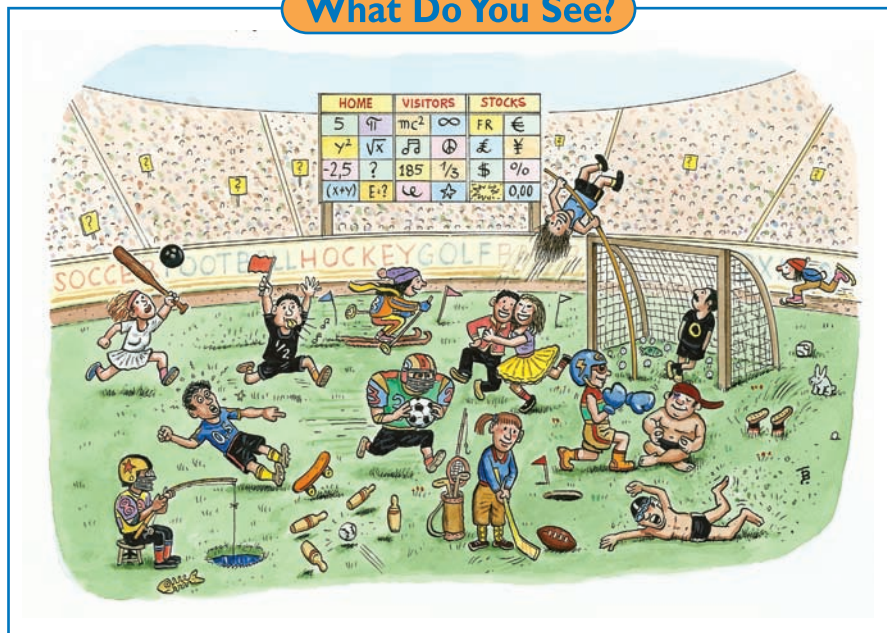




Section 1

Identifying and Classifying: What Is a Sport?

What Do You See?



Learning Outcomes

In this section, you will

- **Apply** brainstorming as a process for generating ideas.
- **Develop** a working definition of the term “sport.”

What Do You Think?

A friend comes by and asks if you want to watch some sports on TV. You turn on the set and your friend says, “That’s a movie.” You try another station and your friend complains, “That’s a soap opera.” You try a third time and your friend says, “Stop, there’s some sports.”

- How did your friend know what type of program was on after seeing the TV for only a few seconds?
- What did your friend observe on the screen that indicated that a sport was on TV?

Record your ideas about these questions in your *Active Physics* log. Be prepared to discuss your responses with your small group and the class.

Investigate

1. Brainstorm a list of at least 10 words or phrases that identify attributes, or characteristics, of activities known as sports. (Example: team involved, individual involved, and/or score kept.)

In brainstorming, all ideas are accepted and no idea is evaluated or thrown out until brainstorming has been completed. During brainstorming, it is “okay” to ask for clarification of an idea, but the discussion of ideas should not occur until later. Continue brainstorming until your group identifies 10 or more attributes of sports or the group runs out of ideas.

- a) A member of your group should volunteer to record the list of attributes of sports as the group is brainstorming them. Everyone, including the person serving as recorder, should participate in identifying attributes.
 - b) Discuss each attribute and decide on a final list of attributes that apply to many, but not necessarily all, sports. Each member of the group should copy the list in his or her notebook under the heading “Attributes Shared by Many Sports.”
2. Brainstorm a list of names of at least 15 sports (examples: baseball, rock climbing). All sports should be accepted without discussion or evaluation. Continue identifying sports until the process either “slows down” after 15 sports are named or when the length of the list of sports reaches 30. Everyone should participate.



- a) One member of your group should record the list of sports.
3. Decide which items on the list “Attributes Shared by Many Sports” apply to every one of the sports identified by the group. Consider the attributes one at a time and ask, “Does this attribute apply to every one of the sports on the list, or to only some of the sports?”
- a) Mark with an asterisk (*) those attributes that apply to every one of the sports identified by the group.
 - b) In your log, make a new list with the heading, “Attributes That Apply to All Sports.”
 - c) Discuss within your group whether any attributes that apply to all sports seem to have been left out; if the group finds any that seem appropriate or necessary, then add them to the list.
4. Define the term “sport.”
- a) Use the list “Attributes That Apply to All Sports” to construct a written definition of the term sport. Test the drafts of your definitions against the list of sports generated by the group—and other sports that may come to mind—until your group agrees upon a definition that seems to apply to all sports.
 - b) Write your group’s definition of the term “sport” in your *Active Physics* log.
 - c) New sports are often considered for inclusion in future Olympic Games. Do the following sports meet your definition of a sport?
 - karate
 - squash
 - roller sports



Physics Talk

THE LAWS OF PHYSICS

Everybody seems to recognize a sporting event when they pass by a field or see it on television. Defining the attributes of a sport can be a bit more difficult. In your group discussions on the nature of sports, you perhaps had disagreements as to which activities are sports. Is ballroom dancing a sport? Is ultimate disk throwing a sport? Is chess a sport? You have been asked to invent a sport that can be played on the Moon. Your discussion of sports from this section will aid you in developing that sport.

Trying to come up with a definition of a sport might have proven difficult, but most people would agree that a sport requires physical action. If a sport requires physical action, then it can be described by the appropriate physics – what scientists sometimes call the **laws of physics**.

The laws of physics are generalizations about relationships in the physical world based on universal and invariable observations. That means that if everywhere the observations of many people about the same event are always the same, scientists can use the observations to develop a law. Laws of physics are universal. They are true anywhere in the universe. They are also parsimonious, meaning that they are clear and concise, and they are no more complex than necessary. They follow “the simpler, the better,” principle. You have already investigated a number of laws of physics. Newton’s laws of motion are three well-known laws of physics you have studied. The law of conservation of energy is also a law with which you are familiar. The activities you see in sports can be explained using these and other laws of physics.

The laws of physics are not laws in the sense you usually think of them. They need no one to enforce them, since nature does the enforcing. If it is found that some event does not obey the laws of physics, the law of physics is amended so that the new law can explain that event as well as all the other events.

When a scientist tries to describe the action in a sport according to the laws of physics, the results may often be very complicated. A curve ball thrown by a pitcher in a baseball game, the spins, twists and turns of a diver, or the trajectory of a forward pass in football will all require complex physics to describe them adequately.



Physics Words

Laws of physics: universal and invariable observations and relations of the physical world. The laws of physics may, however, be disproved if new facts or evidence contradict them.

Checking Up

1. Explain why the laws of physics cannot be broken.
2. List two factors that would be radically different for an athlete playing a sport outdoors on the Moon when compared to Earth.

Active Physics

+Math	+Depth	+Concepts	+Exploration
	♦	♦	♦

Plus

Do Extreme Sports Require Extreme Physics?

Extreme sports take many forms, such as skydiving, hang gliding, and even “air surfing,” where participants jump out of an airplane with a snowboard strapped to their feet. Similar to hang gliding, but with a smaller wing, these “air surfers” use a snowboard to control their descent to the ground.

The physics needed to explain sports of this nature is the same physics that is investigated in *Physics in Action*. For extreme sports like air surfing, scientists looking to explain just what is occurring must look deeply into these phenomena.

Equations for air resistance, or drag, like the one below, are used to help explain the motion of these falling air surfers.

$$D = \frac{1}{2} \rho A C_p v^2$$

This expression may appear extreme to you now, but you will soon learn more about drag in *Section 9* of this chapter, which will help give you a greater understanding of physics.

Motocross, another extreme sport, where people do stunts in midair while riding “dirt” motorcycles, requires understanding the physics of conservation of angular momentum, moment of inertia, and the gyroscopic principle.



All these concepts are part of the basic vocabulary of physics. They describe the real world and are only slightly more complex than the material you are studying in this book. In the future, you will continue to learn about physics and gain a better understanding about these marvelous sports.

To a physicist, physics occurs in even more extreme ways, like ultra-high energy particles, ultra-cold temperatures, and the ultra-strong gravity of black holes. All these exciting areas of study use even more complex and fascinating areas of physics.

1. Choose an extreme sport. Research one physics concept related to the sport that you have not learned about in class. For example, if you choose snowboarding, you may wish to find out what makes snow slippery. Be prepared to present your research to the class.



What Do You Think Now?

At the beginning of the section, you were asked the following:

- How did your friend know what type of program was on after seeing the TV for only a few seconds?
- What did your friend observe on the screen that indicated that a sport was on TV?

After your investigation of what makes a sport, is it possible to come up with a definition for a sport that includes all of the activities people would identify as requirements to be a sport? Explain your answer.

Physics

Essential Questions

What does it mean?

What does brainstorming reveal about the definition of a sport?

How do you know?

What convinced you that your definition of a sport was a good one?

Why do you believe?

Connects with Other Physics Content	Fits with Big Ideas in Science	Meets Physics Requirements
Forces and motion	Well-defined terms	* Agreement on the meaning of terminology and definitions

- * Many groups considered the question of what is a sport. What convinced you that people agree or disagree on the definition of a sport?

Why should you care?

How will you convince NASA that the activity proposed by your group fits the definition of a sport?

Reflecting on the Section and the Challenge

The first item that you must address in your proposal to NASA is how your chosen sport for Moon dwellers meets the basic requirements for a sport. In order for you to convince NASA that you know what the requirements for a sport are, it seems necessary for you to include a fundamental definition of a sport as a basis of your proposal. You may wish to refine your definition later. The list of sports generated by your group during this activity is a good starting place for considering which sports could be adapted to the Moon. However, you probably need more information about the differences between Earth and the Moon before you can make a good decision about the particular sport to include in your proposal.

Physics to Go

1. You learned from this section that the term “sport” means different things to different people. Write a brief paragraph describing an occasion when someone asked you for the definition or the meaning of a term used in a conversation with you. (Example: A parent saying, “Don’t get home too late.”)
2. Look up the definition of “sport” in a dictionary. What do you think of the definition? Explain your answer. How did this definition of sport compare with the one you and your team proposed?
3. Outdoors on the Moon, astronauts must carry compressed air tanks for breathing (there is no air on the Moon). Astronauts must also wear pressurized suits. If the pressurized suit rips or the air tank malfunctions, the astronaut could die. How will this affect participation in sports played on the Moon?
4. List three sports that could be played outdoors on the Moon, taking into account the safety concerns listed in *Question 3*.
5. List three sports that could be played indoors in a stadium on the Moon.
6. Based only on what you know about the Moon so far, how would conditions on the Moon affect
 - a) the sport you like playing the most?
 - b) the sport that you like watching the most?
7. Do the following meet your definition of a sport? Explain.

a) ballroom dancing	b) chess
c) skateboarding	d) white-water canoeing
e) beach volleyball	f) weightlifting
8. *Preparing for the Chapter Challenge*

Part of the excitement of playing sports is having spectators. If the sport on the Moon is to be played on the surface, everyone (athletes and spectators) will require compressed air and pressurized suits. If a normal compressed air bottle holds enough air for 45 minutes, suggest a rules change for a softball game, since the game often lasts several hours.



Inquiring Further

Research the physics of a sport

Many books have been written about the physics of sports, and the Internet has dozens of sites devoted to the explanation of how physics describes a particular sport. Choose a sport that interests you and do an Internet search to find a site that deals with that sport. Summarize what the site says about the sport and the related physics, and give a brief report to the class.