These skills will help you become a better reader. Practice them with either "Life Without Gravity" (p. 372) or "Conversational Ballgames" (p. 379).

**Reading Skill**

The main idea is the central point of a passage or text. The main idea of a paragraph is usually stated in a topic sentence that identifies the key point.

Supporting details give examples, explanations, or reasons.

When reading nonfiction, adjust your reading rate to recognize main ideas and key points.

- **Skim**, or look over the text quickly, to get a sense of the main idea before you begin reading.
- **Read closely** to learn what the main ideas are.
- **Scan**, or run your eyes over the text, to find answers to questions, to clarify, or to find supporting details.

Refer to the chart shown as you look for main ideas.

**Literary Analysis**

An expository essay is a short piece of nonfiction that explains, defines, or interprets ideas, events, or processes. The organization and presentation of information depends on the specific topic of the essay.

**Vocabulary Builder**

**Life Without Gravity**

- **spines** (spinz) n. backbones (p. 373) Sitting up straight is good for our spines.
- **feeble** (fē bēl) adj. weak; infirm (p. 374) The injured bird made a feeble attempt to fly.
- **blander** (bland’ or) adj. more tasteless (p. 374) The lack of spices in the chili made it even blander than the cornbread.

**Conversational Ballgames**

- **elaboration** (ə lab’ a rā’ shan) n. adding of more details (p. 380) His elaboration of the main idea helped me grasp his point.
- **murmuring** (mür’ mar’ in) v. making low, indistinct, continuous sounds (p. 380) My parents were murmuring in the hallway to each other.
- **parallel** (par’ ə lĕl) adv. extending in the same direction and at the same distance apart (p. 381) The train tracks ran parallel to the highway.
- **indispensable** (in’ di spen’ su bəl) adj. absolutely necessary (p. 383) Sunscreen is indispensable in the strong summer sun.
Build Understanding • Life Without Gravity

Background

Gravity and Weightlessness Here on Earth, gravity is the force that holds people and objects down and gives them weight. Beyond Earth’s atmosphere, however, gravity is weaker. This causes people and things to weigh less. For astronauts in space, the weak gravity environment affects how they eat, drink, and move. It can even affect their bones and muscles, as “Life Without Gravity” points out.

Connecting to the Literature

Reading/Writing Connection In “Life Without Gravity,” the author describes some difficult and strange experiences astronauts have as they adjust to being weightless. Write three sentences about how gravity affects your everyday life. Use at least three of these words: enable, predict, react, require, transport.

Meet the Author

Robert Zimmerman (b. 1953)

As a boy, Robert Zimmerman became fascinated with science-fiction books. They appealed to him because “the time was the early 1960s, when the first humans were going into space, and these books had an optimistic and hopeful view of that endeavor, as well as the future.”

Influence of TV Today, Zimmerman watches little television, but as a child, he remembers viewing the blastoff of Mercury, NASA’s first manned spacecraft. He recalls thinking, “This is the United States. We can do anything if we put our minds to it!”

Fast Facts

- Zimmerman spent twenty years in the movie business as a screenwriter and producer, among other jobs.
- Exploring caves is one of Zimmerman’s hobbies. He sees caving as similar to outer space exploration, because both are a hunt “for the unknown.”

Go Online

For: More about the author
Visit: www.PHSchool.com
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Life Without Gravity

Robert Zimmerman
Being weightless in space seems so exciting. Astronauts bounce about from wall to wall, flying! They float, they weave, they do somersaults and acrobatics without effort. Heavy objects can be lifted like feathers, and no one ever gets tired because nothing weighs anything. In fact, everything is fun, nothing is hard.

NOT! Since the first manned space missions in the 1960s, scientists have discovered that being weightless in space isn't just flying around like Superman. Zero gravity is alien stuff. As space tourist Dennis Tito said when he visited the international space station, "Living in space is like having a different life, living in a different world."

Worse, weightlessness can sometimes be downright unpleasant. Your body gets upset and confused. Your face puffs up, your nose gets stuffy, your back hurts, your stomach gets upset, and you throw up. If astronauts are to survive a one-year journey to Mars—the shortest possible trip to the Red Planet—they will have to learn how to deal with this weird environment.

Our bodies are adapted to Earth's gravity. Our muscles are strong in order to overcome gravity as we walk and run. Our inner ears use gravity to keep us upright. And because gravity wants to pull all our blood down into our legs, our hearts are designed to pump hard to get blood up to our brains.

In space, the much weaker gravity makes the human body change in many unexpected ways. In microgravity, your blood is rerouted, flowing from the legs, which become thin and sticklike, to the head, which swells up. The extra liquid in your head also makes you feel like you're hanging upside down or have a stuffed-up nose.

The lack of gravity causes astronauts to routinely "grow" between one and three inches taller. Their spines straighten out. The bones in the spine and the disks between them spread apart and relax.

But their bones also get thin and spongy. The body decides that if the muscles aren't going to push and pull on the bones, it doesn't need to lay down as much bone as it normally does. Astronauts who have been in space for several months can lose 10 percent or more of their bone tissue. If their bones got

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1. inner ears (in' or ir') n. internal parts of the ears that give people a sense of balance.
2. microgravity (mi' krô' grâv' i té') n. state of near-weightlessness that astronauts experience as their spacecraft orbits the earth.
much weaker, they would snap once the astronauts returned to Earth.

And their muscles get weak and flabby. Floating about in space is too easy. If astronauts don’t force themselves to exercise, their muscles become so feeble that when they return to Earth they can’t even walk.

Worst of all is how their stomachs feel. During the first few days in space, the inner ear—which gives people their sense of balance—gets confused. Many astronauts become nauseous. They lose their appetites. Many throw up. Many throw up a lot!

Weightlessness isn’t all bad, however. After about a week people usually get used to it. Their stomachs settle down. Appetites return (though astronauts always say that food tastes blander in space). The heart and spine adjust.

Then, flying around like a bird becomes fun! Rooms suddenly seem much bigger. Look around you: The space above your head is pretty useless on Earth. You can’t get up there to work, and anything you attach to the ceiling is simply something you’ll bump your head on.

In space, however, that area is useful. In fact, equipment can be installed on every inch of every wall. In weightlessness you choose to move up or down and left or right simply by pointing your head. If you turn yourself upside down, the ceiling becomes the floor.

And you can’t drop anything! As you work you can let your tools float around you. But you’d better be organized and neat. If you don’t put things back where they belong when you are finished, tying them down securely, they will float away. Air currents will then blow them into nooks and crannies, and it might take you days to find them again.

In microgravity, you have to learn new ways to eat. Don’t try pouring a bowl of cornflakes. Not only will the flakes float all over the place, the milk won’t pour. Instead, big balls of milk will form. You can drink these by taking big bites out of them, but you’d better finish them before they slam into a wall, splattering apart and covering everything with little tiny milk globules.

Vocabulary Builder

feeble (fi’ bal) adj. weak; infirm
blander (blan’ er) adj. more tasteless

A Critical Viewing

How do you think water is able to act like it does in this photograph? [Analyze]

Reading Skill

Main Idea What is the main idea in this paragraph?

374 n Types of Nonfiction: Expository, Reflective, and Persuasive
Some meals on the space station are eaten with forks and knives, but scooping food with a spoon doesn't work. If the food isn't gooey enough to stick to the spoon, it will float away.

Everyone in space drinks through a straw, since liquid simply refuses to stay in a glass. The straw has to have a clamp at one end, or else when you stop drinking, the liquid will continue to flow out, spilling everywhere.

To prevent their muscles and bones from becoming too weak for life on Earth, astronauts have to follow a boring two-hour exercise routine every single day. Imagine having to run on a treadmill for one hour in the morning and then ride an exercise bicycle another hour before dinner. As Russian astronaut Valeri Ryumin once said, “Ye-ech!”

Even after all this exercise, astronauts who spend more than two months in space are usually weak and uncomfortable when they get back to Earth. Jerry Linenger, who spent more than four months on the Russian space station, Mir\(^3\), struggled to walk after he returned. “My body felt like a 500 pound barbell,” he said. He even had trouble lifting and holding his fifteen-month-old son, John.

When Linenger went to bed that first night, his body felt like it was being smashed into the mattress. He was constantly afraid that if he moved too much, he would float away and out of control.

And yet, Linenger recovered quickly. In fact, almost two dozen astronauts have lived in space for more than six months, and four have stayed in orbit for more than a year. These men and women faced the discomforts of weightlessness and overcame them. And they all readapted to Earth gravity without problems, proving that voyages to Mars are possible . . .

Even if it feels like you are hanging upside down the whole time!

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Apply the Skills

Life Without Gravity

Thinking About the Selection

1. Respond: What do you think is the most difficult thing about living in a weightless environment?
2. (a) Recall: List three unpleasant effects of weightlessness that are explained in the essay. (b) Cause and Effect: Describe the cause of each unpleasant effect.
3. (a) Recall: What are some of the fun aspects of weightlessness? (b) Connect: What new choices does living in a weightless environment give an astronaut?
4. (a) Synthesize: If the astronauts quoted in the article were offered another trip in space, what advice would you give them about the wisdom of taking the trip again? (b) Discuss: Talk about your advice in a small group. As a group, choose three important pieces of advice to share with the class.

Reading Skill

5. What ideas did you get about the article from skimming it before you read?
6. (a) What are three key points in the article? (b) What supporting details does the author provide for each point?
7. What is the main idea of the article?

Literary Analysis

8. Explain why “Life Without Gravity” is an expository essay. Give examples from the text to support your answer.
9. Fill out a chart like the one shown to organize the information provided in the essay.

|------------------------|--------------------------|-----------------------------|----------------------|

QuickReview

Article at a Glance
The writer explores the way astronauts’ bodies are affected by the lack of gravity in space.

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Assessment
For: Self-test
Visit: www.PHSchool.com
Web Code: ema-6302

Main Idea: the most important point

Expository Essay: a short piece of nonfiction that explains, defines, or interprets ideas, events, or processes
Vocabulary Builder

Practice  Rewrite each sentence so that it includes a word from the vocabulary list on page 370 and conveys the same basic meaning.
1. I could barely hear her weak voice over the noise of the radio.
2. My cold makes this food seem less tasty.
3. If we had no bones in our backs, we would not be able to stand.

Writing
Write a brief problem-and-solution essay in which you assess the difficulties of being an astronaut in space.
- Clearly state two problems astronauts face.
- Provide step-by-step solutions to the problems.
- Support each solution with examples from the article.

For Grammar, Vocabulary, and Assessment,
see Build Language Skills, pages 386–387.

Extend Your Learning

Listening and Speaking  In a small group, prepare and deliver an oral summary of Zimmerman's expository essay.
To prepare your summary:
- Outline the main ideas and important supporting details. Note specific quotations that you want to mention.
- Use visual aids such as photographs, illustrations, or charts.
To deliver your summary:
- Speak slowly and clearly.
- Show each visual aid as you talk about the point it illustrates.
- Conclude with a statement expressing the main message.

Research and Technology  Using print and electronic sources, create a bibliography of resources about gravity and weightlessness. Working in a small group, divide the research topics and have each group create a list of resources. Then, put your lists together to make a master list. To list sources accurately, use the MLA format, which is located on page R25.