

# SPACE GAMES

grades 5–8

## Objective

Challenge students to think about how “weightlessness” would affect the way Earth-based games would be played in space.

## Introduction

Unless you are an astronaut you have never experienced the feeling of being “weightless.” The closest thing in our experience that compares to it is being underwater. In fact, in order to train for space missions, astronauts are submerged in a large tank of water to simulate the effect of being weightless.

Once in space, astronauts must quickly acclimate themselves to a weightless environment. Weightlessness affects everything an astronaut does in space. They have to adjust the way they shower, eat, sleep, and even use the bathroom. Additionally, everything in the Space Shuttle that is not anchored in place will also float around weightlessly.

To reinforce the idea of what it means to be weightless, students should think about how microgravity would affect something like playing a typical game that we play here on Earth. If there were no gravity how would a ball bounce? How would astronauts run up and down a tennis or basketball court? How would the rules of the game be affected by weightlessness?

In this activity students will choose an Earth game like basketball or tennis to explore how these games would be affected by being weightless. A video is recommended that makes an excellent introduction to microgravity, but the activity can be done without this video. It is also recommended that the class play the game being discussed before imagining playing it in space, but this is also optional.

## Background Reading for Educators

**Gravity: It’s Universal**, available at

[http://www.amnh.org/education/resources/rfl/pdf/du\\_x05\\_gravity.pdf](http://www.amnh.org/education/resources/rfl/pdf/du_x05_gravity.pdf)

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## Recommended Materials

**Discovery Channel video: Inside the Space Station** (available in VHS or DVD format from Amazon.com for \$14.98, or from Discoverystore.com for \$14.95 VHS, \$19.95 DVD. It can also be borrowed from your local library or video store or purchased at a Discovery Channel store.)

**Basketball** (regulation ball or small foam Nerf® ball)

**Backboard and hoop** (regulation or Nerf® backboard and hoop)

## Procedure

- 1] View the Discovery Channel video on weightlessness. Have a general conversation with your class about what everyday life might be like in a microgravity environment.
- 2] Tell your students that they are going to play a game, and that while they play they should think about how it would be affected by playing in microgravity. The example described here is basketball, but you can choose any game you like, from tennis to volleyball to soccer to ping pong.  
**Ask:** How would astronauts in a space station play the same game?
- 3] Before your students begin playing the game, discuss the rules and actions involved. List the students' responses on the chalkboard.

Below is a list of several important aspects of a basketball game. If your students do not list these points, cite them before they begin playing. This list is not exhaustive, so add any other ideas your students come up with as well. Tell your students that they should think about these points as they are playing and to imagine what would happen if astronauts tried to play the game onboard a space station.

- a] The game is played by players running up and down a court.
- b] Players are not allowed to run or walk with the ball unless they are bouncing it off the floor.
- c] Players pass the ball to other players by throwing or bouncing the ball.
- d] The walls, ceiling, and the floor outside a painted rectangle are considered out-of-bounds. If the ball touches anything out of bounds, play stops and the other team takes possession of the ball.
- e] Points are scored by throwing the ball through a hoop. The ball is aimed by throwing it above the hoop so that it will drop down through it. The ball may also be bounced off a backboard through the hoop.
- f] Players perform a "jump shot" by releasing the ball after they jump into the air.
- g] Players that have a high vertical jump can "dunk" the basketball into the hoop.

- h] Taller players sometimes have an advantage when blocking shots or shooting the ball over defending players.
  - i] Players can “steal” the ball by tapping it away from another player without touching the other player’s hand.
  - j] Contact with other players is against the rules and is penalized by a referee who calls the fouls.
- 4] Take the students to the gymnasium or playground for a game of basketball; alternatively, you may prefer to play in your classroom with a small foam basketball and hoop.

- 5] When you return to the classroom, add any additional thoughts your students come up with to the list on the blackboard, or have them write their own list on an activity sheet.

**Ask:** What do your students think astronauts do for fun in a space capsule? Could astronauts play games in space the way kids play games on Earth? Can they imagine how the astronauts in the space station might play a game of basketball?

**Explain:** The space station’s activity capsule is not very large so one difference is that a basketball game would have to be played in a smaller space.

Dimensions of the international space station: 28 feet long, 14 feet wide.

Dimensions of a standard basketball court: 74 feet long, 42 feet wide.

- 6] Go through all of the points that your students listed about playing basketball on Earth, and discuss how each rule or action would change when played by astronauts in space. Write a list of their answers next to the original list on the chalkboard.

Below is a possible list of how basketball would have to be played differently in space:

- a] You could not run in the Space Station because you would float off the floor.
- b] Bouncing would change. The ball would not fall to the ground when it was released. If you pushed the ball toward the ground, it would bounce back up, but it would not fall to the floor again. It would just keep going up until it hit the ceiling, a wall, your hand, or another player. (Note: even though it would be weightless, the mass of the ball DOES matter. The amount of effort it takes to throw or catch a ball depends on its mass.)
- c] Passing the ball would not be much different, but the ball would travel in a straight line instead of dropping toward the floor. If you threw a bounce pass, you would still need to bounce the ball at the proper angle so it gets to your partner. Astronauts “pass” things to each other in space by gently pushing items toward one another. They must push things gently because while on earth objects eventually come to rest on the floor, in space they just keep bouncing around until someone grabs them.

- d] Since there is no gravity to pull things toward the floor, players would not be able to keep themselves or the ball from bouncing out of bounds or off the walls and ceiling.
  - e] Shooting the ball would be completely different. Gravity no longer pulls the ball down toward the ground, so if you tossed the ball above the rim, it would not arc in the air and fall through the hoop. It would just keep going up until it hit the ceiling. To score a basket, players would have to bounce the ball off the ceiling, or fly above the rim and throw the ball down through the hoop. It would be easy for a player to get above the rim because if they pushed off the floor, they would continue rising until they reached the ceiling, since gravity would not pull them down again.
  - f] Since players would be floating in space there would be no jump shot. Everything would be a “floating shot.”
  - g] Dunking a basketball would be the best way to score. Since you are floating you can simply float over to the backboard and push the ball down through the hoop.
  - h] Taller players would no longer have such an advantage. Since players would no longer all have their feet on the floor, they would not have to try to throw the ball over a taller player’s outstretched arms. Instead of being rooted to the ground, players would float around through the open space of the capsule.
  - i] Stealing a ball would be nearly the same. If you could get your hand on the ball and tap it out of the other person’s grasp then you could successfully steal it.
  - j] People floating through the air would have no way to stop themselves from colliding with other players. Players would find it extremely difficult to control the direction they moved in, because the slightest push would send them floating off in a different direction. They would not be able to stop themselves from bouncing off the walls, ceiling, and floor unless there was something to grab hold of.
- 7] Discuss how the rules of the game could be changed so that it could be played in space. In basketball, for instance, the rules about contact with other players might have to be changed, since there would be no way to avoid bumping into each other. Since the ball would not fall to the floor, the out-of-bounds rules would have to be changed to allow the ball to remain in play after touching these surfaces.
- 8] As an optional follow-up activity to do in class or at home, ask each student to write similar lists for a game of their own choosing, and have them suggest ways the rules could be changed to play the game in space.