

GRADE 12: PHYSICAL SCIENCE

Benchmark D:

Forces and Motion

5: Use and apply the laws of motion to analyze, describe, and predict the effects of forces on the motion of objects mathematically.

PROCEDURE:

In discussion before viewing *Virtual Reality: Physics*, the teacher may consider engaging students in discussion on any of the following topics:

- Virtual reality environments can be manipulated to obey/defy the laws of physics.
- In virtual reality, an astronaut hopping on the Moon can be used to demonstrate Newton's 1st Law of Motion.
- It is possible to truly feel like you are walking on the Moon with virtual reality environments.

In discussion after viewing *Virtual Reality: Physics*, the teacher may have a follow-up discussion on the same topics discussed before viewing the video.

BEFORE VIEWING:

Have each student complete the "Before Viewing" column on the Agree-Disagree Chart.

WHILE VIEWING:

Students make notes about their impressions of how physics concepts can be used when working with virtual reality software and environments.

AFTER VIEWING:

Have students complete the "After Viewing" column on the Agree-Disagree Chart. Discuss the changes in their answers.

DIRECTIONS:

Mark whether you agree or disagree with each statement in the left column before viewing the video. After viewing the video, identify whether you agree or disagree with each statement in the right column. Discuss each statement as a group.

<i>Before Viewing</i>	<i>Statement</i>	<i>After Viewing</i>
Agree Disagree	In a 3D game simulation for learning about a NASA career in engineering or science, it's important for the gameplay to be as much like the real world as possible.	Agree Disagree
Agree Disagree	If an astronaut jumps on the Moon in an upwards direction, he or she will keep moving in that direction at the same speed until they experience another force such as gravity.	Agree Disagree
Agree Disagree	Using the laws of physics to model a virtual reality environment helps the learner experience "being there" on the Moon.	Agree Disagree

PROCEDURE:

Distribute the pre and post-viewing guide on the following page to provide focused viewing for students while watching the *STEM Career Lab* video, *Virtual Reality: Physics*.

Before viewing the video, instruct students to read and respond to the "What I Already Know" column of the *Virtual Reality: Physics Viewing Guide*. Let students know it's okay if they do not know all of the answers. Play the *Virtual Reality: Physics* video and instruct students to now fill out the "What I Learned" column. After playing the video, use the guide to facilitate a post-viewing discussion with students.

1. Gravity is a force because objects feel it as a pull.
2. A walker on the Moon feels one-sixth the gravitational force of a walker on Earth.
3. "An object in motion will stay in motion..."
4. An astronaut hopping on the Moon in an upwards direction will keep moving in that direction at the same speed until they experience another force such as gravity.
5. Forces cause acceleration, as shown by the equation $f=ma$ (Force equals mass times acceleration).
6. On the Moon, a hopper is typically off the surface for 1.5 seconds.
7. NASA wants their game to be as scientifically accurate as possible so it has the highest realism for the players.

	<i>What I Already Know</i>	<i>What I Learned</i>
1. Why is gravity a force?		
2. How does the force of gravity felt by a walker on the Moon compare to the force on Earth?		
3. What does Newton's First Law of Motion predict about objects in motion?		
4. What does Newton's First Law of Motion predict about an astronaut hopping on the Moon?		
5. What does Newton's Second Law of Motion predict about objects in motion?		
6. If a hopper on Earth is typically off the ground for 1/4 second, how long would they stay off the surface on the Moon?		
7. Why does NASA care about making a game as scientifically accurate as possible?		