The Force of Gravity

Summary

The activities in this lesson will allow students to observe and analyze the forces of gravity.

Main Core Tie

Science - 3rd Grade

Standard 4 Objective 2

Materials

It's An Uphill Battle

Pipe insulator (cut in half lengthwise)
Marble
2 chairs

- It's an Uphill Battle data recording sheet (pdf)

Ball Throwing

Tennis ball

- Throwing Balls overhead transparency (pdf)

Additional Resources

Books

- *3rd grade Elementary CORE Academy Handbook*
  (2003); ISBN 1-890563-78-1
- *Looking Inside Sports Aerodynamics (X-Ray Vision)*
  , by Ron Schultz; ISBN 0753453487
- *Experiments with Gravity (True Books)*
  , by Salvatore Tocci, Robert Gardner, Nancy R. Vargus; ISBN 051629348
- *The Science Book of Gravity*
  , by Neil Ardley; ISBN 0385253877

Videos

- *Roller Coaster*
  ! (1993, WGBH Educational Foundation)
- *Lift-Off to Learning*
  , Space Basics, NASA, 21:00

Laser disc

- *Windows on Science, Primary Vol. 3*
  , Force and Motion, Lesson 11

Background for Teachers

If you throw a ball into the air, the force you exert pushes the ball forward and/or up. The ball continues to move in that direction until the effect of gravity becomes stronger than the force of your throw. Gravity pulls the ball downward toward Earth.

Intended Learning Outcomes

1. Use Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interests
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Instructional Procedures

Invitation to Learn

Bicycle Ride Pantomime

Tell the students they are going to pretend to go on a bike ride and they need to listen carefully as you describe the terrain and respond appropriately.

"It is a nice spring day--great for a bike ride. You put on your helmet and pull your bike to the end of the driveway. You carefully climb onto your bike. After looking both ways, you start pedaling and turn right onto the road. The road is nice and flat for awhile. Now, you are approaching a small hill. To get to the top you have to push a little harder and faster on your pedals. The road levels off and then disappears. You suspect that the road goes downhill. You are correct. It is a long gentle slope. As you go down the hill, you can coast instead of pedal. You turn right at the bottom of the hill where the road flattens out. A nice steady even pedaling keeps you going at a constant speed. You spot a steep ravine up ahead. As you approach, you sigh before starting downhill. You have to apply the brakes to prevent yourself from going too fast. As soon as you reach the bottom, you start to climb uphill. It is so steep; you have to pedal really hard and fast. Once on top, you stop to catch your breath. The flat terrain is inviting. You pedal along at a steady speed. You turn left at the corner and continue your steady pedaling until you reach your friend's house. You turn left into their driveway, stop, get off your bike, lean your bike against the wall, and take off your helmet."

What would you tell your friend about your bike ride and the effect of gravity as you went up and down the hills?

Instructional Procedures

It's An Uphill Battle

1. Place the chairs approximately 24" apart.
2. Place the pipe insulator between the two chairs, forming a "U" and extending 36" off the floor at both ends. Tape the pipe onto the chairs.
3. Explain to the students that you are going to release a marble from various starting points. Have the students predict how far up on the other side the marble will roll.
4. Place the marble on the pipe insulator 30" from the floor and release it.
5. Observe how far up the other side the marble traveled. Record your observations on the *It's an Uphill Battle* data recording sheet.
6. Repeat steps four and five from a height of 24", 18", 12" and 6".
7. Analyze the results.

Relate this activity to the Roller Coaster activity.

Ball Throwing

1. Display the *Throwing Balls* overhead transparency showing three scenarios of a thrown ball. Have students predict which scenario is correct.
2. Watch the video: *Lift-Off to Learning, Space Basics*
3. Go outside and have the students experiment throwing a ball. Instruct the students to observe and analyze the forces acting on the ball and the results of those forces.
4. Have the students discuss and analyze the overhead transparency pictures again and reach a conclusion of what happens to a ball that is thrown in the air.

Extensions

Writing

Have the students select and research an amusement park ride of their choice. Write a report detailing when, where, why, how, and by whom the ride was invented. The student may also include technological advances in the ride since its original invention. Include what forces are involved.

Music

Sing Gravity (pdf).

Family Connections

Play Ball

Play a game with family that requires a ball. Instruct students to discuss the effect of forward momentum and gravity on the ball.

Family Bike Ride

Go on a family bike ride. Discuss how it requires more force to go up a hill than down a hill.

Amusement Park

Design (and construct) an amusement park ride at home with the help of family. Bring the ride to school and set up a class amusement park.

Assessment Plan

It's an Uphill Battle

- Did the student accurately fill in the information on his/her data recording sheet?
- Can the student explain (written or orally) why the ball does not travel up as far on the opposite side compared to the spot from which it was released? This may be illustrated and explained in his/her science journal.

Ball Throwing

- Students draw a diagram of what happens when a ball is thrown in their science journals. Label the forces and direction of the forces acting upon the ball.

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