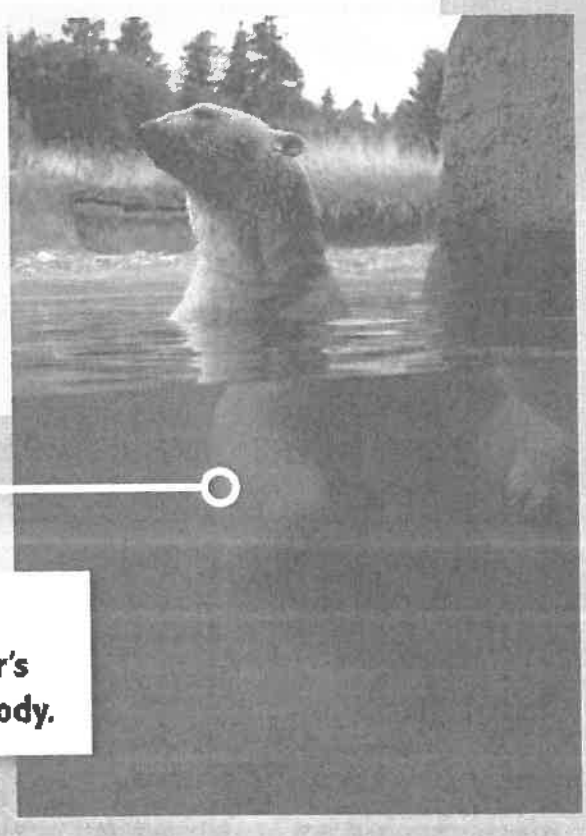
Light Bends

What happened to the straw in the glass? Did someone break it? No! What you are observing is another property of light—refraction.

Active Reading As you read these pages, underline words that identify the cause of refraction. Circle words that identify an effect of refraction.

The bending of light as it passes at an angle from one type of matter into another is called **refraction**. Refraction occurs because the speed of light varies depending on the material through which the light travels. As the light changes speed, it bends. Look at the straw at the top of this page. Light from the top of the straw passes through the air and the glass to your eyes. But light from the bottom part starts out in the water and passes into the glass and then into the air. Each time the light enters a new material, it bends slightly because it changes speed. By the time this light reaches your eyes, it is coming from a different angle than the light from the top of the straw. As a result, the straw appears to be bent or broken.



Refraction produced the illusion that this polar bear's head is separate from its body.

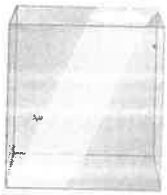
A **prism** is a transparent material that separates white light into its component colors by refraction. When white light enters a prism, the different colors of light bend at different angles. The light moves through the prism and exits it as a rainbow.

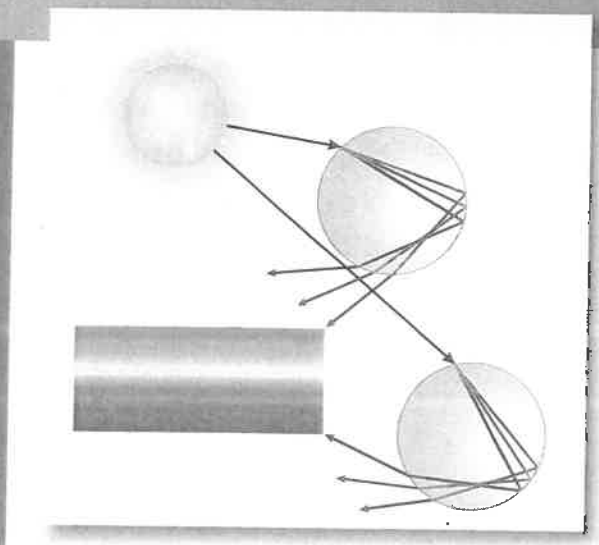
Light bends in other ways. *Diffraction* is the bending of light around barriers or through openings. If you look at the edges of a shadow cast in bright sunlight, you may notice that the edges of the shadow are blurry. This blurriness is caused by light bending around the edge of the object. The colors of the sunset are a result of diffraction as sunlight bends around particles in the air.

Do the Math!

Angles of Refraction

The diagram shows how light bends as it enters and then exits a transparent material. Use a protractor to measure the angles formed as the light is refracted.



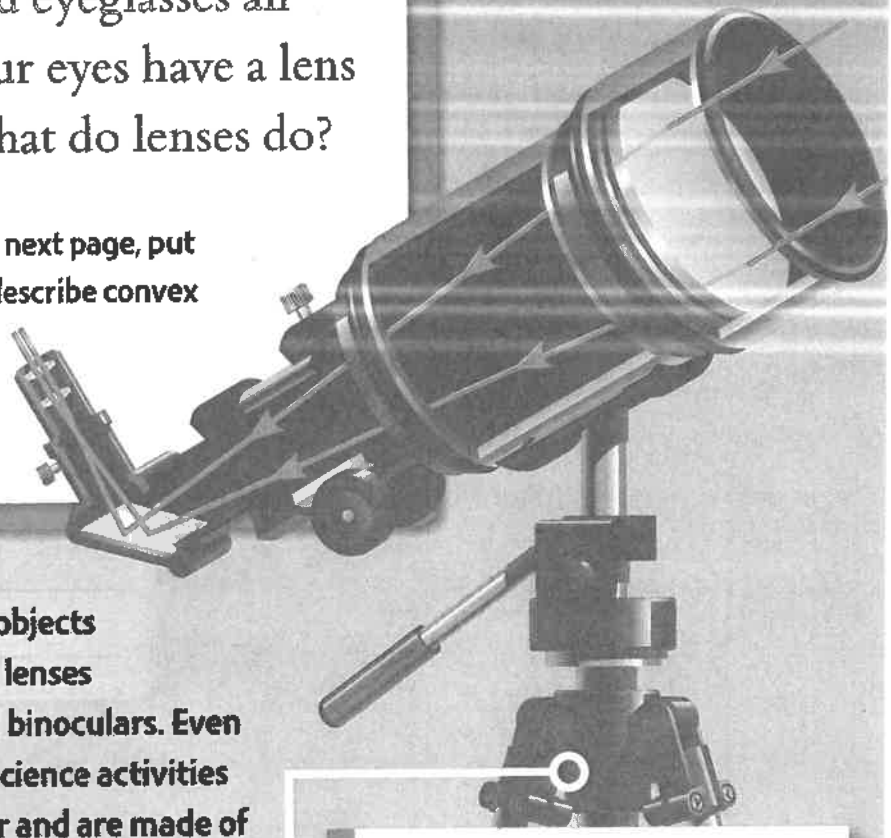


Rainbows are a product of refraction and reflection. Sunlight separates into colors as it passes from the air into a water droplet. The colored light is reflected off the back of the drop, and it is refracted again as it passes into the air. Light from many droplets forms the arcs of color in a rainbow. Red light comes from droplets higher in the air, and violet light comes from lower droplets.

Lenses

Cameras, telescopes, and eyeglasses all contain lenses. Even your eyes have a lens inside each of them! What do lenses do?

Active Reading As you read the next page, put brackets [ ] around the details that describe convex and concave lenses. Draw a line under the main idea that the details help explain.



Telescopes use lenses to magnify objects. Incoming light moves through a convex lens, which bends light toward the center of the tube and brings it into focus. The concave eyepiece lens magnifies the image.

Lenses are curved transparent objects that refract light. You can find lenses in DVD players, photocopiers, and binoculars. Even the microscope you use in many science activities has a lens. Most lenses are circular and are made of clear glass or plastic. Many devices use a series of lenses to make images clearer. Lenses vary greatly in size. Microscopes use several tiny lenses to magnify small objects. The Yerkes Observatory in Wisconsin has a reflecting telescope with a lens that is over a meter in diameter!

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Most concave lenses have an inward curve on both sides. These lenses spread light waves apart.

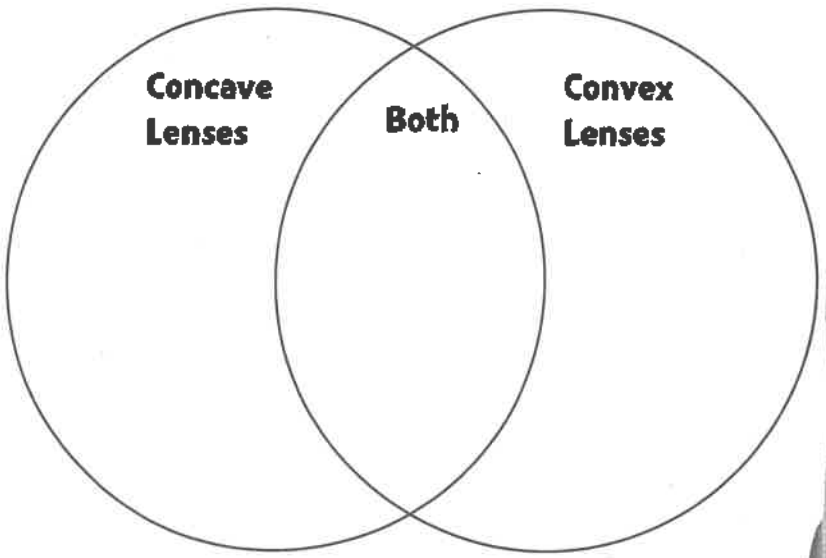
A *convex lens* is a lens that is thicker at the center and thinner at the edges. Convex lenses are sometimes called positive lenses because they bring light waves together. In other words, a convex lens focuses light. This bending allows an image to form at a point called the focal point.

A *concave lens* is a lens that is thicker at the edges and thinner at the center. Sometimes called negative lenses, concave lenses spread light waves apart from a focal point.

Eyeglasses may have concave or convex lenses, depending on the type of vision correction needed.

Concave, Convex, or Both?

Fill in the Venn diagram to compare and contrast concave and convex lenses.

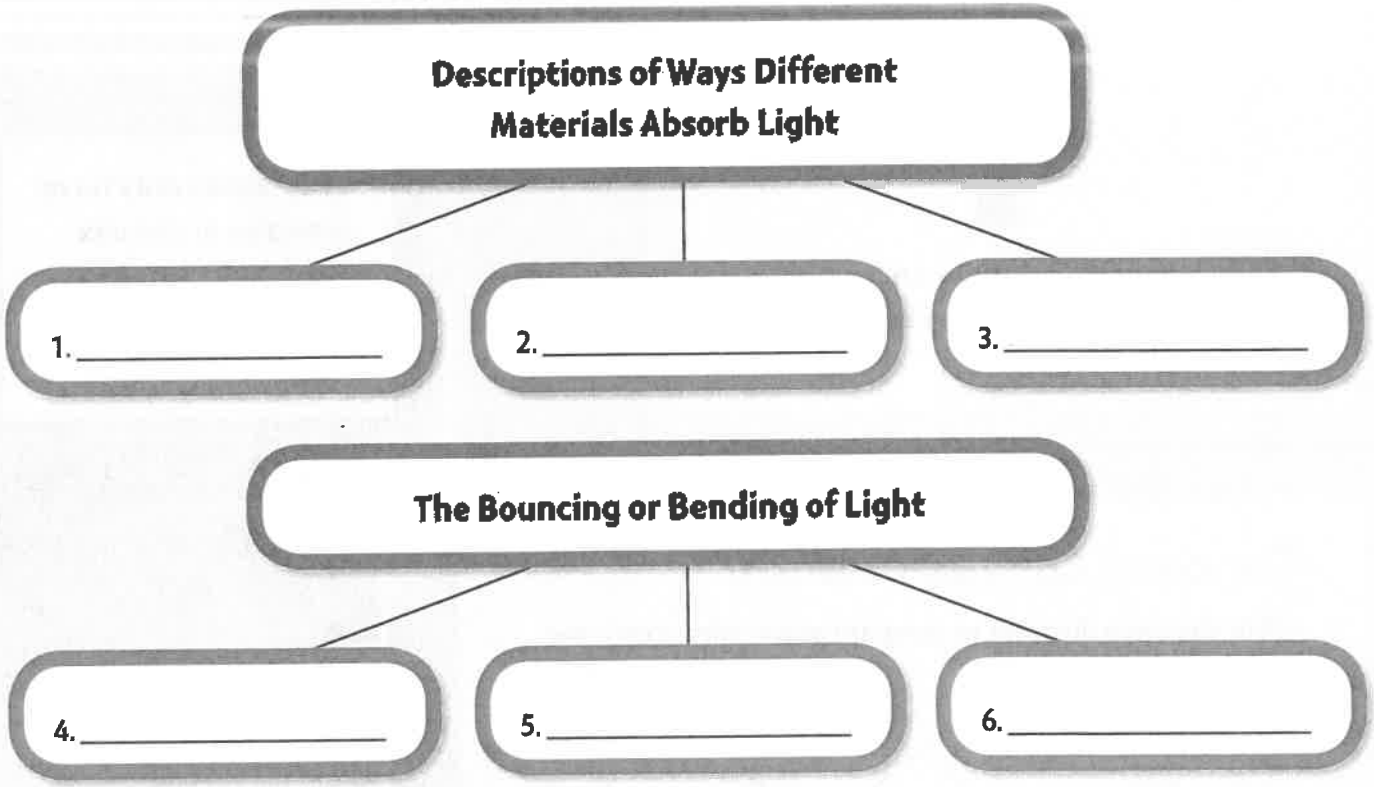


Sum It Up!

When you're done, use the answer key to check and revise your work.

Use the terms below to fill in the graphic organizers about some properties of light.

reflection	translucent	diffraction
opaque	refraction	transparent



Answer Key: 1, 2, and 3: transparent, translucent, and opaque in any order 4, 5, and 6: reflection, refraction, and diffraction in any order

Brain Check

Name ______________________________

Word Play

1 Use the clues to help you write the correct word in each row. Some boxes have already been filled in for you.

a.				F	R				I		
b.				F	R				I		
c.				F					I		
d.								R	I		
e.			A					R			
f.			A								
g.			A								

Clues

a. This makes the edges of a shadow look blurred.
b. It's another way of saying "the bending of light."
c. This is the word for the bouncing of light off an object.
d. This object will separate light into the colors of the spectrum.
e. This word describes objects that let light pass through them.
f. This word describes objects that let only some light pass through them.
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transparent*	reflection*	prism*	diffraction
translucent*	opaque*	refraction*	

* Key Lesson Vocabulary

Bonus

The prefix *con-* means "with." What words with this prefix can you find in the lesson?

____

Apply Concepts

2 Which is better: checking your appearance in a regular mirror or checking it in a sheet of crumpled aluminum foil? Explain why one reflective surface is better than the other.

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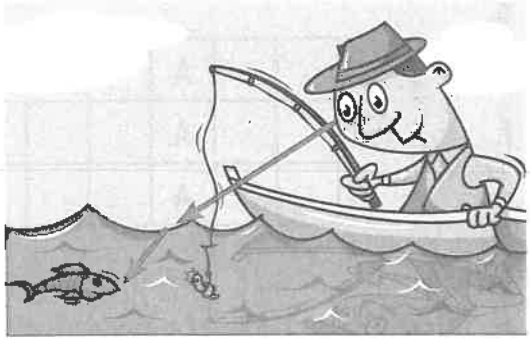


4 Circle the image that shows an opaque material.

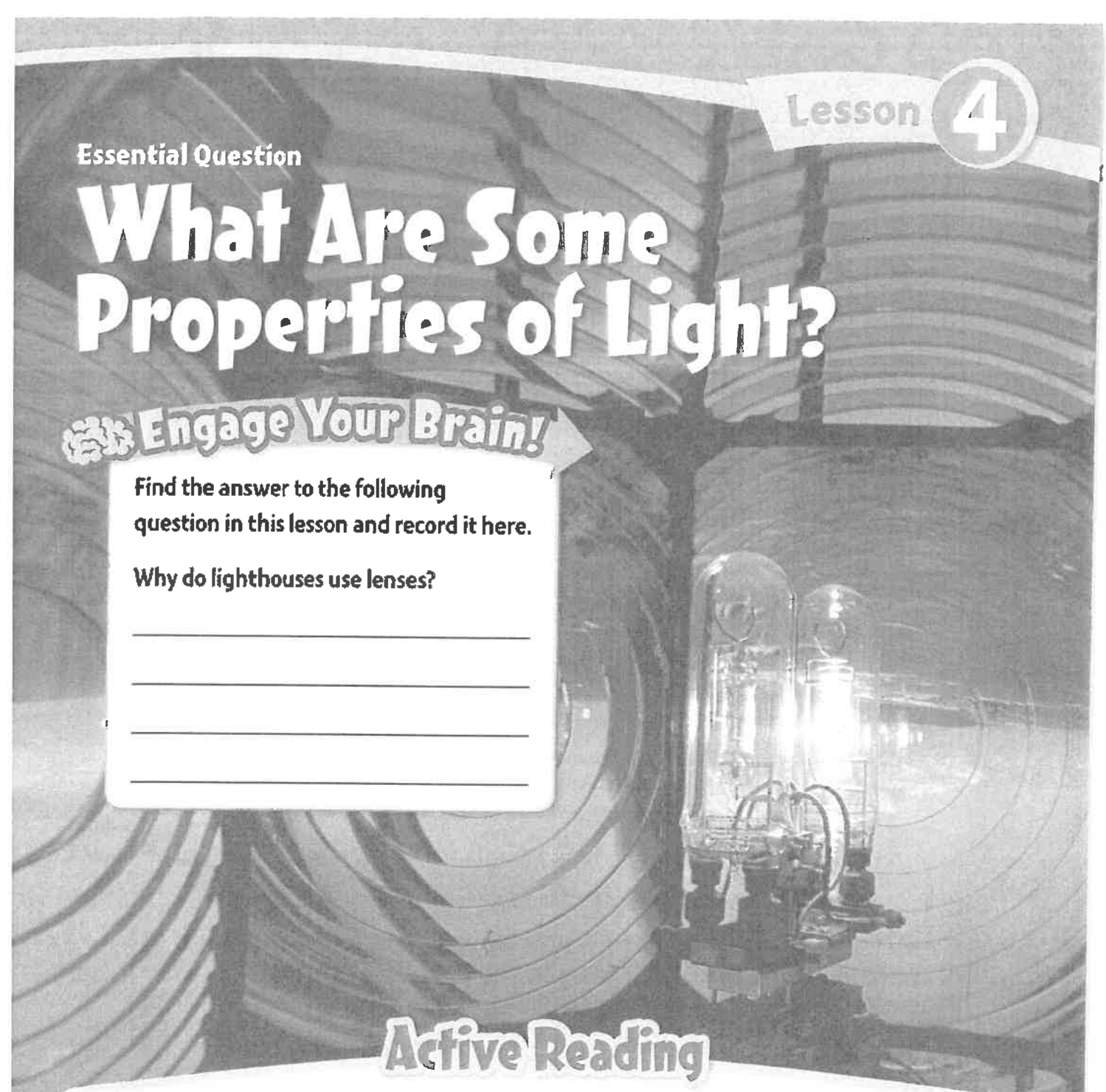
Take It Home!

With a family member, walk through the rooms of your home and identify opaque, transparent, and translucent objects. See how many surfaces you can find in which you can see a reflection.

Lesson 4

Essential Question

What Are Some Properties of Light?



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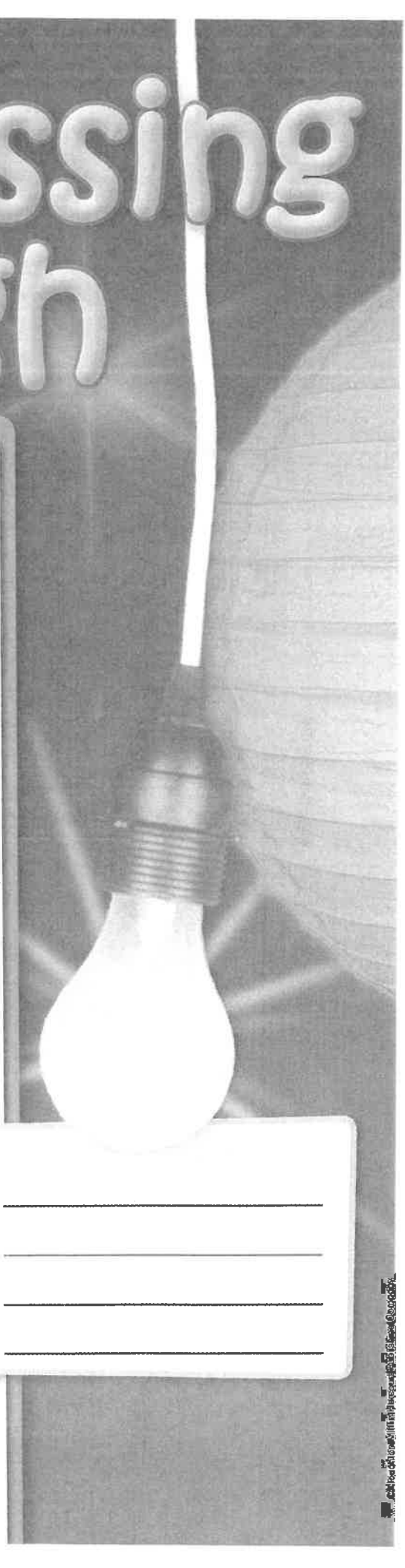

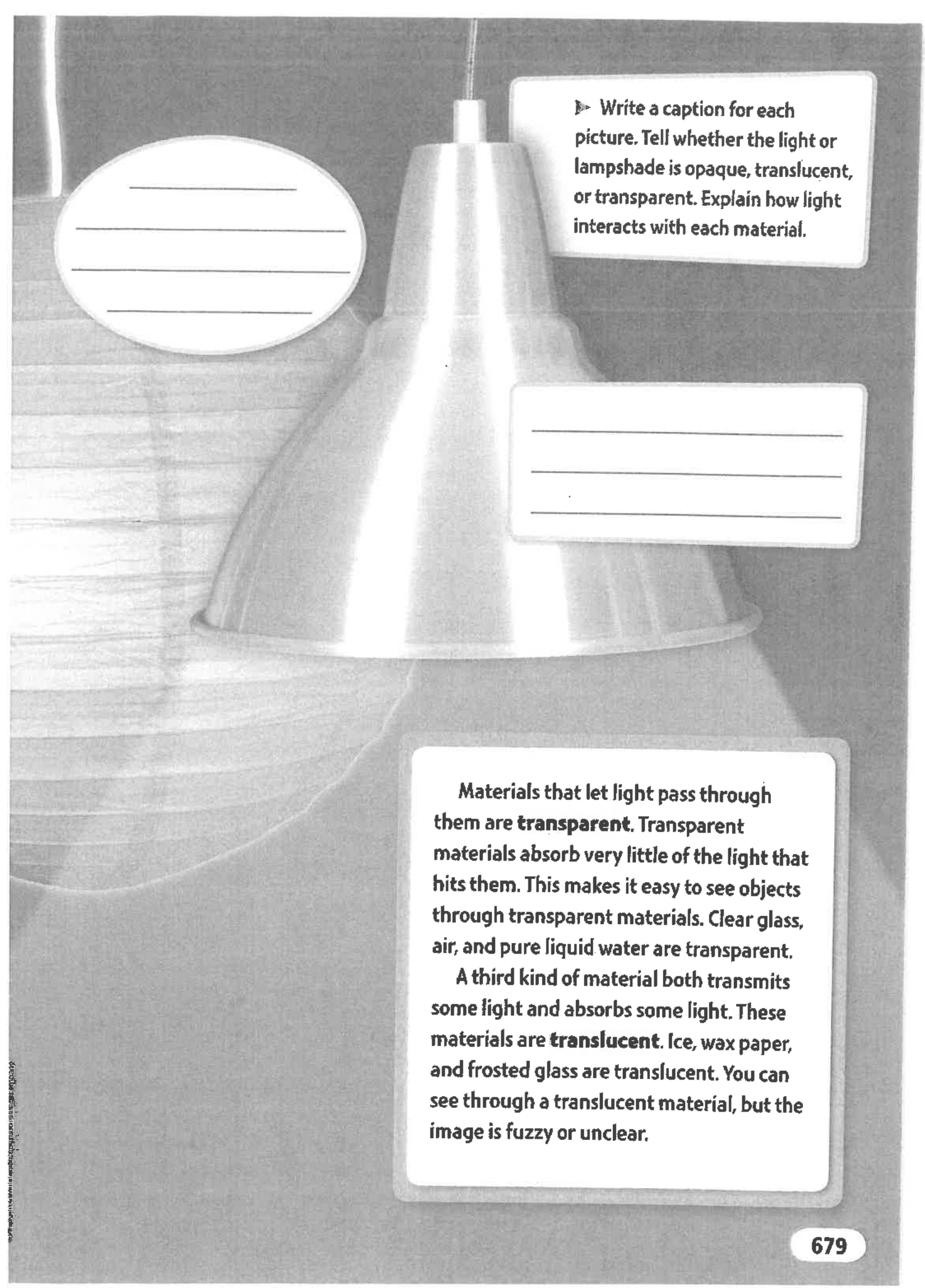

▶ Write a caption for each picture. Tell whether the light or lampshade is opaque, translucent, or transparent. Explain how light interacts with each material.

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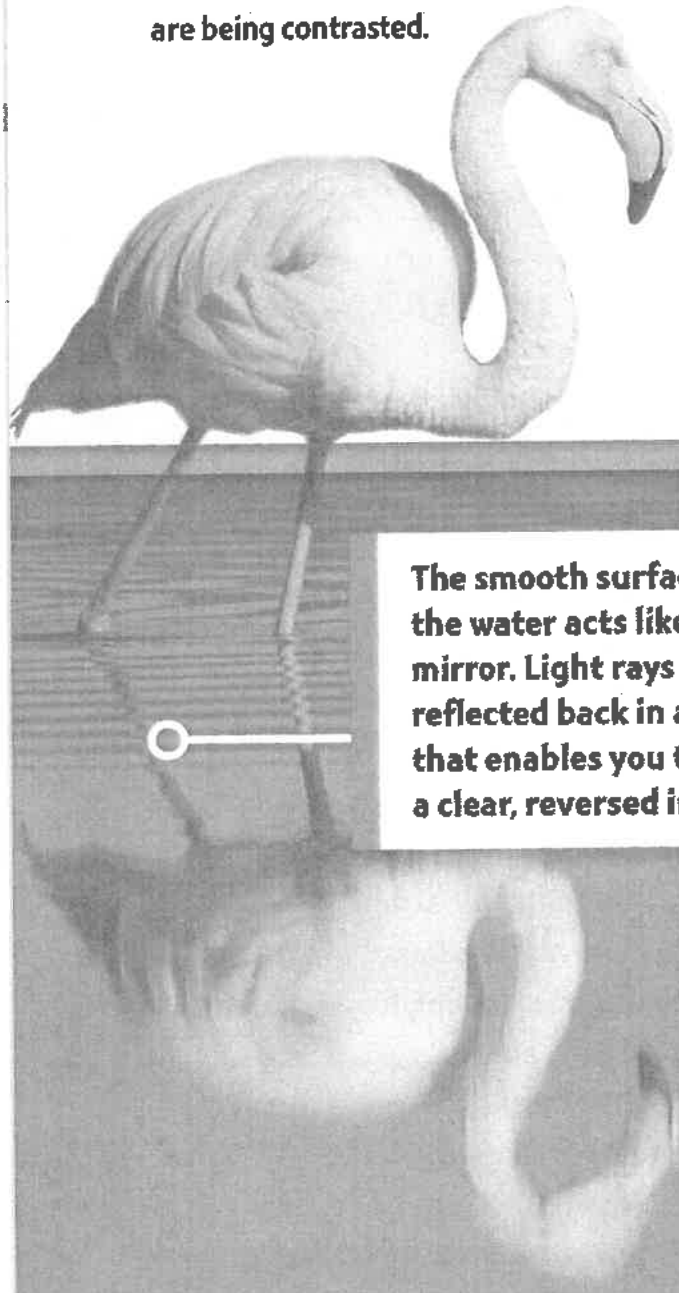

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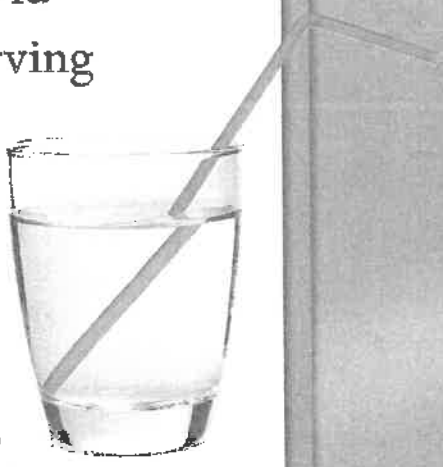

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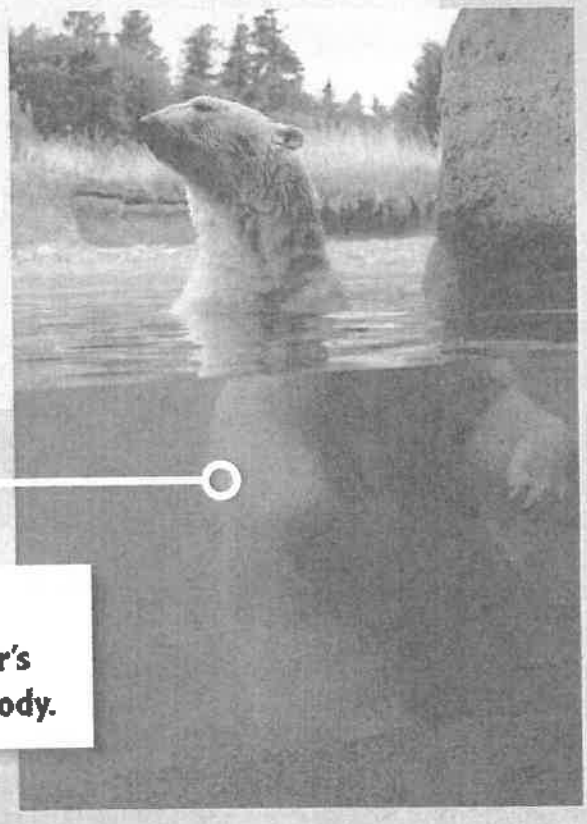

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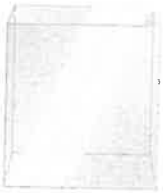
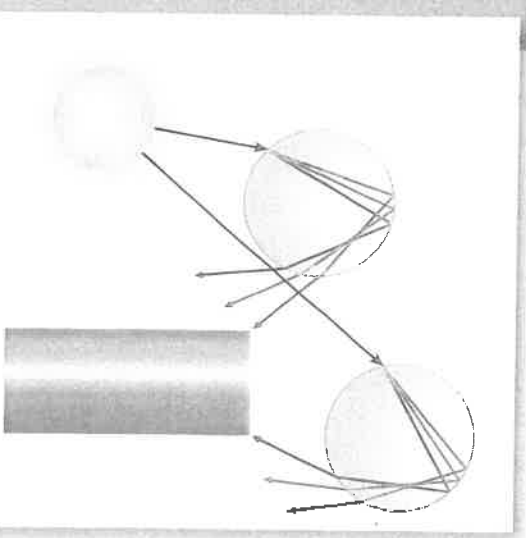
Do the Math!

Angles of Refraction

The diagram shows how light bends as it enters and then exits a transparent material. Use a protractor to measure the angles formed as the light is refracted.





Rainbows are a product of refraction and reflection. Sunlight separates into colors as it passes from the air into a water droplet. The colored light is reflected off the back of the drop, and it is refracted again as it passes into the air. Light from many droplets forms the arcs of color in a rainbow. Red light comes from droplets higher in the air, and violet light comes from lower droplets.

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Cameras, telescopes, and eyeglasses all contain lenses. Even your eyes have a lens inside each of them! What do lenses do?

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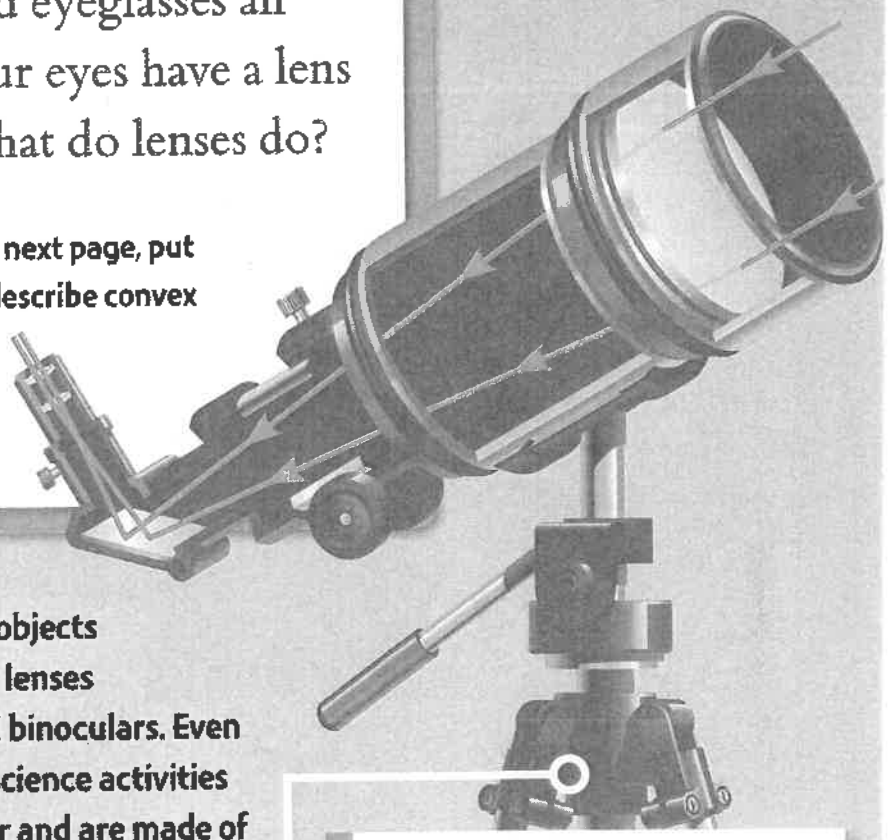

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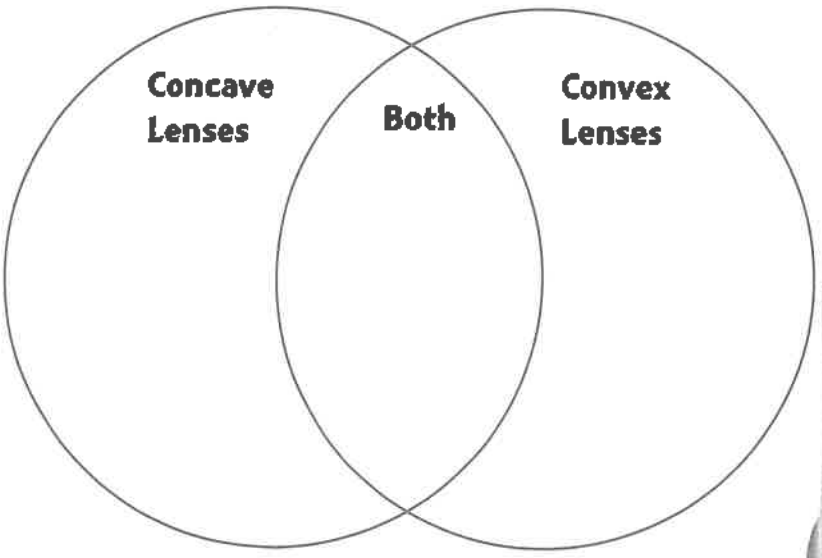
Concave, Convex, or Both?

Fill in the Venn diagram to compare and contrast concave and convex lenses.



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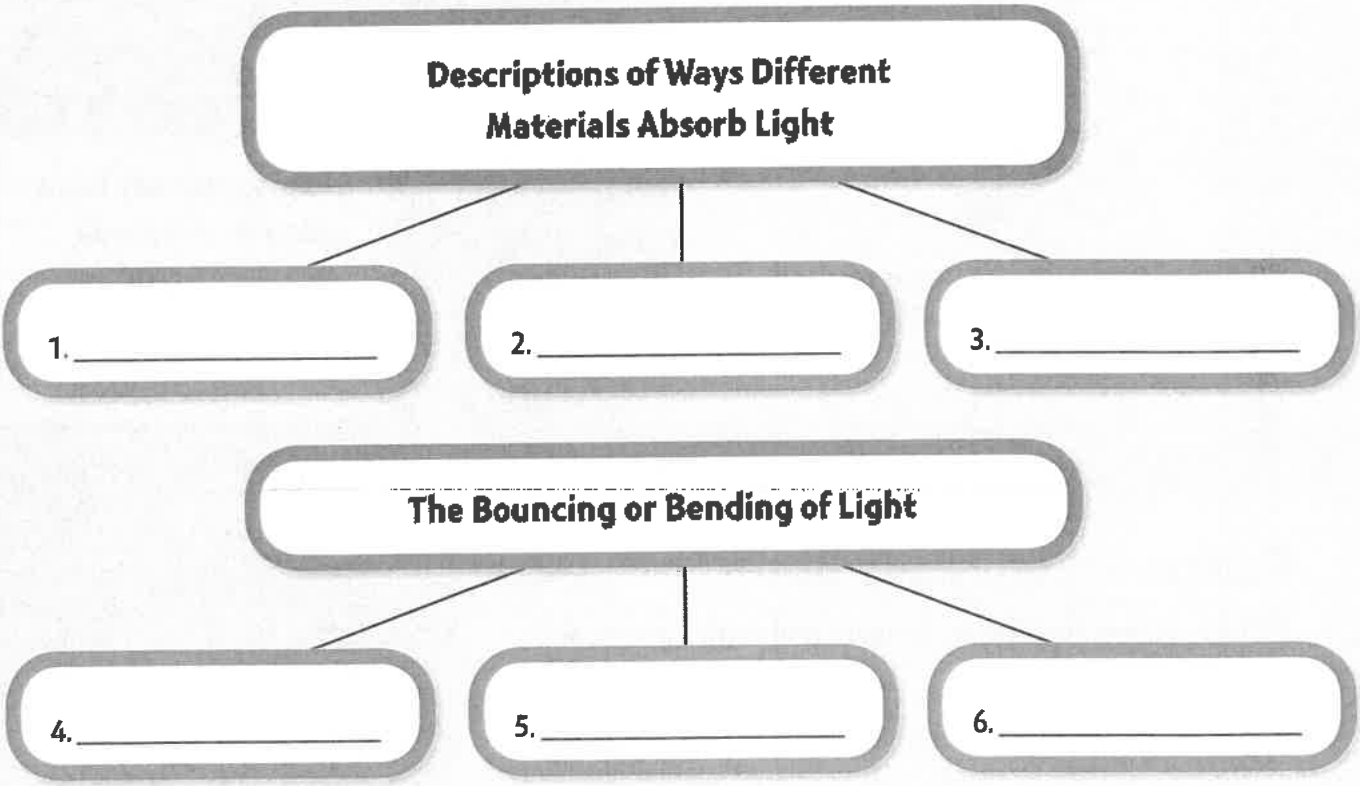
opaque	refraction	transparent



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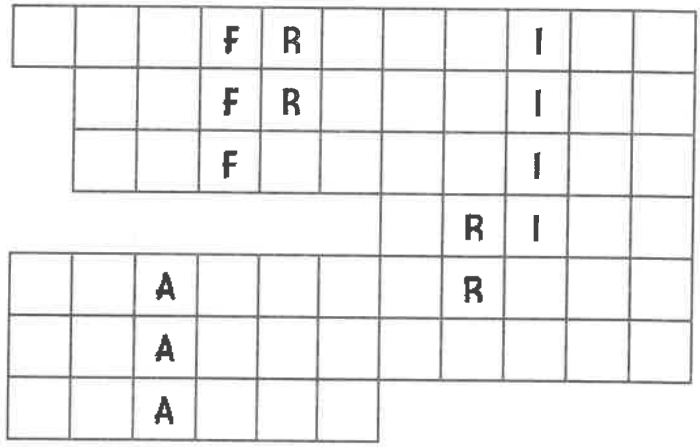
Brain Check

Lesson 4

Name _____

Word Play

1 Use the clues to help you write the correct word in each row. Some boxes have already been filled in for you.



Clues

a. This makes the edges of a shadow look blurred.
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c. This is the word for the bouncing of light off an object.
d. This object will separate light into the colors of the spectrum.
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transparent*	reflection*	prism*	diffraction
translucent*	opaque*	refraction*	

* Key Lesson Vocabulary

Bonus

The prefix *con-* means "with." What words with this prefix can you find in the lesson?

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Apply Concepts

2 Which is better: checking your appearance in a regular mirror or checking it in a sheet of crumpled aluminum foil? Explain why one reflective surface is better than the other.

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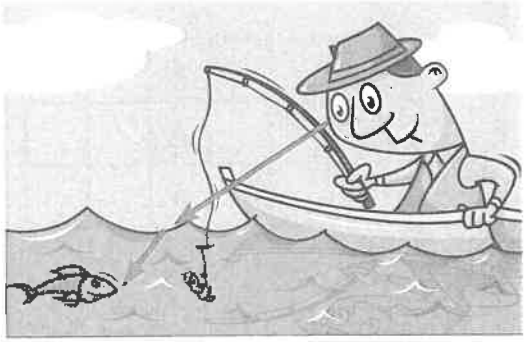
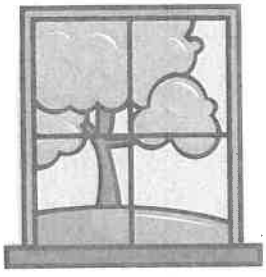


4 Circle the image that shows an opaque material.

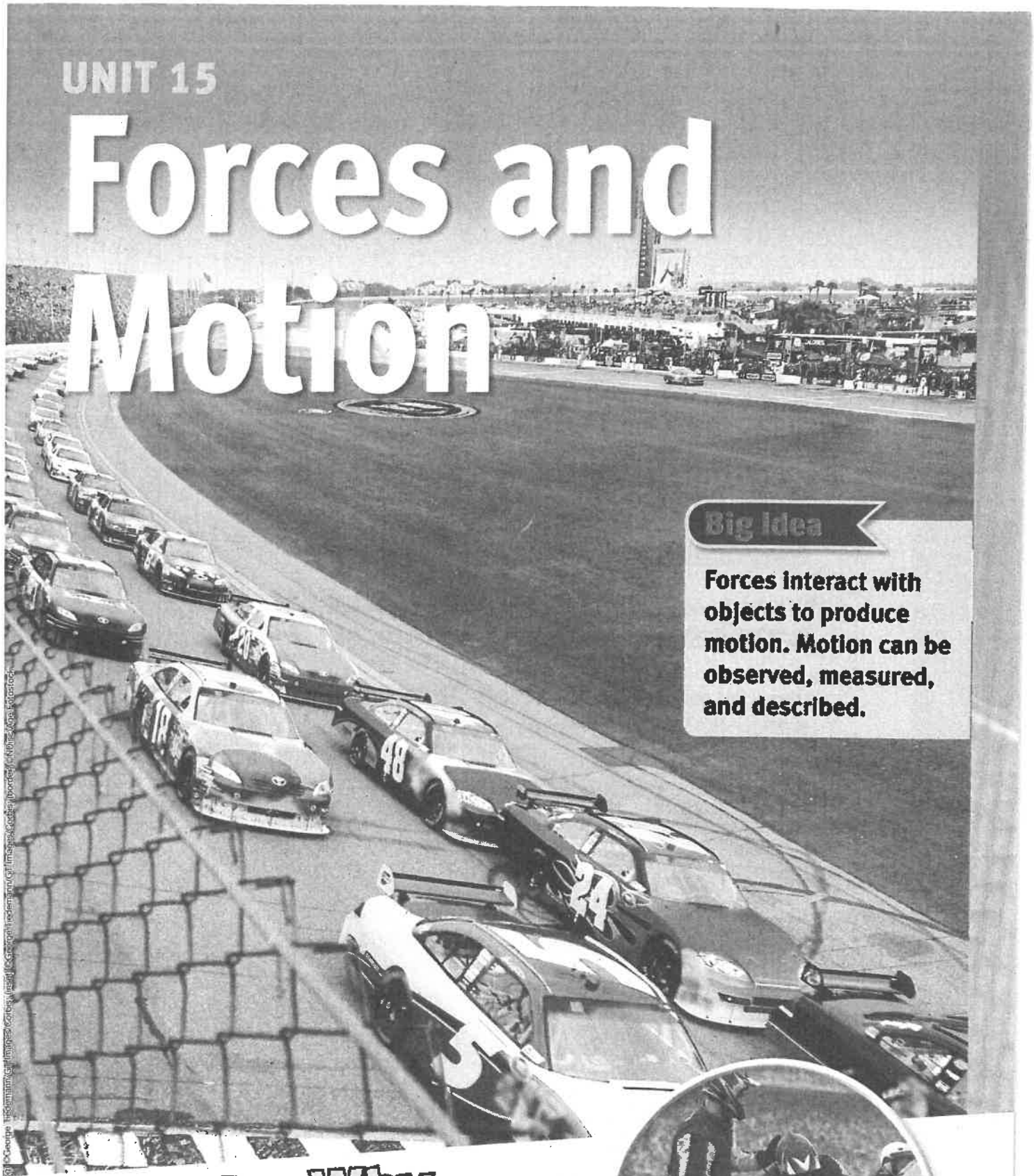


Take It Home!

With a family member, walk through the rooms of your home and identify opaque, transparent, and translucent objects. See how many surfaces you can find in which you can see a reflection.

UNIT 15

Forces and Motion



Big Idea

Forces interact with objects to produce motion. Motion can be observed, measured, and described.

I Wonder Why

Why does a pit crew need to replace the racecar's tires several times during the race? ***Turn the page to find out.***

Here's why Friction gives the racecar traction and allows it to grip the track, but it also produces a lot of heat. The high speed and forceful turns of a race wear tires out quickly.

In this unit, you will explore the Big Idea, the Essential Questions, and the Investigations on the Inquiry Flipchart.

Levels of Inquiry Key ■ DIRECTED ■ GUIDED ■ INDEPENDENT

Track Your Progress

Big Idea Forces interact with objects to produce motion. Motion can be observed, measured, and described.

Essential Questions

Now I Get the Big Idea!

Science Notebook

Before you begin each lesson, be sure to write your thoughts about the Essential Question.

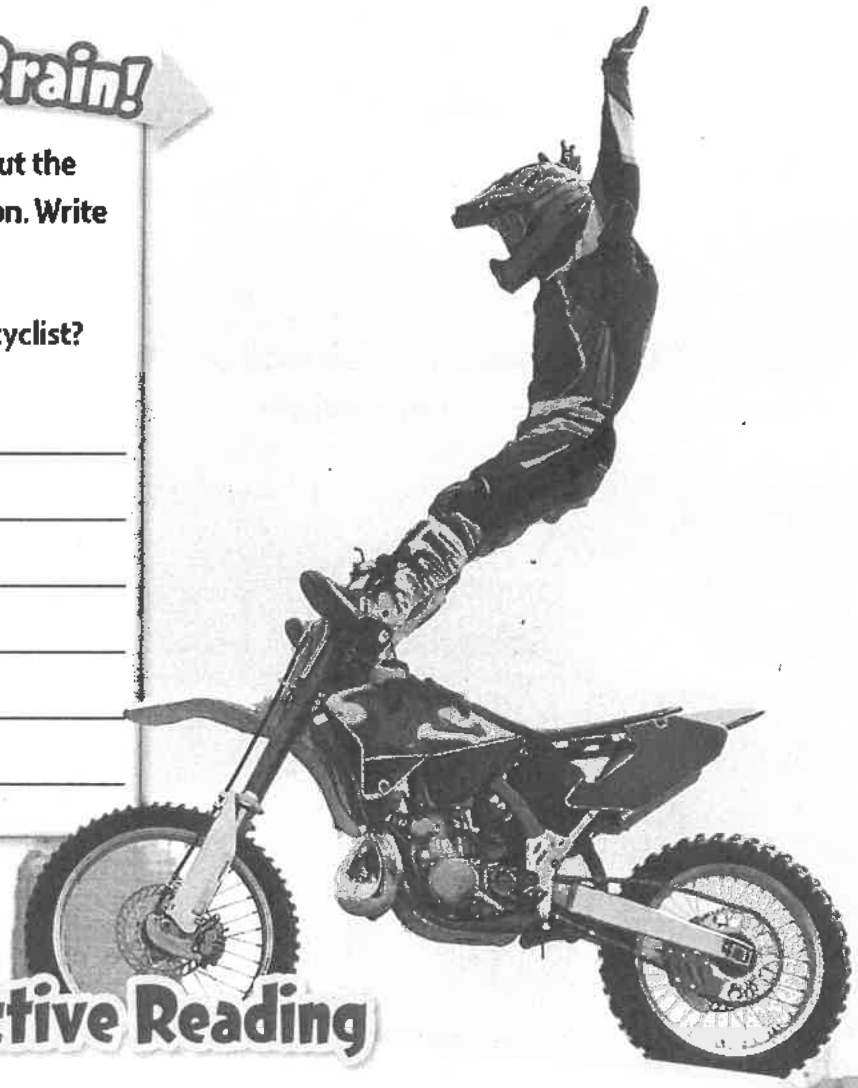
Essential Question

What Are Forces?

Engage Your Brain!

As you read the lesson, figure out the answer to the following question. Write the answer here.

What forces are acting on this cyclist? Are all the forces balanced?



Active Reading

Lesson Vocabulary

List the terms. As you learn about each one, make notes in the Interactive Glossary.

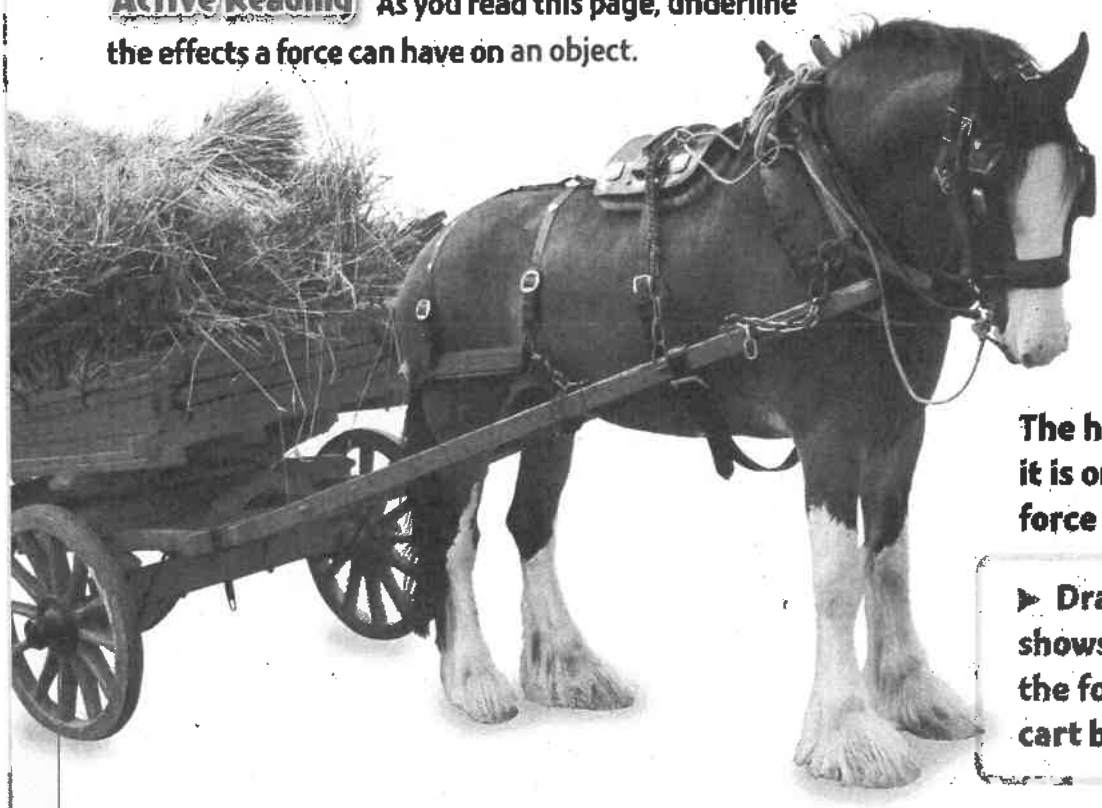
Cause and Effect

Some ideas in this lesson are connected by a cause-and-effect relationship. Why something happens is a cause. What happens as a result of something else is an effect. Active readers look for effects by asking themselves, What happened? They look for causes by asking, Why did it happen?

PUSHING and Pulling

You pull on a door to open it. You lift up a backpack. You push on the pedals of a bike to go faster. What is the relationship between force and motion?

Active Reading As you read this page, underline the effects a force can have on an object.

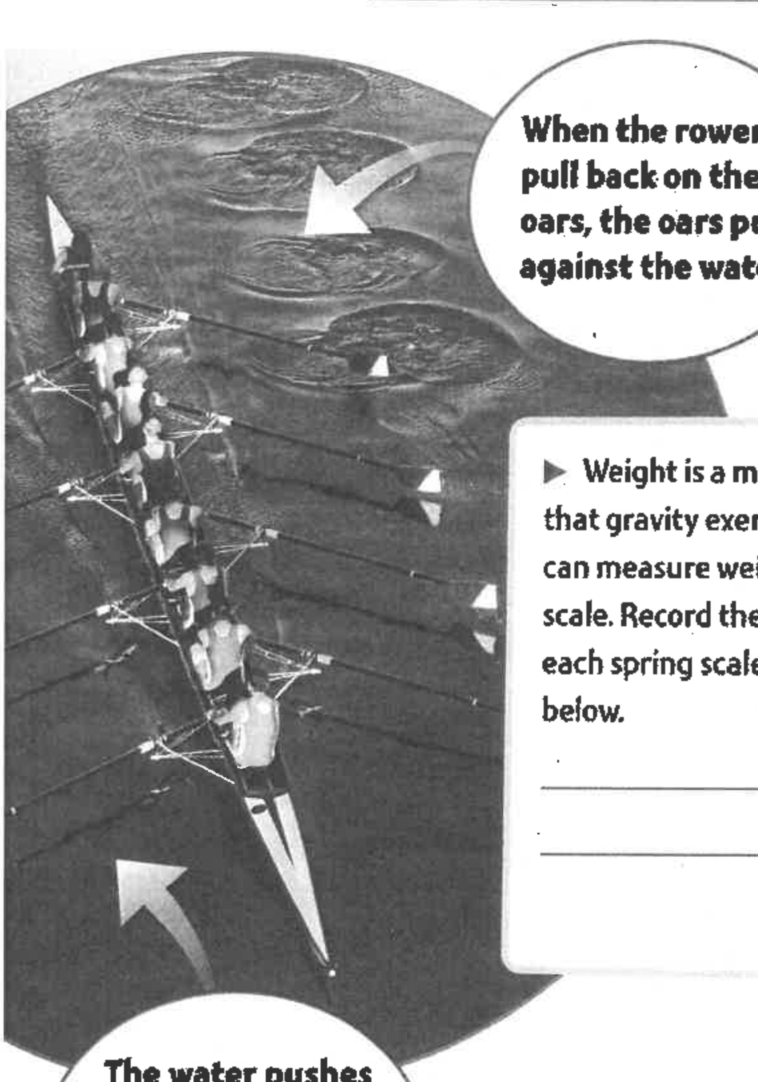


The horse and the road it is on both exert a force on the cart.

▶ **Draw an arrow that shows the direction of the force applied to the cart by the horse.**

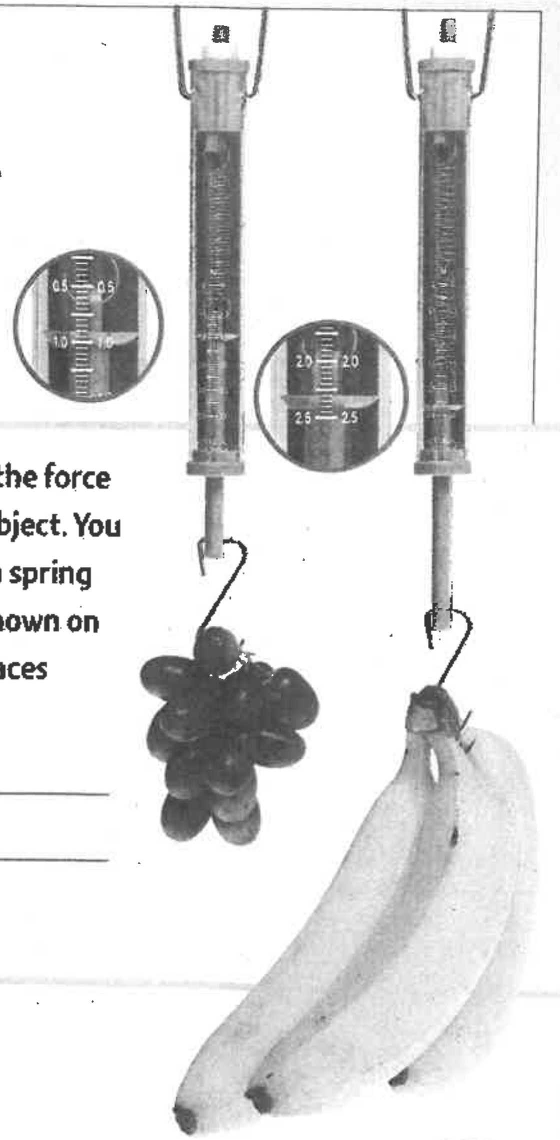
Changes in motion all have one thing in common. They require a **force**, which is a push or a pull. Forces can cause an object at rest to move. They can cause a moving object to speed up, slow down, change direction, or stop. Forces can also change an object's shape.

Forces are measured with a spring scale in units called newtons (N). The larger the force, the greater the change it can cause to the motion of an object. Smaller forces cause smaller changes. Sometimes more than one force can act together in a way that does not cause a change in motion.



When the rowers pull back on the oars, the oars push against the water.

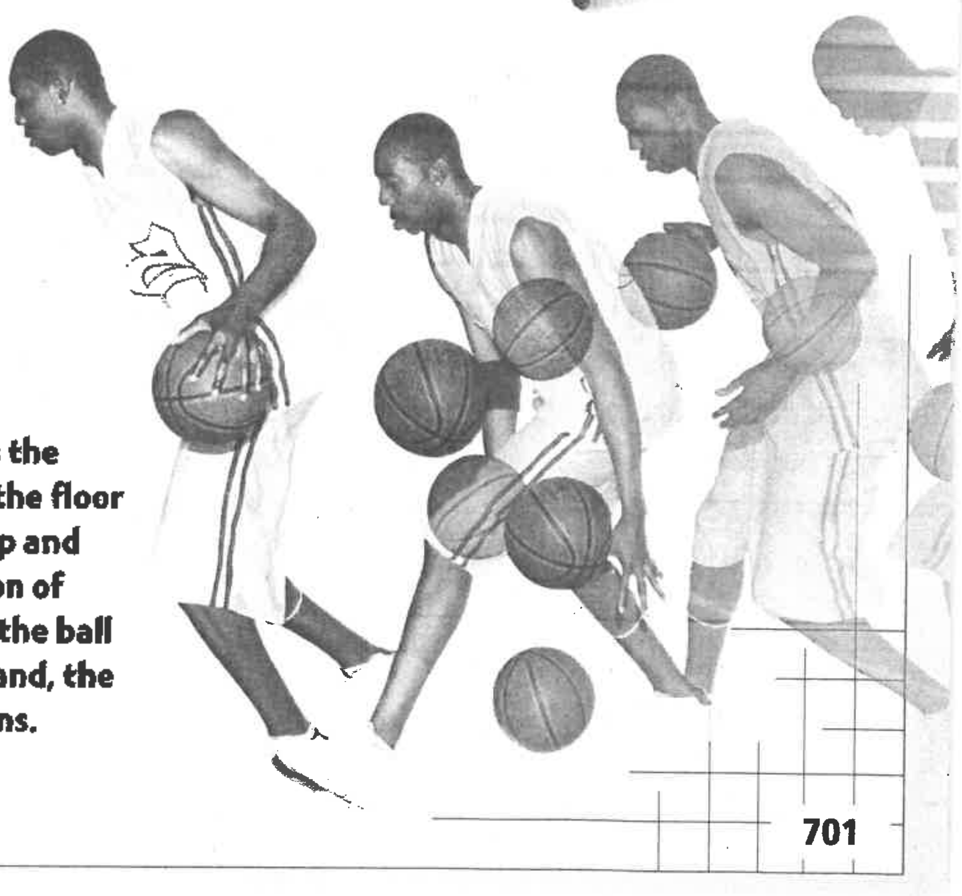
The water pushes back against the oars. This force causes the boat to move.



▶ Weight is a measure of the force that gravity exerts on an object. You can measure weight with a spring scale. Record the weight shown on each spring scale in the spaces below.

____

____



When the ball hits the floor, the force of the floor makes the ball stop and change its direction of movement. When the ball hits the player's hand, the same thing happens.

TWO COMMON Forces

What do the skydivers and some of the flower petals have in common? They are both falling! What causes this?

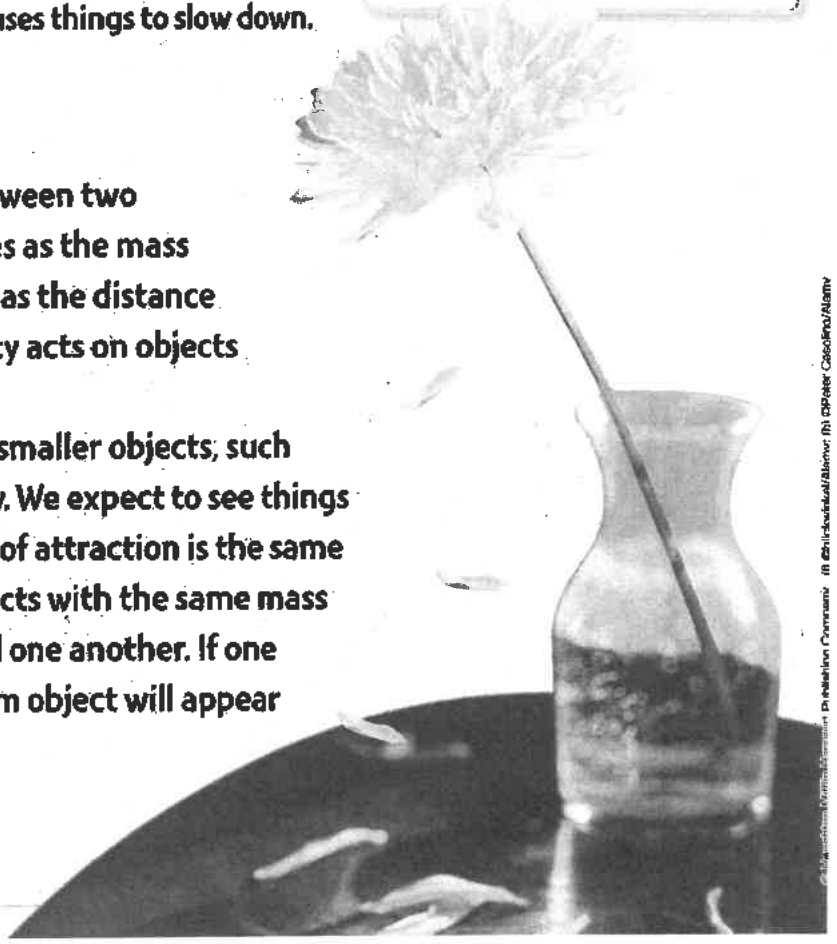
Active Reading As you read these pages, circle the sentence that describes a force that causes things to slow down.

▶ Draw an arrow showing the direction of the gravitational force between Earth and the falling flower petals.

Gravity

Gravity is a force of attraction between two objects. The size of this force increases as the mass of the objects increases. It decreases as the distance between the objects increases. Gravity acts on objects even if they are not touching.

Large objects such as Earth cause smaller objects, such as the skydivers, to accelerate quickly. We expect to see things fall toward Earth. However, the force of attraction is the same on both objects. If you place two objects with the same mass in outer space, they will move toward one another. If one object is "above" the other, the bottom object will appear to "fall up" as the other "falls down"!

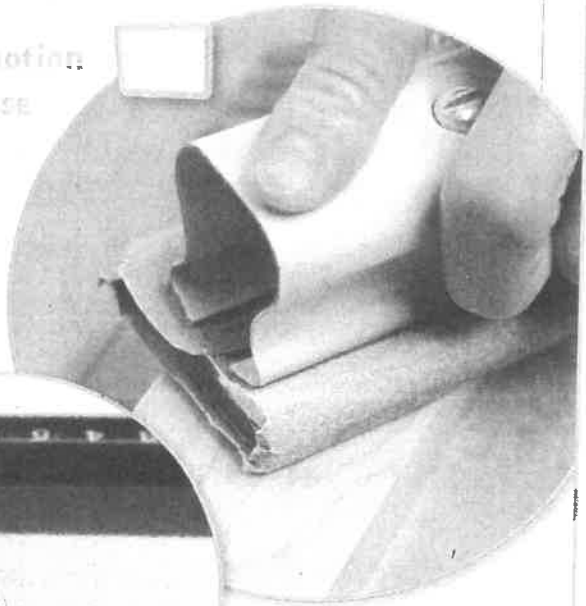


Friction

Is it easier to ride your bike on a smooth road or on a muddy trail? Why?

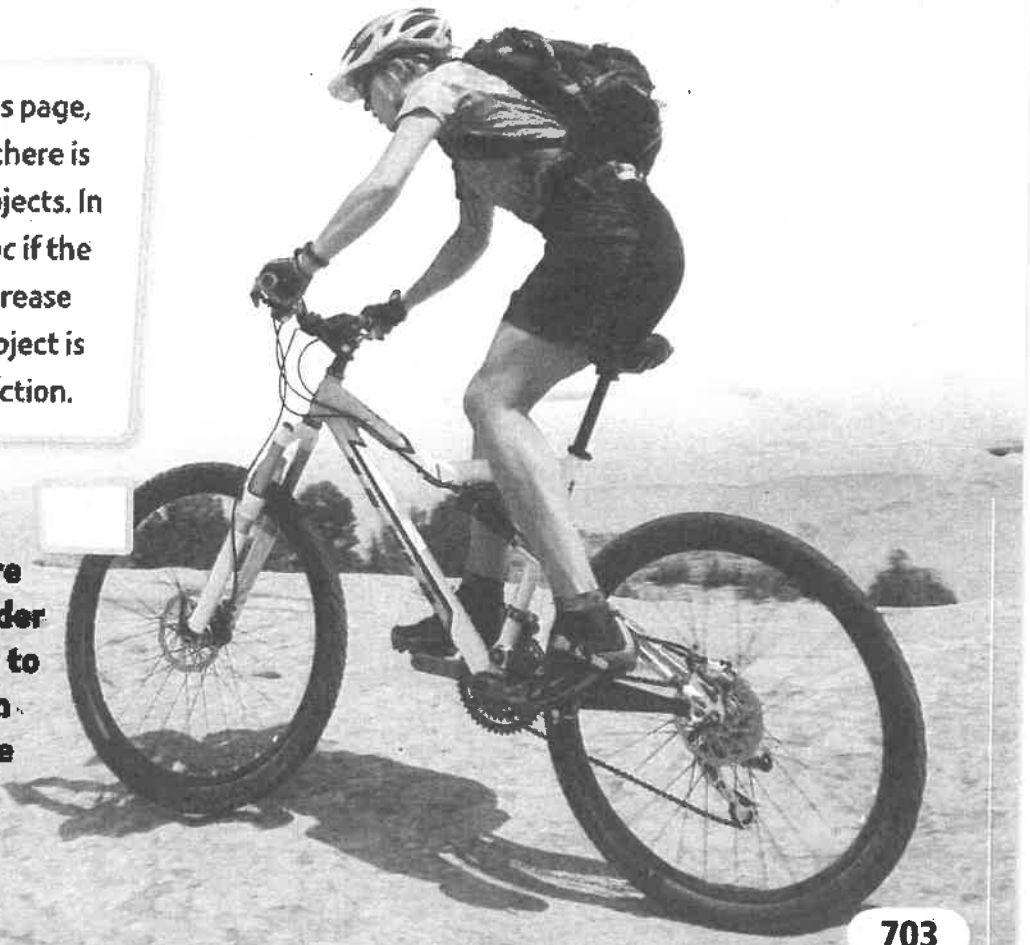
Friction is a force that opposes motion. Friction acts between two objects that are touching, such as the bike tires and the road. Friction can also exist between air and a moving object. This is called air resistance.

It is easy to slide across smooth ice because it doesn't have much friction. Pulling something across rough sandpaper is a lot harder because there is lots of friction.



An air hockey table blows air upward. This layer of air reduces the surface friction, so the pieces move quickly.

▶ In the pictures on this page, circle the places where there is friction between two objects. In the small boxes, write *Inc* if the object is designed to increase friction and *Dec* if the object is designed to decrease friction.



The tires on this bike are designed to keep the rider from slipping. You have to pedal harder on a rough surface to overcome the force of friction.

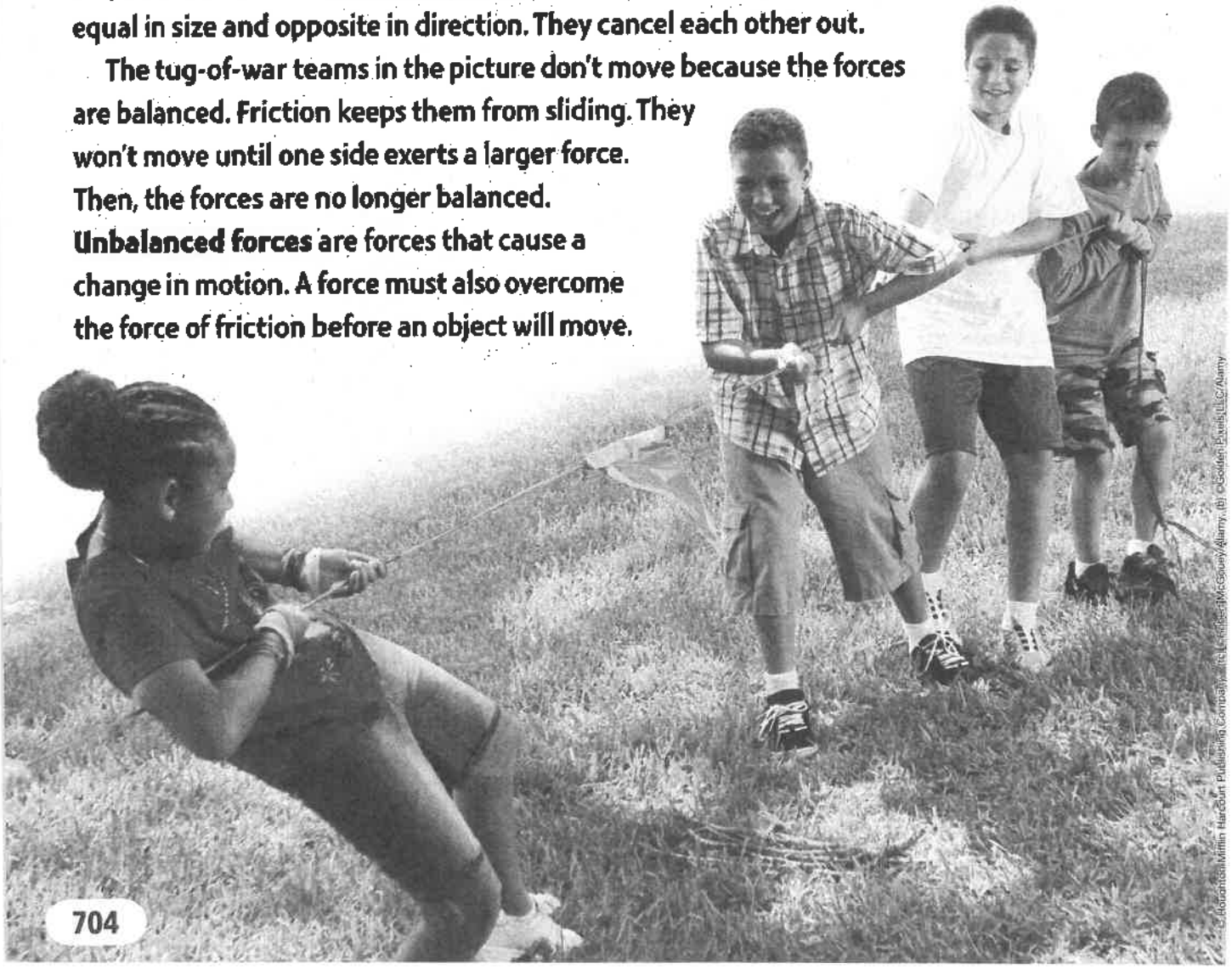
BALANCED or Unbalanced?

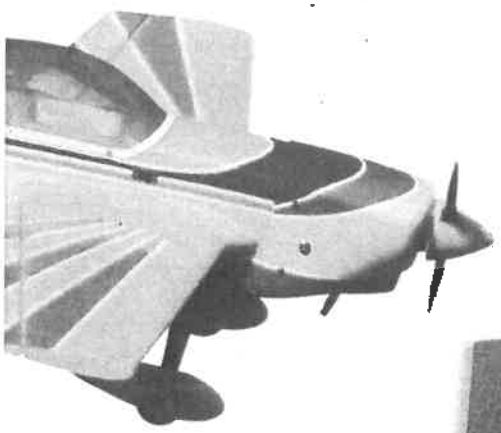
The tug-of-war teams are both applying forces. So why isn't anyone moving?

Active Reading **Draw a circle around a sentence that explains why objects don't always move when a force is applied.**

When you sit on a chair, the force of gravity pulls you down. The chair pushes you up. You stay in one place because the forces on you are balanced. **Balanced forces** are forces on an object that are equal in size and opposite in direction. They cancel each other out.

The tug-of-war teams in the picture don't move because the forces are balanced. Friction keeps them from sliding. They won't move until one side exerts a larger force. Then, the forces are no longer balanced. **Unbalanced forces** are forces that cause a change in motion. A force must also overcome the force of friction before an object will move.





When a plane flies at a constant velocity, all the forces on the plane are balanced. If they weren't, the plane would speed up, slow down, or gain or lose altitude.

The push on the first domino was a(n) _____ force that caused it to fall into the next domino. As each domino fell, it transferred the force to the next domino.

The force exerted on this domino by the falling dominoes is balanced by the force of the box. Because the forces are _____, the domino doesn't fall.

▶ Are there any forces acting on the dominoes that have fallen? If so, are they balanced or unbalanced? How do you know?

_____

_____

_____

_____

The forces on the dominoes are _____ when they are standing upright. When a falling domino hits them, the forces become _____ and they fall.

PULL (or Push) Harder!

Would you expect a bunt in baseball to go out of the park? Why or why not?

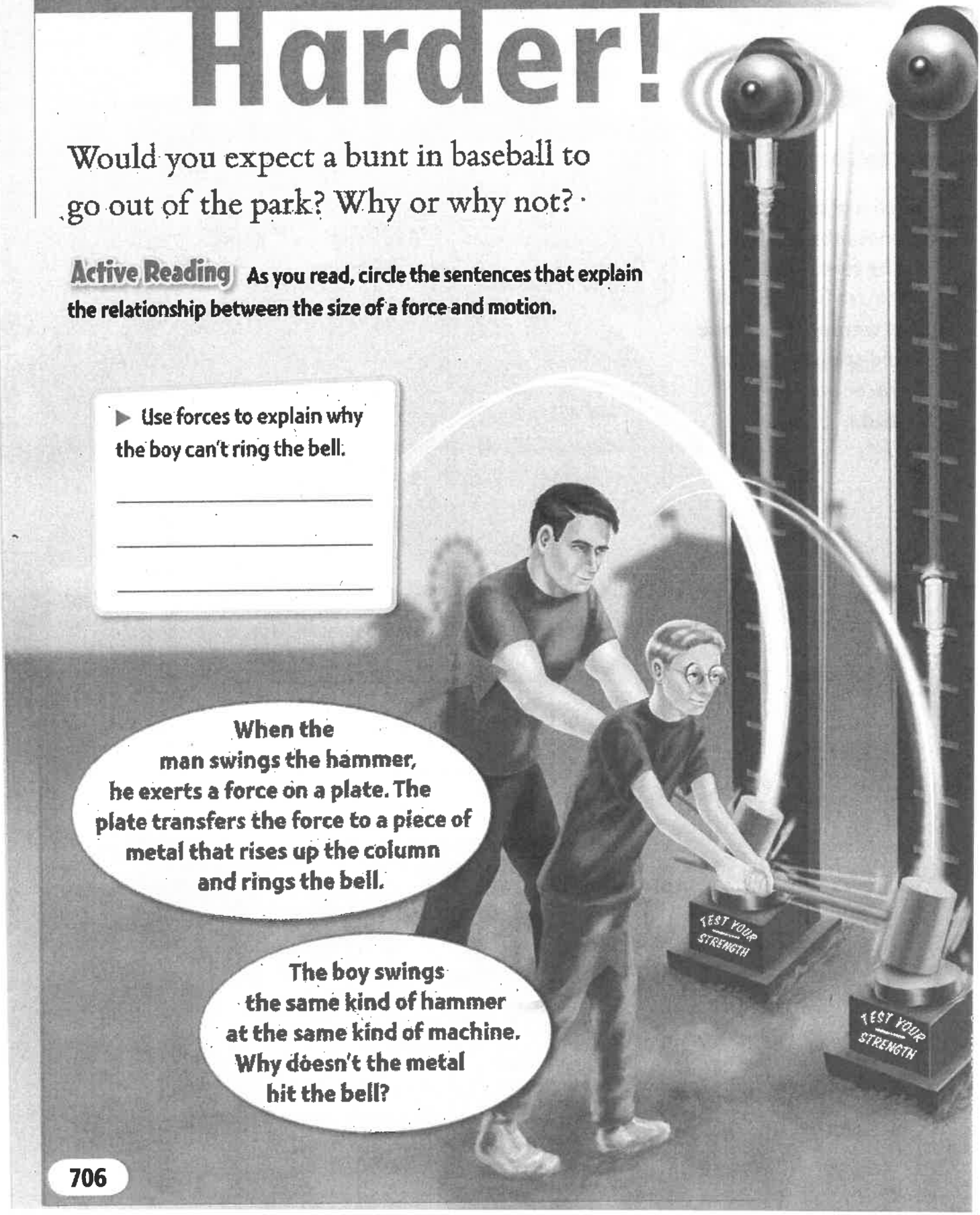
Active Reading **As you read, circle the sentences that explain the relationship between the size of a force and motion.**

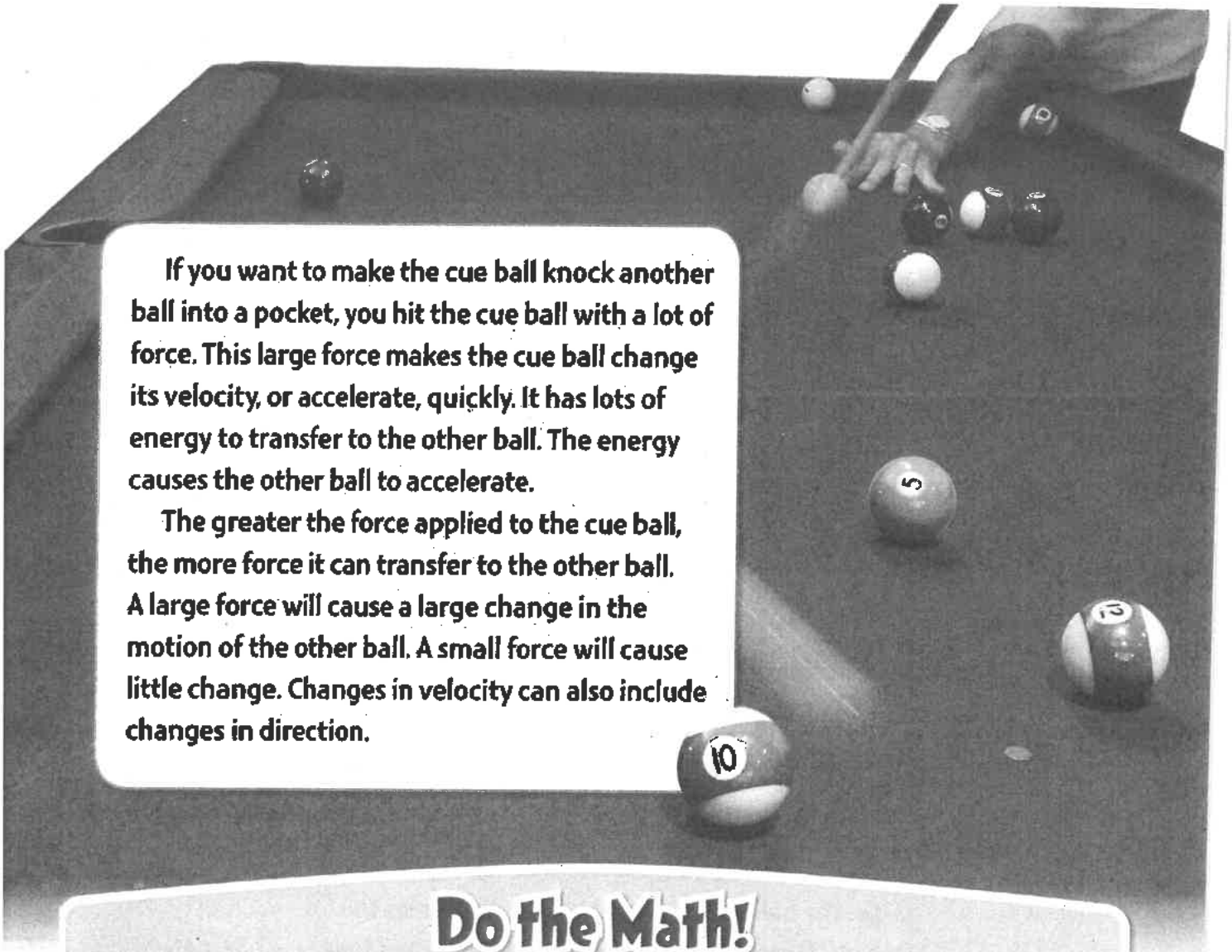
▶ Use forces to explain why the boy can't ring the bell.

_____

_____

_____





If you want to make the cue ball knock another ball into a pocket, you hit the cue ball with a lot of force. This large force makes the cue ball change its velocity, or accelerate, quickly. It has lots of energy to transfer to the other ball. The energy causes the other ball to accelerate.

The greater the force applied to the cue ball, the more force it can transfer to the other ball. A large force will cause a large change in the motion of the other ball. A small force will cause little change. Changes in velocity can also include changes in direction.

Do the Math!

Display Data in a Graph

Use the data in the table to make a graph that shows the relationship between the force applied to an object and its acceleration.

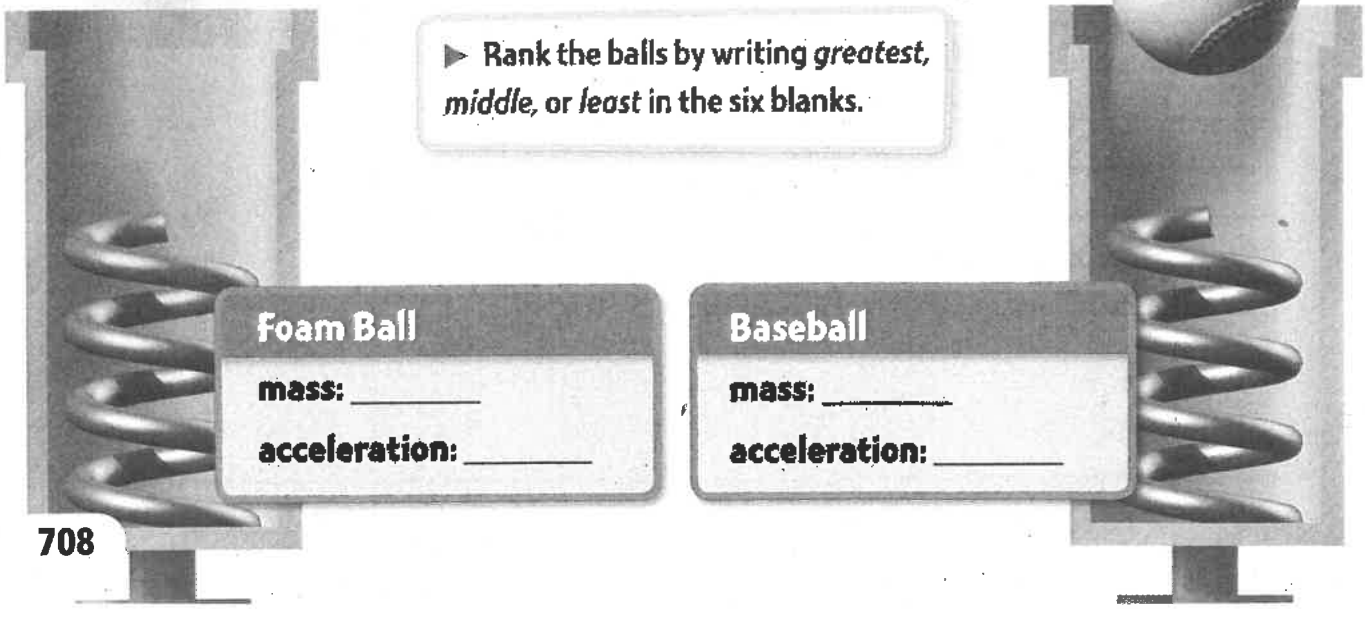
Force (N)	Acceleration (m/sec^2)
1	0.5
2	1.0
5	2.5
8	4.0
10	5.0

I'M NOT Moving!

It's easy to lift your empty backpack off the ground. Could you use the same force to lift it when it's full of books?

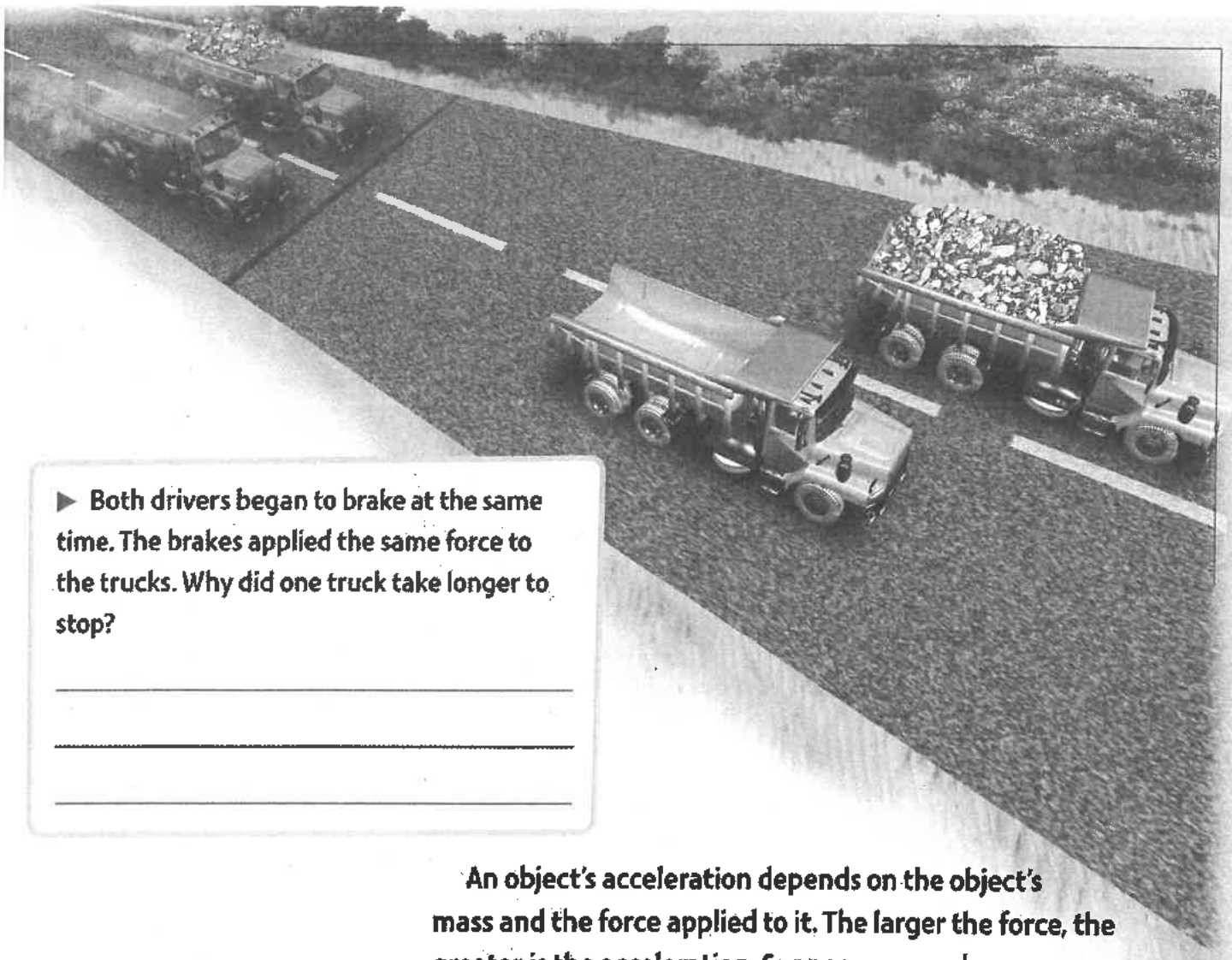
Active Reading As you read these pages, circle cause-and-effect signal words, such as *because, so,* or *therefore.*

The springs in the pictures all exert the same force on the balls, causing them to roll across the page. The ball with the least mass accelerates the fastest. Therefore, it travels the farthest. The same force has a greater effect on an object with a small mass than an object with a larger mass.



▶ Rank the balls by writing *greatest, middle,* or *least* in the six blanks.

Foam Ball	Baseball
mass: _____	mass: _____
acceleration: _____	acceleration: _____



▶ Both drivers began to brake at the same time. The brakes applied the same force to the trucks. Why did one truck take longer to stop?

_____

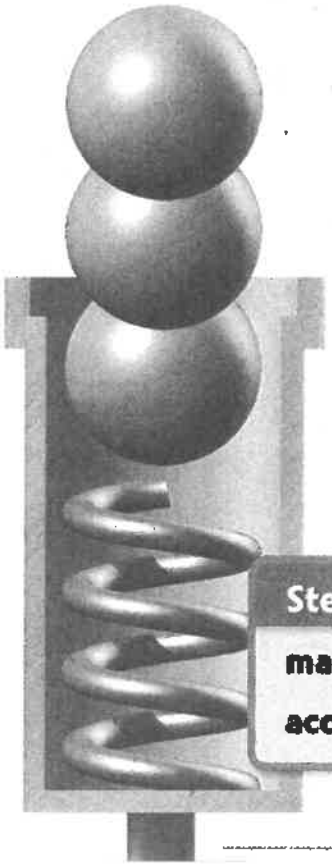
_____

_____

An object's acceleration depends on the object's mass and the force applied to it. The larger the force, the greater is the acceleration. Suppose you push a wagon gently. The wagon speeds up slowly. If you use more strength to push, then the wagon's speed changes quickly.

The less an object's mass is, the less force is needed to change its motion. It's easier to push an empty shopping cart than a full one. Light cars are used in drag races because a car with less mass speeds up faster than a car with more mass.

If you want to slide a heavy box across the floor faster, you have two options. You could take some items out of the box, which decreases its mass. Or you could have a friend help you, which increases the force you apply.



Steel Ball

mass: _____

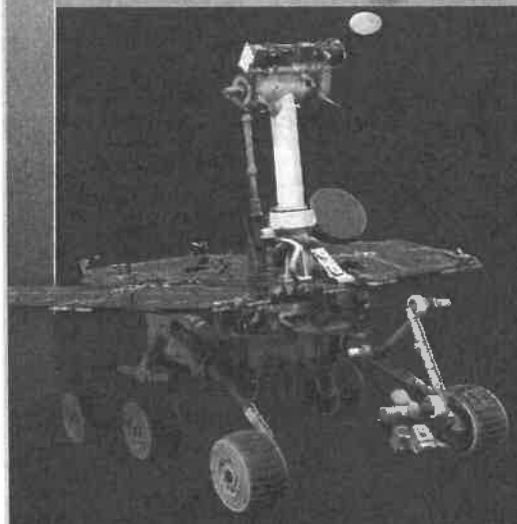
acceleration: _____

Why It Matters

How did I get to Mars?

LET'S GO to Mars!

How did an understanding of forces help to send a rover to Mars and safely land it there?



1 The first force you need is an unbalanced force to oppose Earth's gravity. A huge booster rocket produces nearly 900,000 N of force that accelerates the rocket upward.

2 After the booster rocket falls away, smaller rockets in the second stage fire. The rockets change the direction of the vehicle's motion and put it in orbit around Earth.

3 The third-stage rocket firing produces enough force to reach "escape velocity." Earth's gravity can no longer pull it back down. We're on our way!

▶ What forces act on the rocket while it's at rest on Earth's surface? Are they balanced or unbalanced?

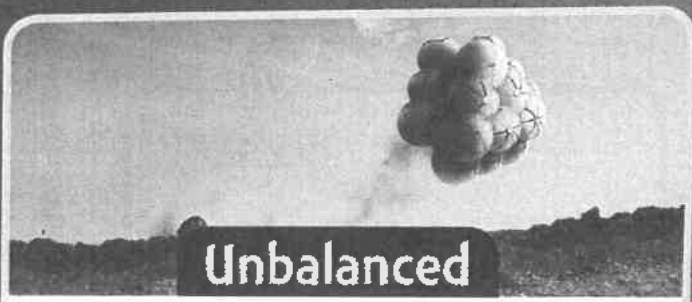
Balanced

▶ At what points during the Rover's trip to Mars are the forces on it balanced?

_____

_____

_____



Unbalanced

▶ What unbalanced forces are acting on the Rover as it lands on Mars?

_____

_____

_____

Gravity

▶ Use forces to explain why the Rover required a parachute and "air bags."

_____

_____

_____

During much of the time it takes the spacecraft to travel to Mars, it travels at a constant velocity. The forces acting on the spacecraft are balanced, so its motion does not change.

Tiny rockets occasionally fire to keep the spacecraft on course. During these times, the forces are unbalanced.

As the spacecraft approaches Mars, gravitational attraction begins to accelerate it toward the surface. Like a person jumping from a plane, the Rover detaches from the spacecraft. Parachutes open to slow its fall. Then a big ball inflates around the Rover. When the Rover hits the surface of Mars, it bounces around until it comes safely to rest.

Mars Rover air bag testing

Sum It Up!

When you're done, use the answer key to check and revise your work.

Change the part of the summary in blue to make it correct.

1. Forces are pushes and pulls that increase the speed of objects.

   _____
   _____

2. Gravity is the force of attraction between a planet and another object.

   _____
   _____

3. An object moving through the air slows down because it is affected by the force of gravity.

   _____
   _____

4. When balanced forces act on an object, the object falls.

   _____
   _____

5. In order for an object to change its speed or direction, someone has to push it.

   _____
   _____

Answer Key: 1. can change the motion or shape of objects 2. any two objects 3. the force of friction 4. doesn't change its motion 5. an unbalanced force must act on it

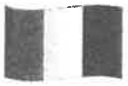
Brain Check

Lesson 1

Name _____

Word Play

1 **A foreign-language teacher placed words from other languages into the following sentences. For each sentence, write the English word that means the same as the foreign word. Then use the circled letters to complete the riddle.**

1.  Italian

   A push is an example of a forza. Another example is a pull.

   _ (11) _ (3) _

2.  French

   The force of attraction between Earth and objects on its surface is pesanteur.

   _ (8) _ _ _ _ _

3.  Russian

   The force between two moving objects that are touching is Tpenne.

   (4) _ _ _ _ _ (7) _

4.  German

   Two forces that are equal in size but opposite in direction are ausgeglichene Kräfte.

   _ _ _ _ _ (10) _ _ _ _ (5) _ _ (9)

5.  Portuguese

   Two forces that are not equal in size are Forças desequilibradas.

   (2) _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ (6) _

6.  Chinese

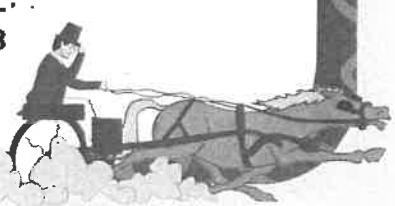
   A 彈簧秤 is a tool that can be used to measure the size of a force.

   (1) _ _ _ _ _ (12) _ _ _ (13)

Riddle: What conclusion did the student draw?

The __o__r__e of the __o__c__ is the h_____e, of ____ur____.
1 2 3 4 5 6 7 8 9 10 11 12 13

Try saying that five times fast!



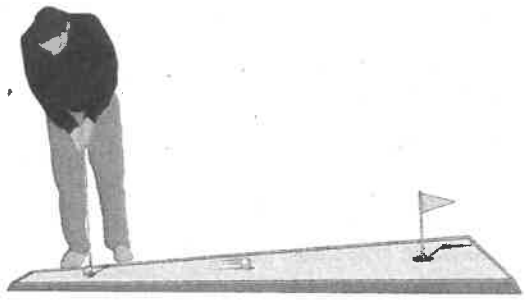
Apply Concepts

2 Draw pictures of two activities that you might do. In the first, draw a pushing force. In the second, draw a pulling force.

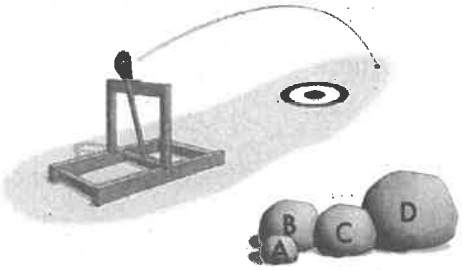
pushing force

pulling force

3 The golfer applied a force when he hit the ball. Describe at least two forces acting on the ball as it rolls. Draw arrows to show the forces.



4 Two students are using a catapult to try and hit a target. The catapult has only one setting. The first time they tried, they used Rock B. Which of the remaining rocks is likely to come closer to the target? Why?

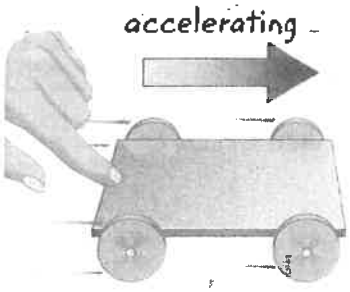


Name _____

Lesson 7

5 Use the words *balanced* and *unbalanced* as you name and describe the forces acting in each of these pictures.

a. accelerating



b.

c.

_____ _____ _____

_____ _____ _____

_____ _____ _____

_____ _____ _____

6 Draw what will happen to a ball that you throw straight up into the air. Explain why this happens.

_____

_____

_____

_____

_____

7 Explain why it is easy to slip on a floor that is wet.

_____

_____

_____

_____

_____

8 Look at the drawings to the right. Mary measured the distance each ball traveled. Draw lines to match the ball with the distance it traveled.

Explain why each ball traveled a different distance.

_____

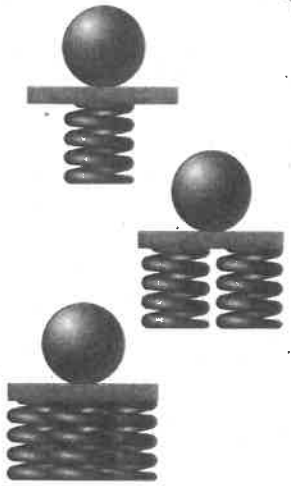
_____

_____

25 cm

15 cm

20 cm



9 Give an example of each of the following.

a. A force is applied but nothing happens.

_____

b. A force causes an object to change shape.

_____

c. A force causes an object to change position.

_____

d. A force causes an object to stop moving.

_____

10 Circle the object(s) whose velocities are not changing. Draw an up arrow next to the object(s) whose speeds are increasing. Draw a down arrow next to the object(s) whose speeds are decreasing.

A car travels 35 miles per hour around a bend in the road.

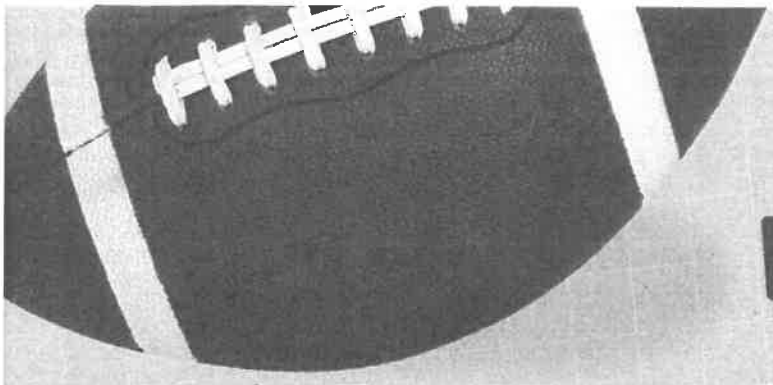
A car comes to a stop when a traffic light turns red.

A race car accelerates when a race begins.

A car is driving 45 miles per hour down a straight road.

Take It Home!

Discuss with your family what you've learned about forces. Together, identify five forces that you use to change the motion of objects in your everyday life. Consider forces that weren't discussed in the lesson.

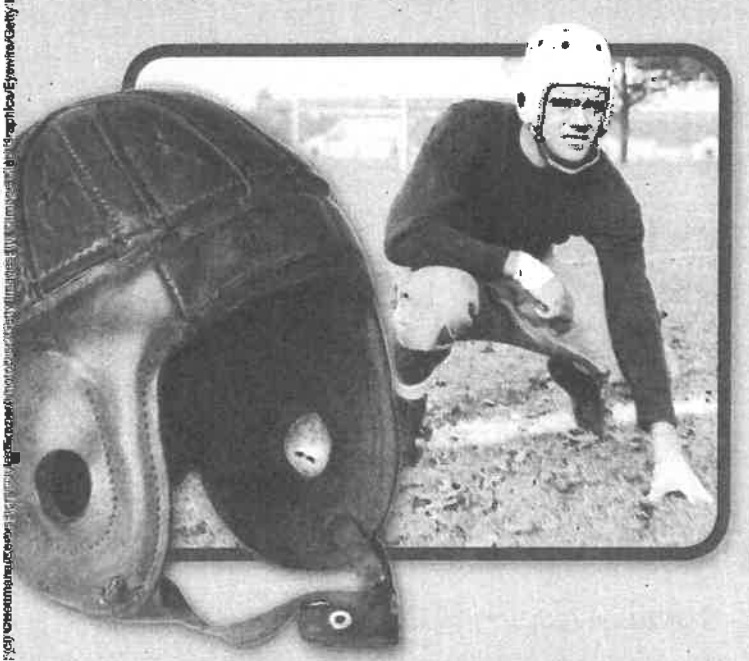


S.T.E.M.

Engineering & Technology

Football Safety Gear

Football is a rough sport. In order to protect players from injury, designers have developed protective gear.



The first helmets were custom made out of leather by horse harness makers. Later, ear holes and padding were added. These helmets had little padding and no face guards.

Hard plastic shells, fitted foam linings, and metal facemasks now make helmets more protective. Some helmets even contain sensors that transmit signals to warn if a player's head has been hit hard enough to cause a serious injury.

Critical Thinking

How do modern materials make it possible to build a better helmet than one made of just leather?

S.T.E.M.
continued

When engineers develop new materials, it can spark new and improved designs of all sorts of familiar objects.

Choose two pieces of safety gear from your favorite sport or activity. Draw each piece of gear. Do research to find out what material makes up each piece. Label the materials. Explain how one material's properties made it a good design choice.

List three features of this bicycle helmet. Underline the features that are for safety. Circle the features that are for comfort.

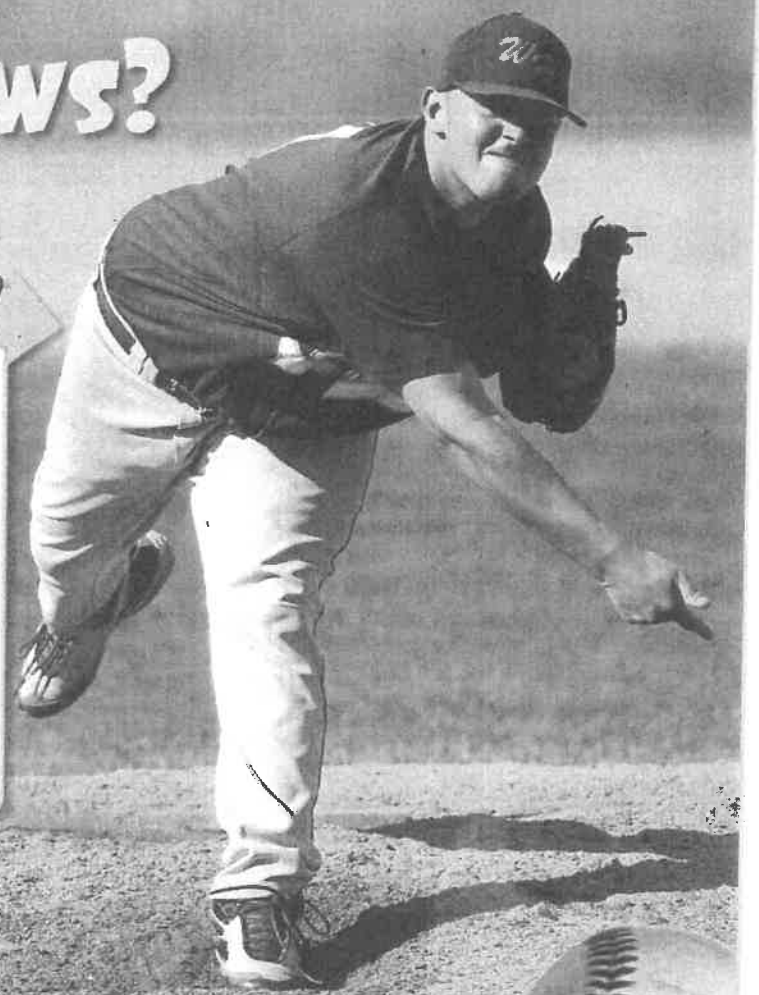
Build On It!

Rise to the engineering design challenge—complete Design It: Balloon Racer in the Inquiry Flipchart.

Lesson 4

Essential Question

What Are Newton's Laws?



Engage Your Brain!

Look for the answer to the following question in this lesson and record it here.

How does a baseball obey Newton's laws?

_____

_____

_____

_____

Active Reading

Lesson Vocabulary

List each term. As you learn about each one, make notes in the Interactive Glossary.

_____

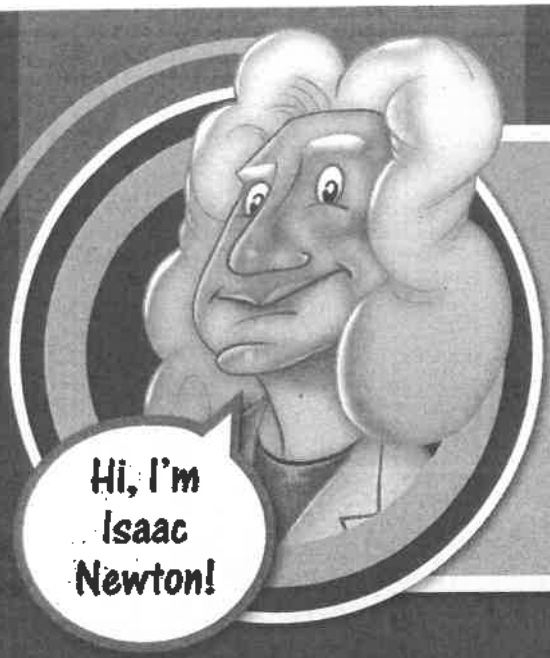
_____

_____

Cause and Effect

Many ideas in this lesson about Newton's laws of motion are related by cause and effect. A cause is the reason something happens. An effect is what happens as a result of a cause. Active readers look for effects by asking themselves, What happened? They look for causes by asking, Why did it happen?

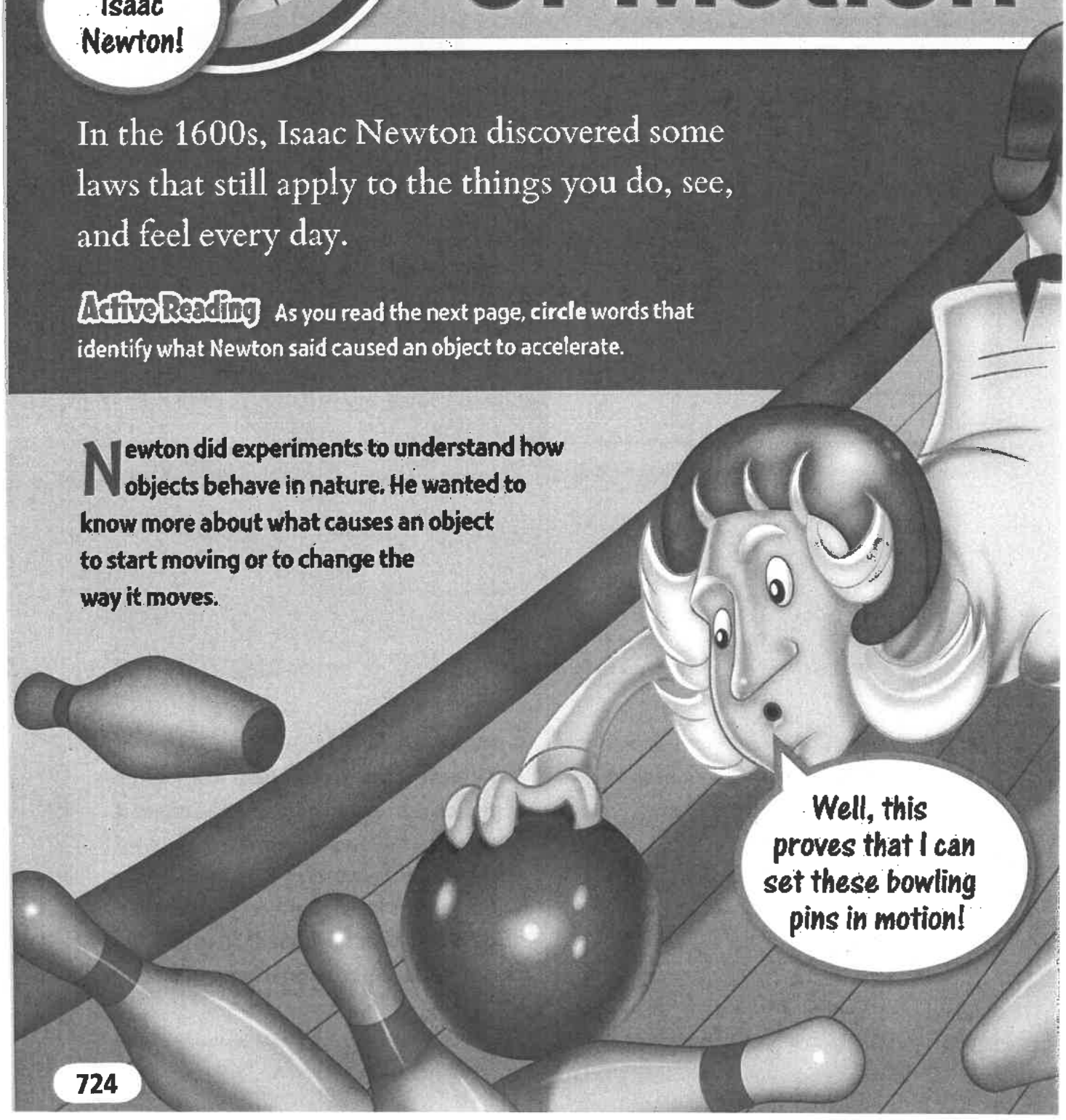
Newton's First Law of Motion



In the 1600s, Isaac Newton discovered some laws that still apply to the things you do, see, and feel every day.

Active Reading As you read the next page, **circle** words that identify what Newton said caused an object to accelerate.

Newton did experiments to understand how objects behave in nature. He wanted to know more about what causes an object to start moving or to change the way it moves.



In 1687, Newton published a book about how objects move in the physical world. The English scientist summed up his ideas in three rules, or laws. *Newton's first law of motion* states that no acceleration can happen without an unbalanced force. Here, *acceleration* means "change in motion" and *force* means "a push or a pull." Another way to say Newton's first law is this: Objects at rest don't move unless an unbalanced force acts on them. Objects in motion don't slow down, speed up, stop, or turn unless a force makes them do so.

Newton's first law describes inertia. **Inertia** is the tendency of objects to resist a change in motion. Think of riding in a car. If the car turns sharply in one direction, your body feels pulled to the other side of the car. Your body is attempting to continue moving in the same direction as it was before the car turned. When the car stops, your seat belt and friction from the seat provide the unbalanced force needed to keep you in your seat.

When a car makes a sudden stop or turn, a seat belt helps keep your body from continuing its previous motion.

Describing Inertia

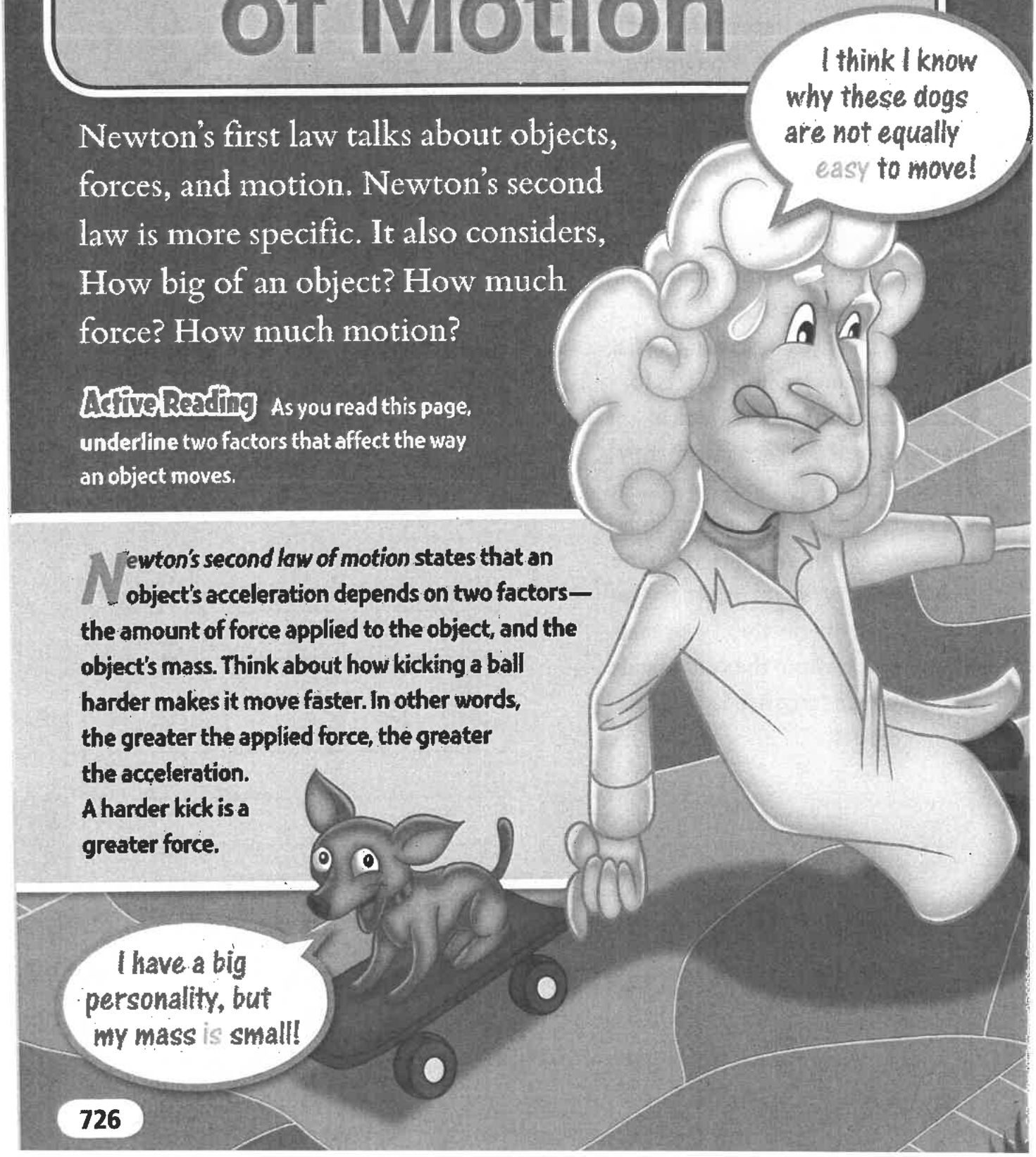
Inertia applies both to objects that are moving and objects that are at rest. Explain each situation, using examples.

Newton's Second Law of Motion

Newton's first law talks about objects, forces, and motion. Newton's second law is more specific. It also considers, How big of an object? How much force? How much motion?

Active Reading As you read this page, **underline** two factors that affect the way an object moves.

Newton's second law of motion **states that an object's acceleration depends on two factors—the amount of force applied to the object, and the object's mass. Think about how kicking a ball harder makes it move faster. In other words, the greater the applied force, the greater the acceleration. A harder kick is a greater force.**



My mass is large, so I have a big interest in resting!

Do the Math!

Solve Word Problems

F means *force*, *m* means *mass*, and *a* means *acceleration*.

Use Newton's second law ($F = m \times a$) to find the missing values in the equations below. Recall that the standard unit of force is the newton (N).

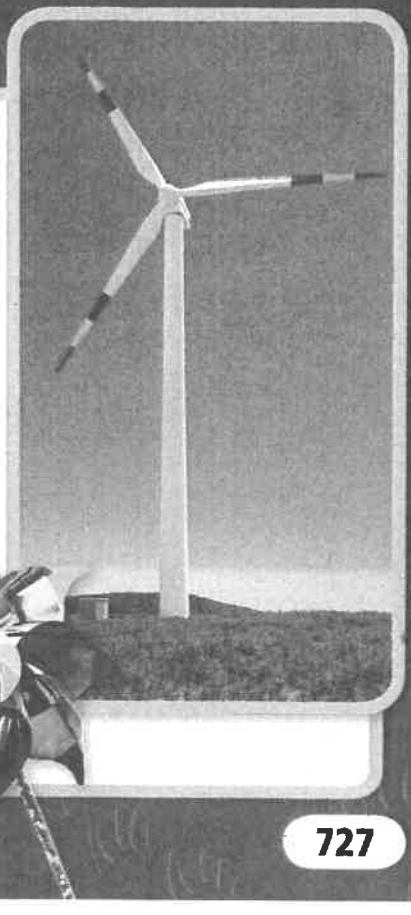
If a mass has a value of 1 and its acceleration is a value of 3, what is the value of the force acting on the mass?

_____

A ball has a mass of 6 units. Its acceleration is 8 units. What is the value of the force that set the ball in motion?

_____

The mass of an object affects how, or if, the object moves when a force is applied to it. Think of an empty shopping cart at a grocery store. How much force does it take to start it moving? Not much, right? Now imagine the cart filled with groceries. If you used the same amount of force as before, would the full cart move? Probably not. Newton's second law explains why you must use more force to move an object with a greater mass. The second law of motion can be written as an equation: Force = mass × acceleration.



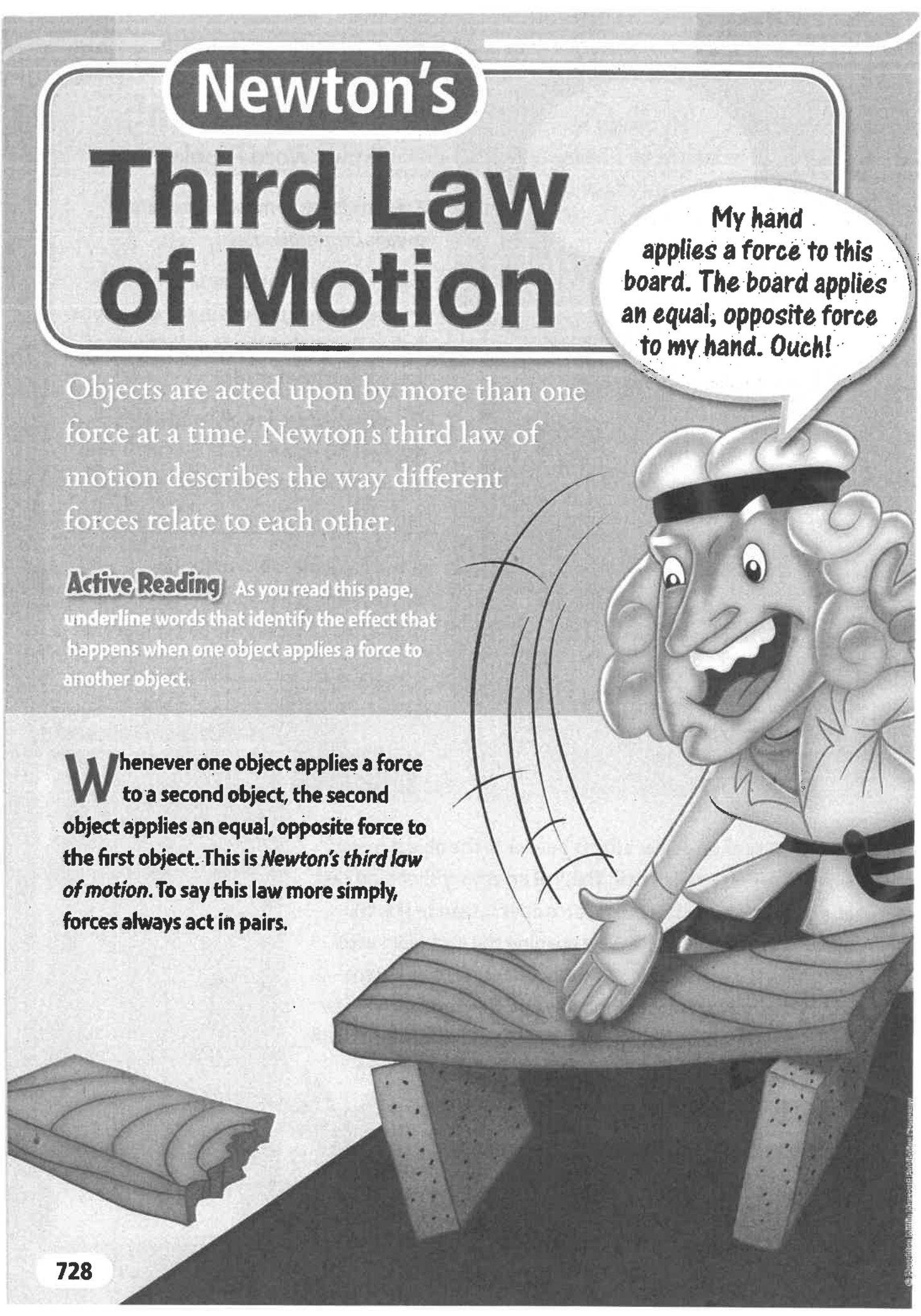
The amount of force needed to turn the pinwheel would not be enough to move the blades of the **wind turbine.**

Newton's Third Law of Motion

Objects are acted upon by more than one force at a time. Newton's third law of motion describes the way different forces relate to each other.

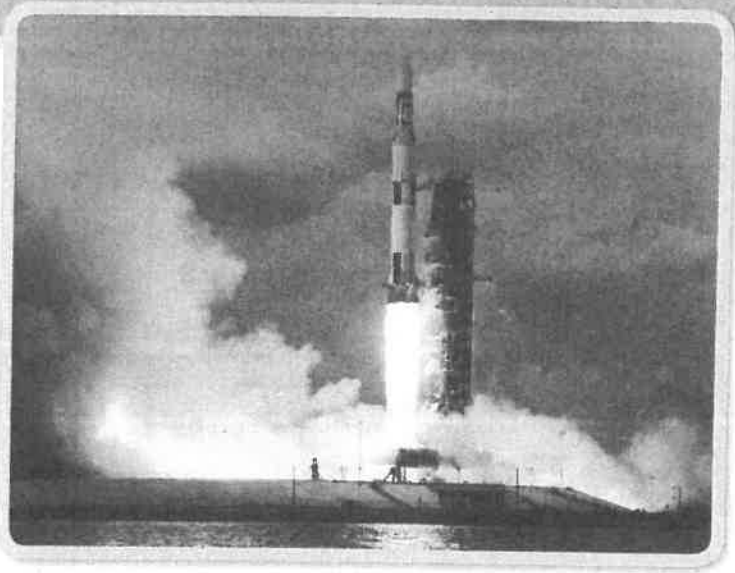
Active Reading As you read this page, underline words that identify the effect that happens when one object applies a force to another object.

Whenever one object applies a force to a second object, the second object applies an equal, opposite force to the first object. This is *Newton's third law of motion*. To say this law more simply, forces always act in pairs.



To better understand Newton's third law, picture two objects—your body and a wall. As you lean against the wall, your body applies a force to the wall. The wall doesn't move because it applies the same amount of force to you. Sometimes scientists use the terms *action force* and *reaction force* to refer to a pair of forces.

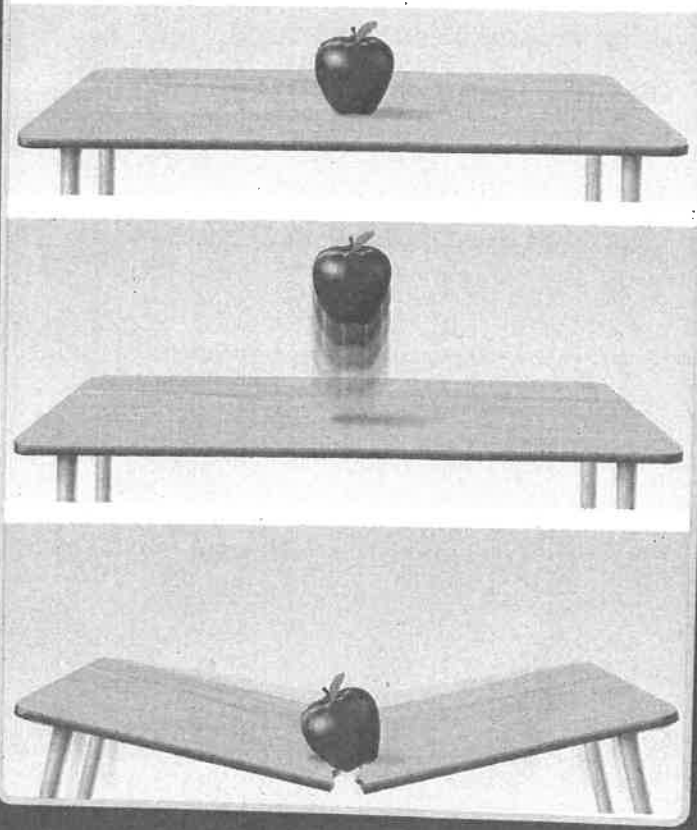
Now think about the two adjectives that Newton used to describe a pair of forces. How are action and reaction forces *equal* and *opposite*? The two forces described above are equal in size, and they are opposite in direction.



During takeoff, the rocket's thrusters push the exhaust gases downward as the gases push the rocket upward with an equal force.

Forces in Action

Look carefully at the diagrams of the apple and the table. Draw arrows to show the forces between apple and table. Make longer lines to show stronger forces.

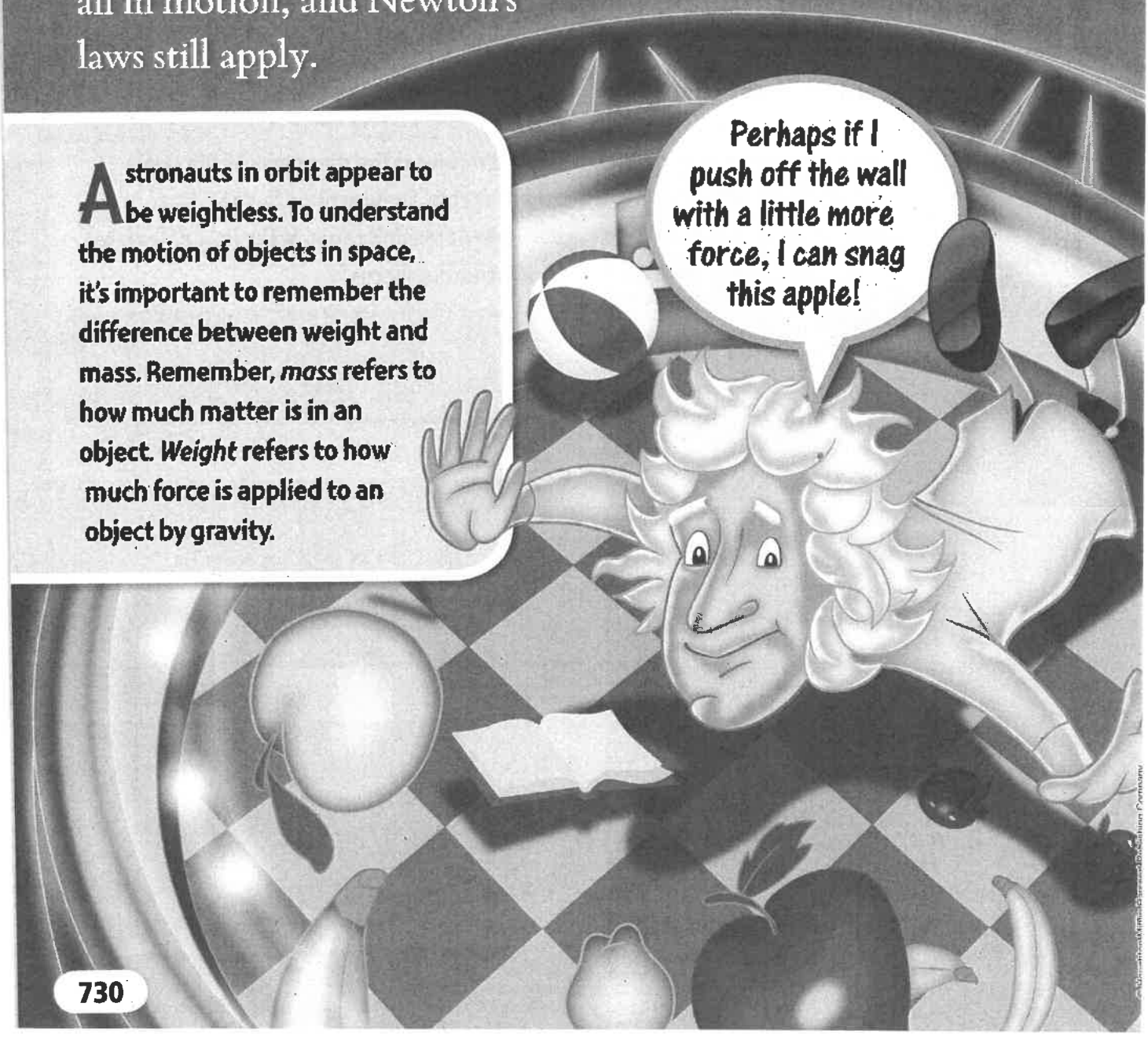


Motion in Space

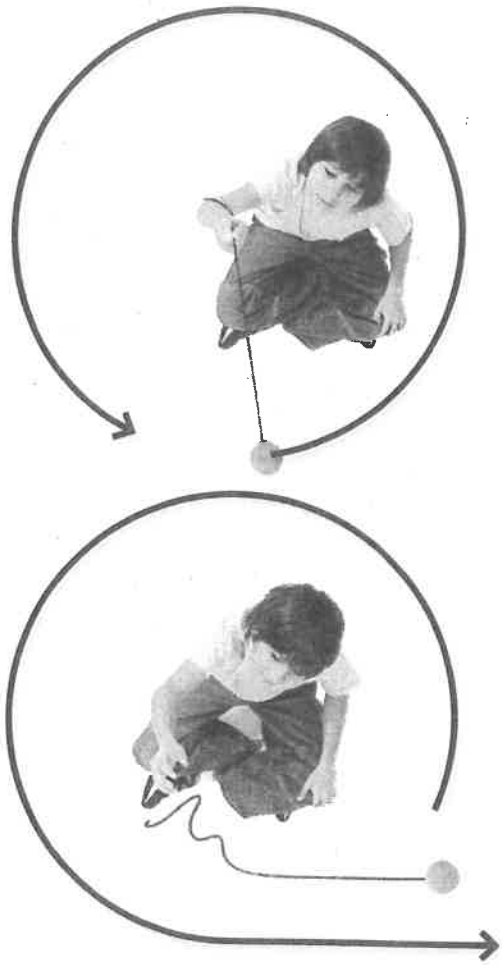
You've probably seen pictures of astronauts floating with other objects inside a spacecraft. The astronauts, the objects, and the spacecraft are all in motion, and Newton's laws still apply.

Active Reading As you read the next page, **circle** the main idea. **Underline** details that add important information about the main idea.

Astronauts in orbit appear to be weightless. To understand the motion of objects in space, it's important to remember the difference between weight and mass. Remember, *mass* refers to how much matter is in an object. *Weight* refers to how much force is applied to an object by gravity.



As a person swings an object in a circular motion, you can see an example of how objects orbit Earth. The string acts like gravity, constantly pulling the object toward the center of the circular path. If the person lets go, inertia takes over; the object keeps traveling, but in a straight line. The *International Space Station* (*ISS*) shows how Newton's first law works in space. Because of inertia, the *ISS* moves forward at a contant speed. At the same time, gravity pulls the *ISS* toward Earth, so that the *ISS* constantly changes direction. As a result of these two motions, the *ISS* follows the curve of Earth's surface. What would happen if Earth's gravity did not constantly pull on the *ISS*? Inertia would cause the station to fly off into space in a straight line!



▶ Explain what two forces are acting on Isaac Newton as he floats in the *ISS*.

Newton's laws of motion apply to objects in space, because the laws involve mass, not weight. The mass of an object is the same on Earth and in space. An object's weight can change because it is related to the force of gravity at a particular location. Astronauts feel and look weightless because of microgravity. Often mistakenly called "zero gravity," *microgravity* occurs because Earth's gravity causes the space station to fall toward Earth at a constant rate. Everything inside the space station falls at the same rate. Because the astronauts are also in free fall, they appear to float.

Sum It Up!

When you're done, use the answer key to check and revise your work.

For each of the following questions about Newton's laws of motion, circle the correct answer to complete the sentence.

1. Newton's first law states that no [acceleration / inertia] can happen without a force.
2. When a raindrop strikes a brick wall, the force the raindrop applies to the brick wall is [greater than / equal to / less than] the force the brick wall applies to the raindrop.
3. Two identical boxes are placed on the ground next to each other. One is empty, and one is filled with sand. It would take [more force / the same amount of force / less force] to pull the empty box than the box with sand.
4. When a hammer strikes a nail, the direction of the force the hammer applies to the nail is [the same as / opposite from] the direction of the force the nail applies to the hammer.
5. Two powerful forces that can overcome inertia are [mass / friction] and gravity.

Answer Key: 1. acceleration, 2. equal to, 3. less force, 4. opposite from, 5. friction, 6. microgravity

Brain Check

Lesson 4

Name _____

Word Play

1 Unscramble the scrambled words in each sentence. Write the unscrambled word after the sentence. The first one is done for you.

a. The two forces in a pair are **poseptio** in direction.	o p p o s i t e
b. An object's acceleration depends in part on the **sasm** of the object.	_ _ _ _ _
c. Newton's first law gives a good description of **etirian**.	_ _ _ _ _ _ _ _
d. In science, **neteocacrila** is a term for a change in speed or direction.	_ _ _ _ _ _ _ _ _ _ _ _ _
e. Objects do not change their motion unless some **creof** makes them change.	_ _ _ _ _
f. In space, **virmrciroygat** causes an astronaut to feel weightless.	_ _ _ _ _ _ _ _ _ _ _ _

Bonus

In a pair of forces, the first force is sometimes called an _ _ _ _ _ _ _ force, and the second force is sometimes called a _ _ _ _ _ _ _ _ _ force.

acceleration	action	force	inertia*
mass	microgravity	opposite	reaction

* Key Lesson Vocabulary

Apply Concepts

2 Look at the illustrations of two shopping carts. Circle the cart that would be harder to move. Explain why this is so.

3 Explain how a person taking a nap on a grassy meadow is an example of inertia.

4 Make three drawings to illustrate Newton's three laws of motion. Label your drawings with the name of the law and other important words.

Take It Home!

Share with your family what you have learned about Newton's laws of motion. With one or more family members, design and perform a demonstration of inertia.

10 THINGS TO KNOW ABOUT Safety Engineers

1. A safety engineer helps design and test devices to make them safer.
2. Safety engineers make changes to designs to avoid possible dangers.
3. I'm a crash test dummy. Some safety engineers use me as a model.
4. Safety engineers can make machines, such as cars, safer to use.
5. Safety engineers make cars safer with inventions such as seat belts and air bags.
6. Some safety engineers focus on stopping specific dangers, such as fires.
7. Safety engineers help society have fewer injuries and illnesses.
8. Some keep germs from spreading into our food and making us sick.
9. They may focus on protecting workers from getting hurt on the job.
10. To do their jobs, safety engineers need to study physics, chemistry, math, and human behavior.

Now You Be the Engineer!

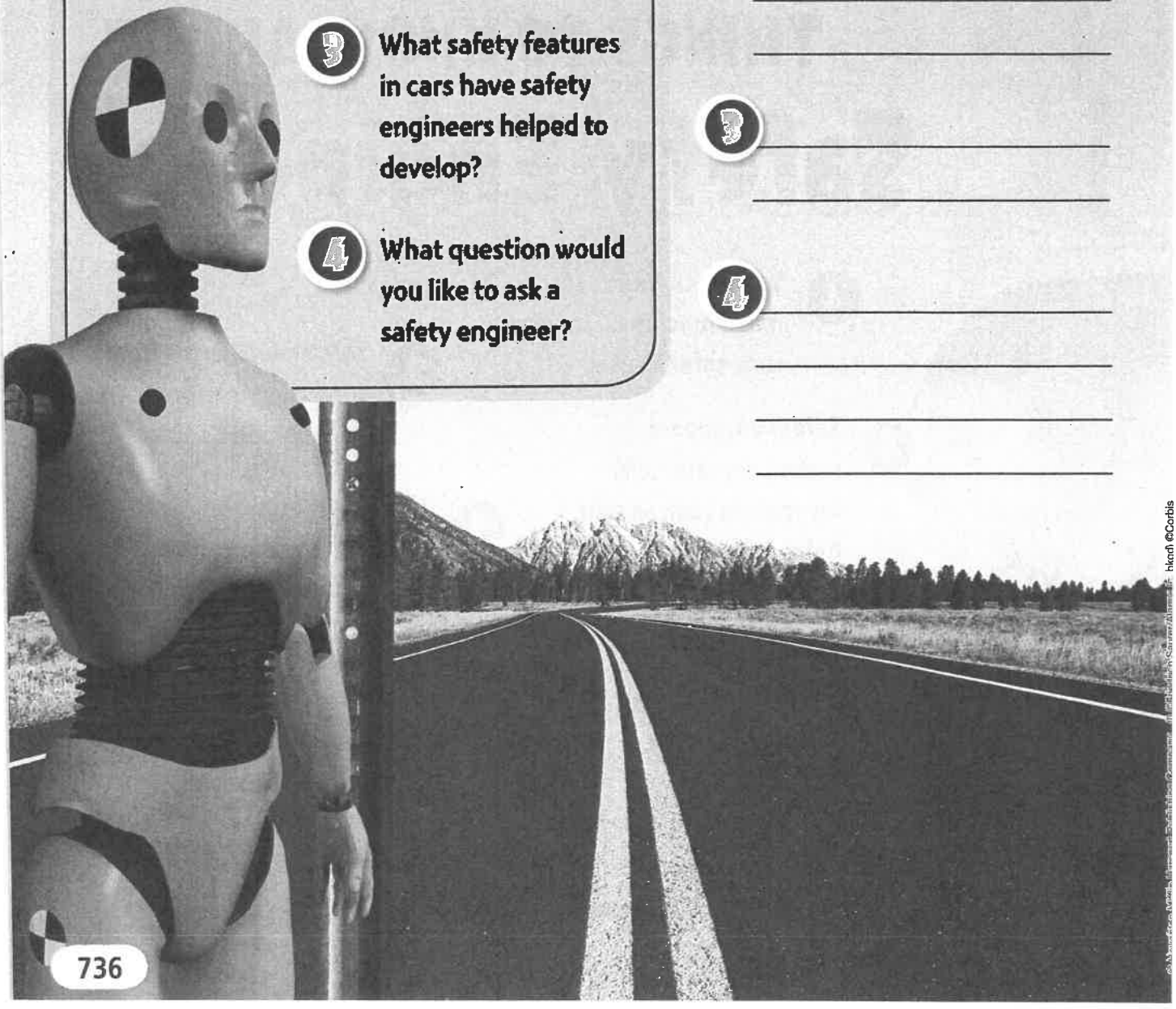
1. What do you think is the best thing about being a safety engineer?
2. How do safety engineers help society?
3. What safety features in cars have safety engineers helped to develop?
4. What question would you like to ask a safety engineer?

1 _____

2 _____

3 _____

4 _____



Inquiry Flipchart page 78

Lesson 3 INQUIRY

Name _____

Essential Question

What Are Balanced and Unbalanced Forces?

Set a Purpose

What will you learn from this investigation?

_____

_____

_____

_____

Think About the Procedure

What forces are acting on the blocks when they are sitting on the table?

_____

_____

_____

_____

Why will you pull the block across several different surfaces?

_____

_____

_____

_____

Record Your Data

Record your measurements in this table.

Forces Investigation	
Action	**Force (N)**
Lift one block	
Lift two blocks	
Lift three blocks	
Pull block on sandpaper	
Pull block on waxed paper	
Pull block on oiled paper	

Draw Conclusions

What is required to start an object moving?

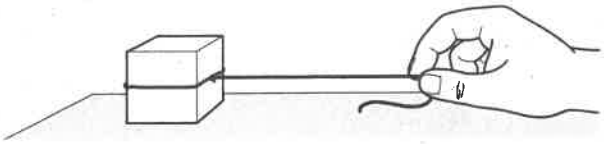
_____

_____

_____

Analyze and Extend

1. The block below is being pulled to the right. Draw arrows to show the forces acting on the object. Label each arrow.



2. At what point during this activity were the forces on the block balanced? Draw the block, and show the forces as arrows.

3. How is an object's mass related to the upward force needed to overcome the pull of gravity?

4. What forces acted on the block as you tried to pull it horizontally? Were the forces balanced or unbalanced?

5. Why did the blocks require a different force to begin moving on the three different surfaces?

6. What other questions would you like to ask about balanced and unbalanced forces? What investigations could you do to answer the questions?

Inquiry Flipchart page 77

Lesson 2 INQUIRY

Name _____

Essential Question

How Do Forces Affect Motion?

Set a Purpose

What will you learn from this experiment?

_____

_____

_____

State Your Hypothesis

Write your hypothesis, or testable statement.

_____

_____

_____

_____

_____

Think About the Procedure

Why do you use a rubber band to start the toy truck rather than your hand?

_____

_____

_____

_____

Why do you add bolts to the truck?

_____

_____

_____

_____

Record Your Data

In the table below, record the data you gathered.

How Forces Affect Motion			
Part I:	Distance rubber band was stretched		
	1 cm	3 cm	5 cm
Distance traveled (cm)			
Part II:	Rubber band stretched to 3 cm		
	Empty truck	Truck with 4 bolts	Truck with 8 bolts
Distance traveled (cm) Trial 1			
Distance traveled (cm) Trial 2			
Distance traveled (cm) Trial 3			

Draw Conclusions

Each time you changed a variable and launched the truck, you ran three trials. Calculate the average distance traveled by the truck in each experimental setting.

Experimental settings	Average distance traveled (cm)
Rubber band at 1 cm	
Rubber band at 3 cm	
Rubber band at 5 cm	
Truck with 0 bolts	
Truck with 4 bolts	
Truck with 8 bolts	

Draw two bar graphs to display your data.

Analyze and Extend

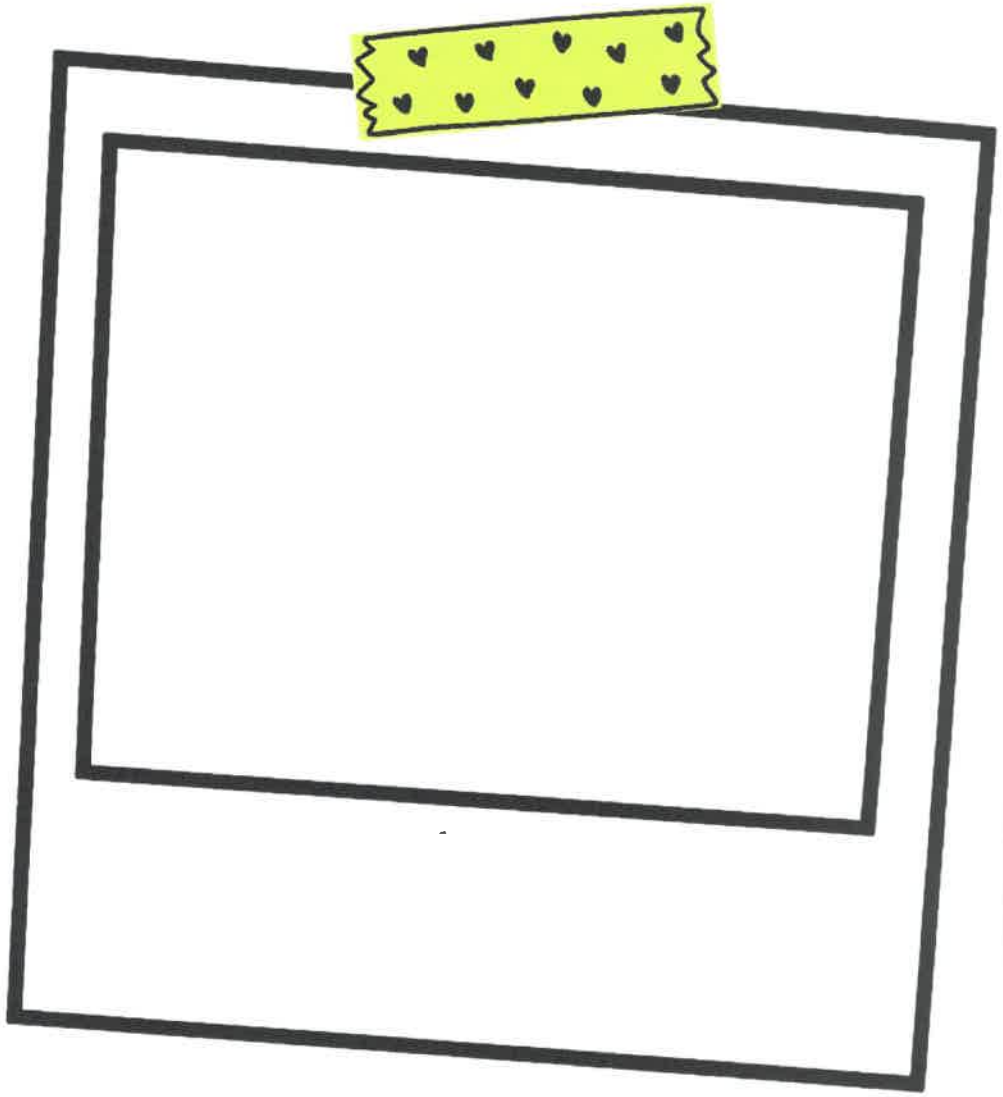
1. Interpret your data. How is an object's mass related to its change in motion when acted on by a force?

2. How does the size of the force applied to an object affect its motion?

3. Why is it important to repeat an experiment several times or to have several people perform the same experiment?

4. Write another question you could ask about using forces and motion. What experiment could you do to answer your question?

19-20



FIFTH GRADE

MEMORIES!

All About ME!

THINGS I LOVED THIS YEAR

BEST FRIENDS

HOBBIES

INTERESTS

CLASS news

BOYS VS. GIRLS

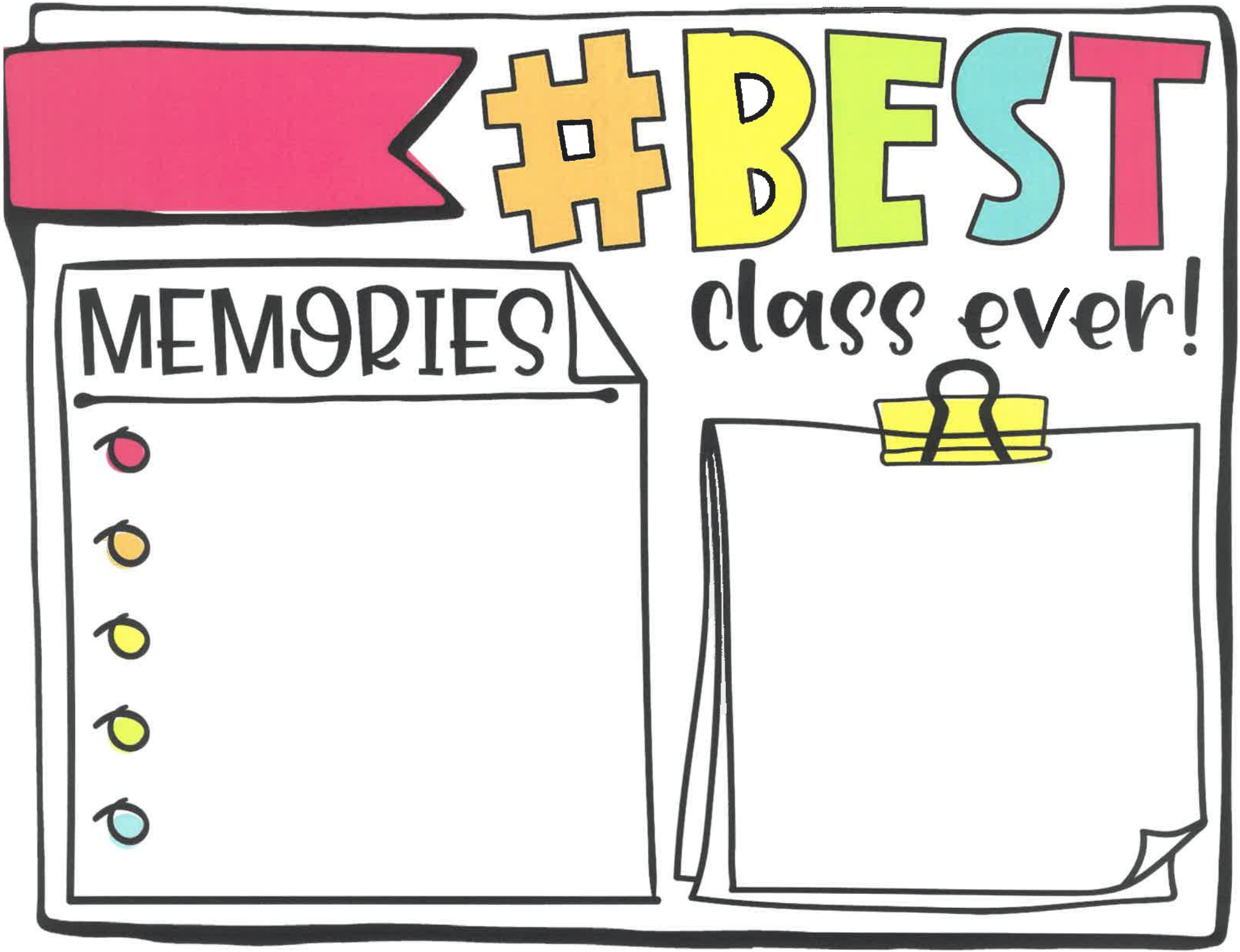
BEST THINGS ABOUT MY CLASS

OUR FAVORITE ACTIVITIES

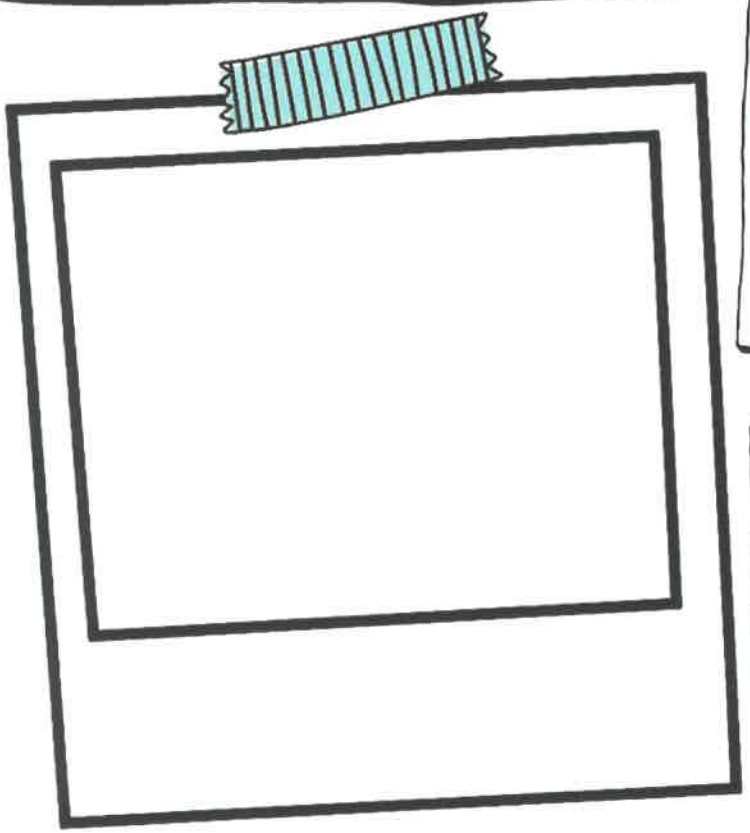
OUR STRENGTHS

OUR STRUGGLES

THE FUNNIEST THING THAT HAPPENED THIS YEAR


#BEST
MEMORIES
class ever!

STUDENT spotlight



FAVORITE SUBJECT

WHEN I GROW UP,

FAVORITE DESSERT

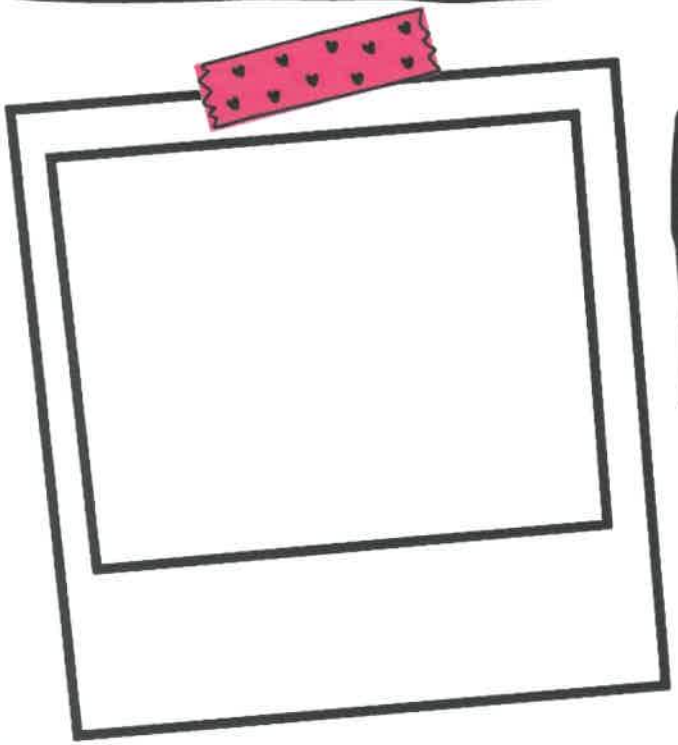
BIRTHDAY

FAVORITE MEMORY OF THE YEAR

MY HOBBIES

THINGS THAT MAKE ME HAPPY!

All About My Amazing TEACHER



I'll ALWAYS REMEMBER

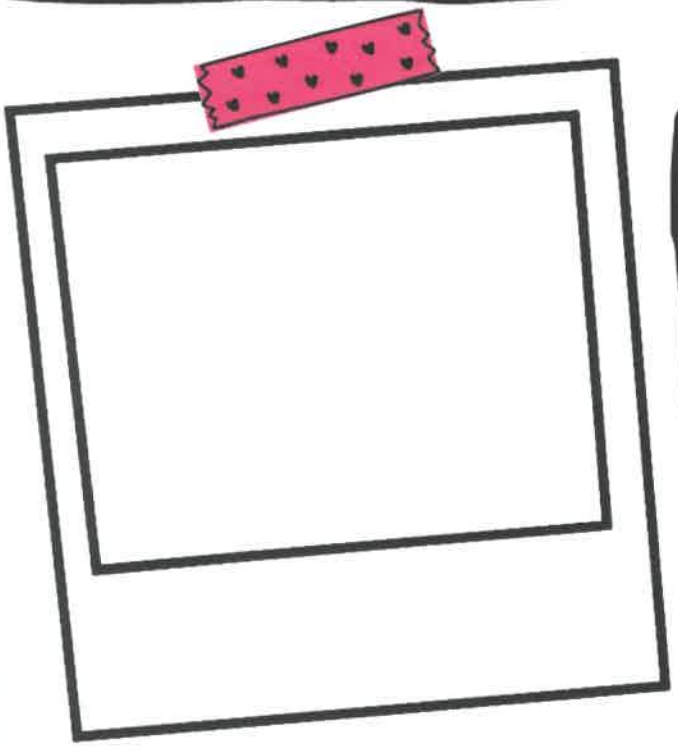
FAVORITE MEMORIES

WORDS
TO DESCRIBE MY TEACHER

- [x]
- [x]
- [x]
- [x]

I'll MISS

All About My Amazing TEACHER



I'll ALWAYS REMEMBER

FAVORITE MEMORIES

WORDS

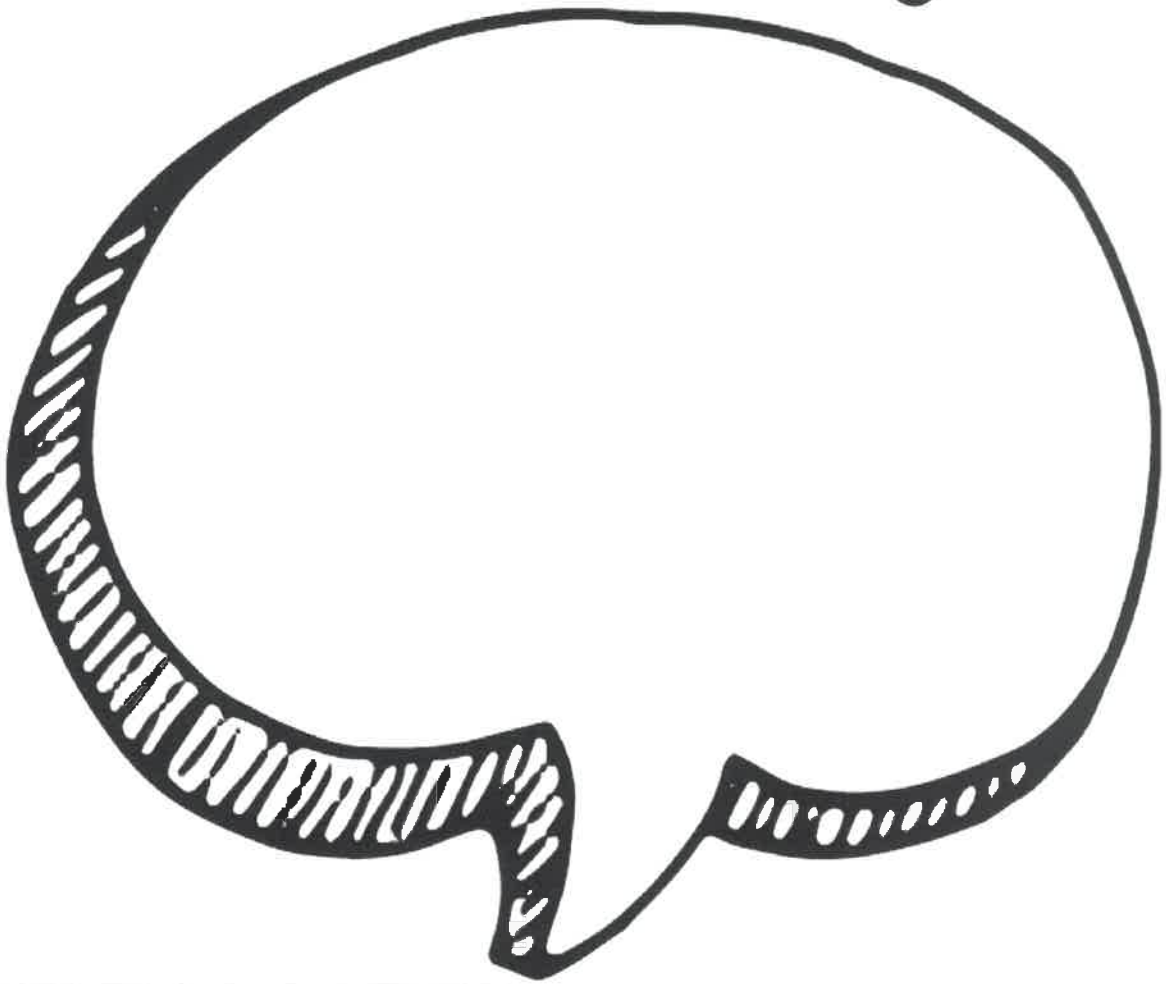
TO DESCRIBE MY TEACHER

- [x]
- [x]
- [x]
- [x]

I'll MISS

QUOTE of the year

THINGS my TEACHER ALWAYS SAYS

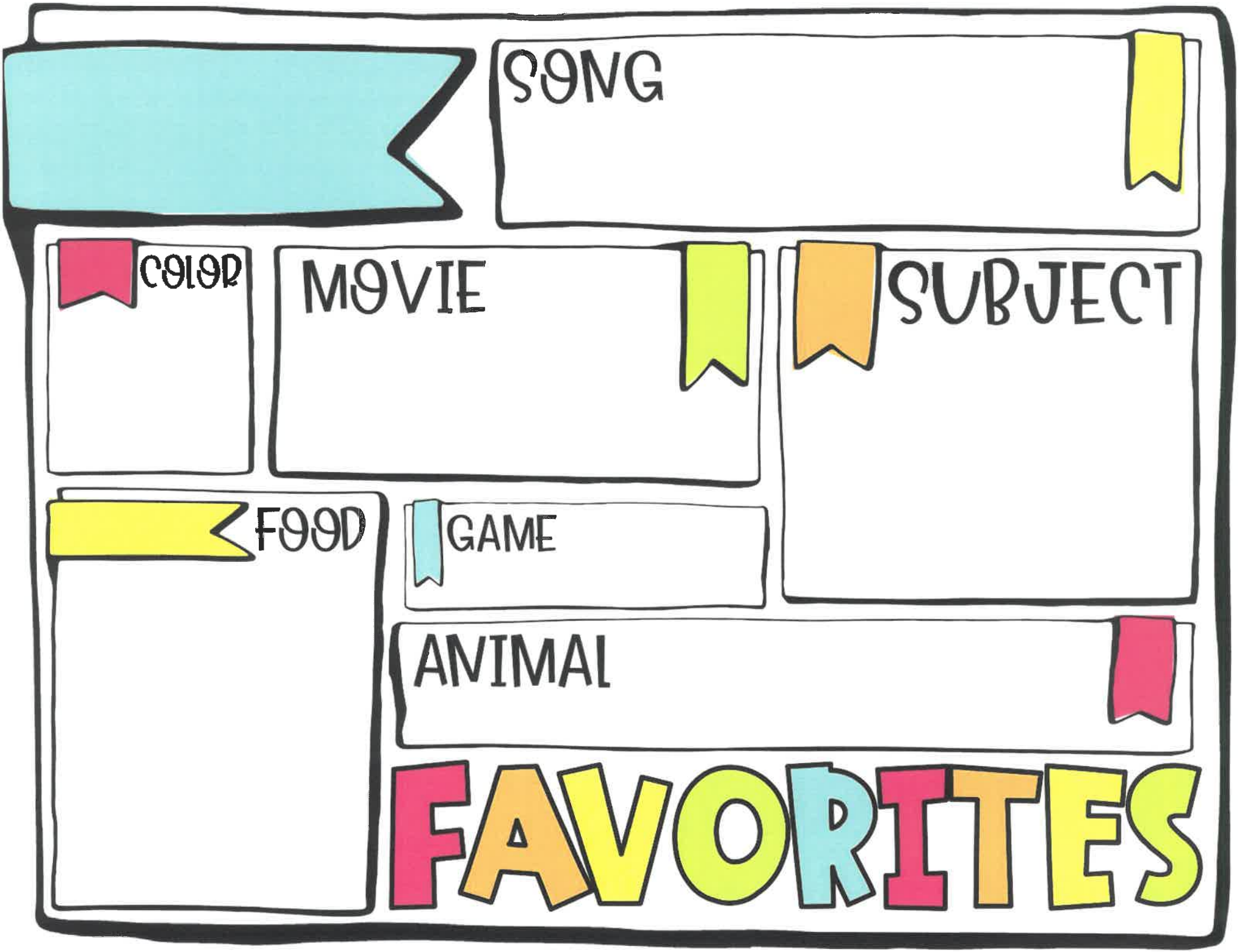


Field Trip FUN

WHERE WE WENT

BEST MEMORIES

WHAT I LEARNED

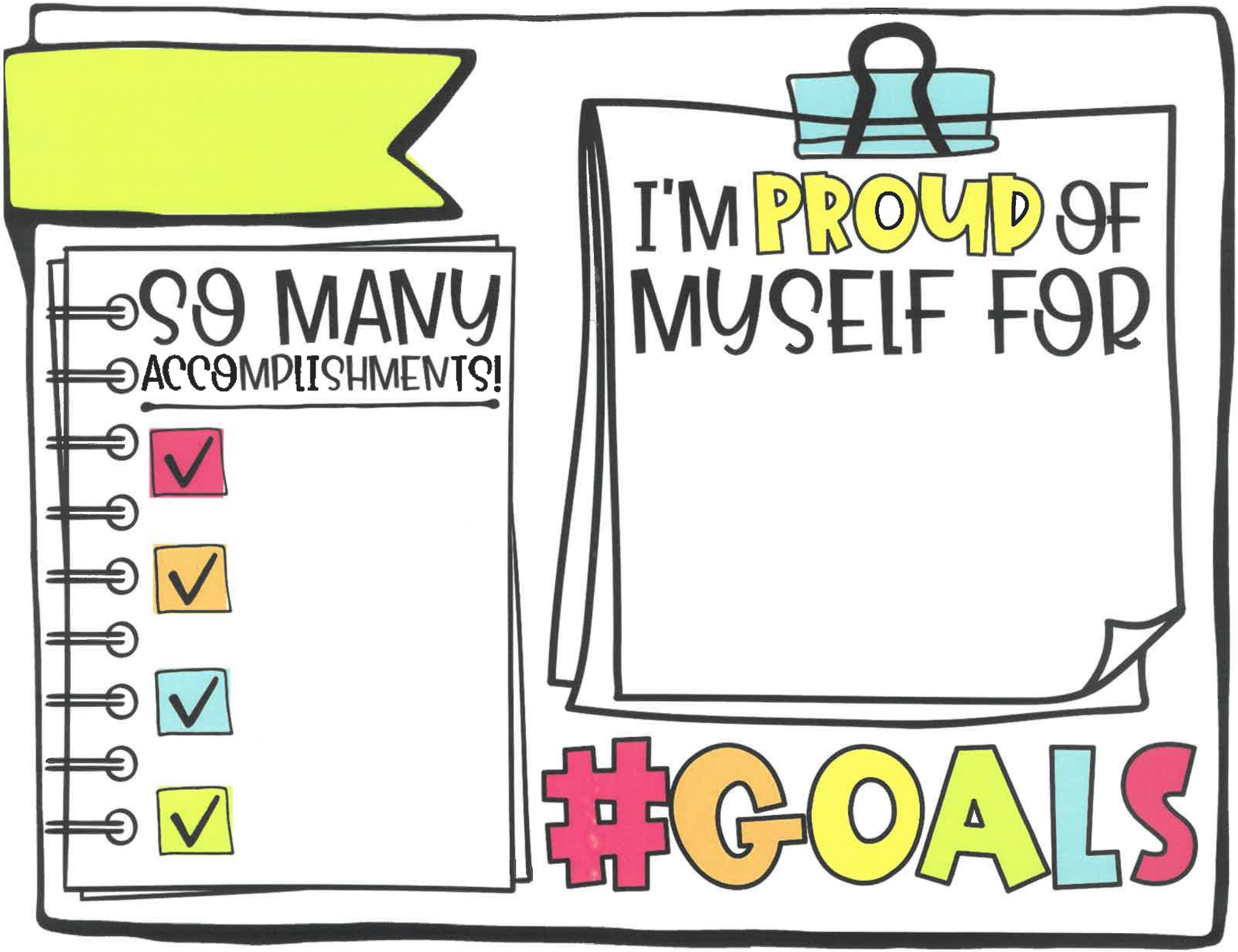

SONG
COLOR
MOVIE
SUBJECT
FOOD
GAME
ANIMAL
FAVORITES

BOOKS of the year

TOP FIVE

- [ ]
- [ ]
- [ ]
- [ ]
- [ ]

MY FAVORITE BOOK OF THE YEAR WAS


SO MANY
ACCOMPLISHMENTS!
I'M PROUD OF
MYSELF FOR
#GOALS

A typical day at SCHOOL

OUR DAILY SCHEDULE

MY MORNING ROUTINE

LUNCH

RECESS

MY FAVORITE PART OF THE DAY

All about SPECIALS

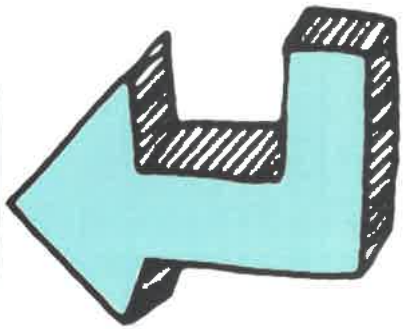
OUR SPECIALS

COOL THINGS WE DID IN SPECIALS

SOMETHING I LEARNED

I STRUGGLED TO LEARN

MY FAVORITE SPECIAL WAS



LEARNING all the things!

MY BIGGEST AHA!

In my wildest DREAMS

STEPS TO ACHIEVE MY DREAMS

NEXT YEAR, I HOPE

IN 5 YEARS, I HOPE TO

A SKILL I'D LIKE TO LEARN

IN 20 YEARS, I HOPE TO BE

A NOTE

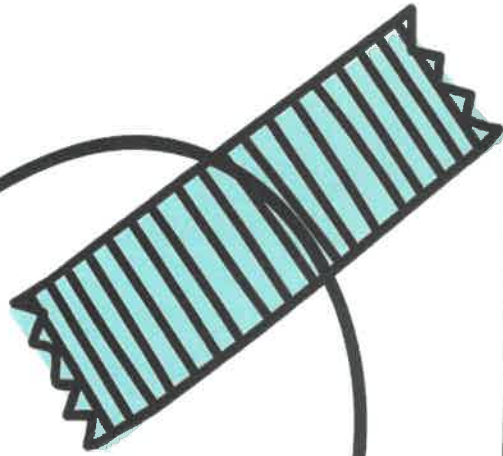
to my future self

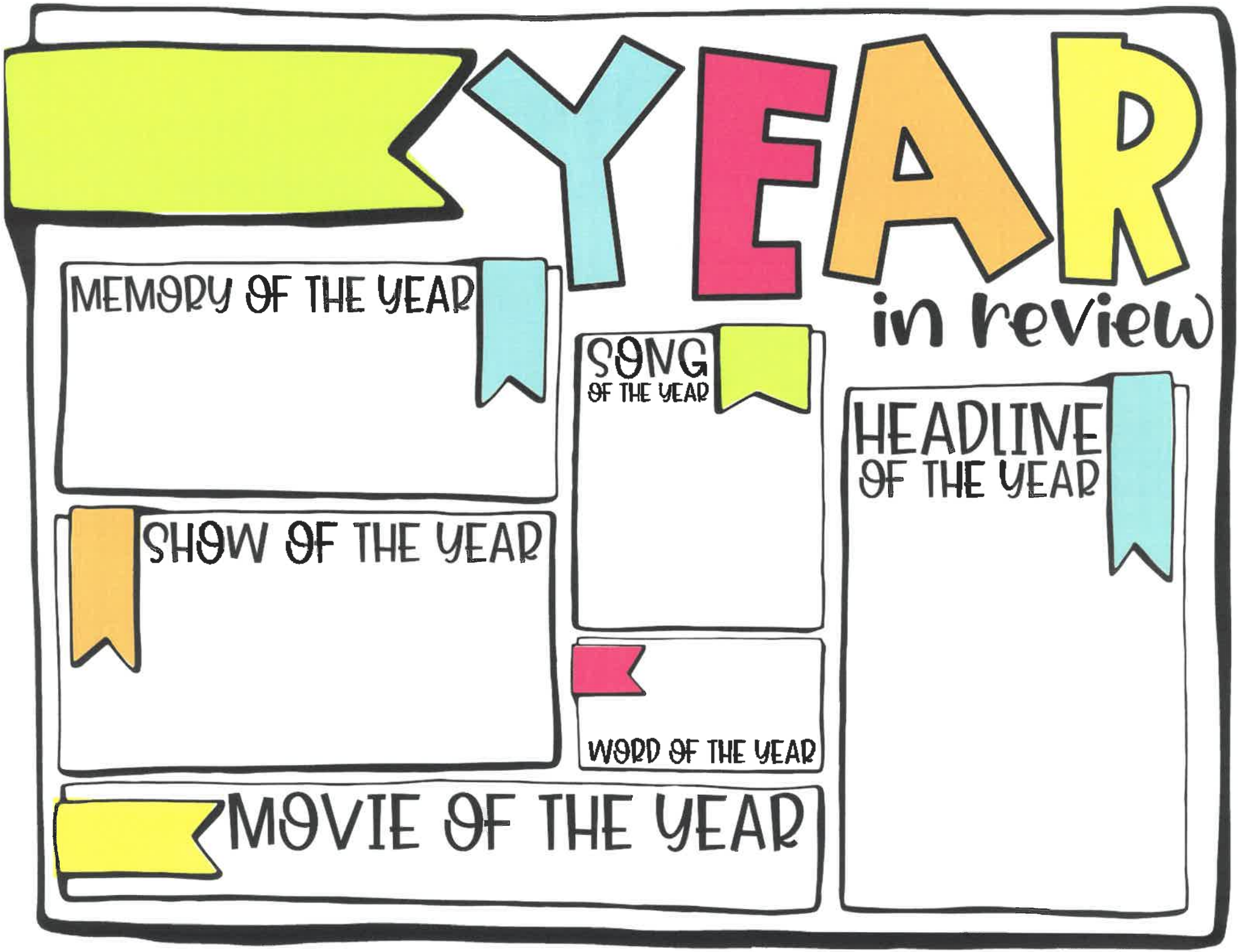
THE BEST THINGS ABOUT ME!

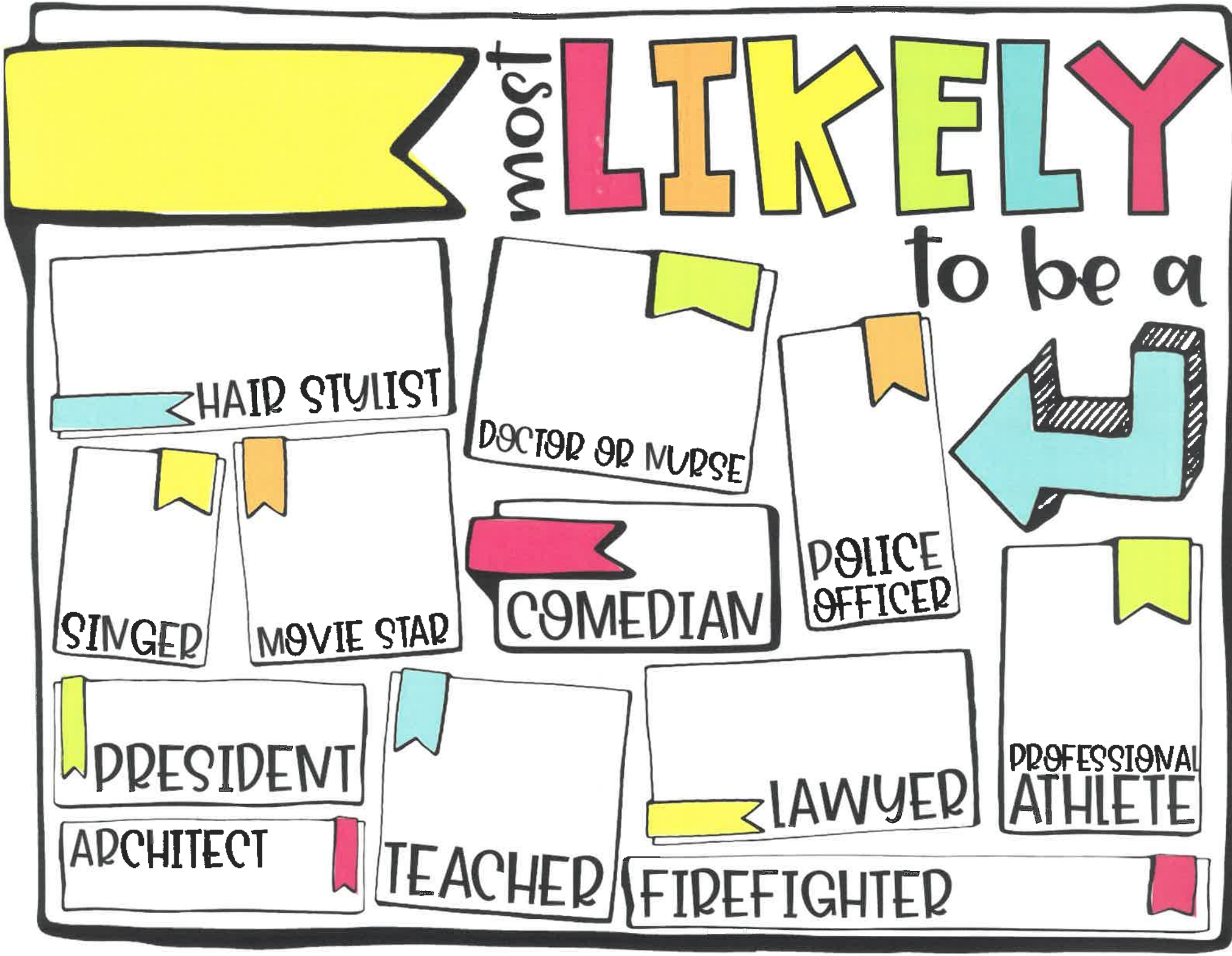
It's so hard to say GOODBYE

WHAT I'LL MISS MOST

I FEEL...




YEAR
in review
MEMORY OF THE YEAR
SONG OF THE YEAR
HEADLINE OF THE YEAR
SHOW OF THE YEAR
WORD OF THE YEAR
MOVIE OF THE YEAR


most LIKELY
to be a
HAIR STYLIST
DOCTOR OR NURSE
POLICE OFFICER
SINGER
MOVIE STAR
COMEDIAN
PRESIDENT
ARCHITECT
TEACHER
LAWYER
PROFESSIONAL ATHLETE
FIREFIGHTER

DISTANCE learning

MY STRUGGLES

MY STRENGTHS

WHAT I MISSED MOST ABOUT OUR CLASS

MY REFLECTION

LIFE in quarantine

MY CHALLENGES AT HOME

MY CHALLENGES WITH SCHOOLWORK

HOW I TRY TO PASS THE TIME

SOMETHING I HAVE LEARNED

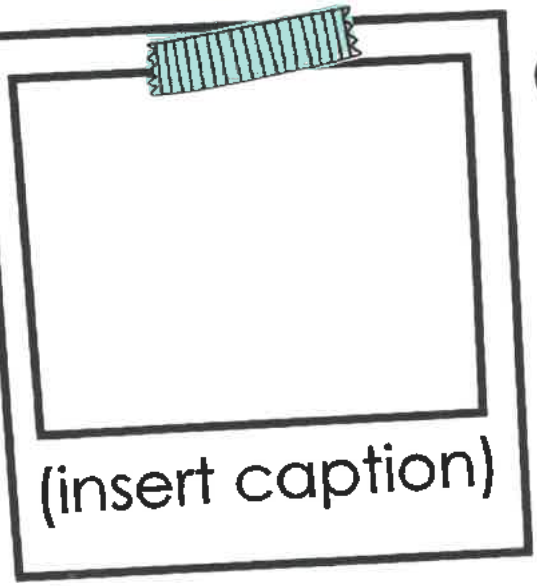
THINGS I AM GRATEFUL FOR IN QUARANTINE

POSITIVES OF QUARANTINE

SUMMER dreamin'

TO-DO

- [x]
- [x]
- [x]
- [x]



(insert caption)

IF I COULD TAKE A DREAM VACATION I WOULD GO TO

THIS SUMMER I HOPE TO