

Follow-up Discussion

The most important part of this segment is to examine both the facts and beliefs generated by the class in their "Everything We Know About..." list. Research indicates that students will retain their previous misconceptions — in preference to the new information — until they actively recognize and correct their own errors. Because of this, it is important to lead students to the correct ideas while identifying and correcting any misconceptions from the class list. After reviewing the list, encourage students to share the answers they got to the questions raised before viewing the program.

Raising a thought-provoking question is a good way to assess the overall depth of understanding. A couple of suggestions are listed below:

1. Explain how friction is a necessary force that helps shape our world.
2. Talk about how life would be different without the force of magnetism.
3. Discuss the saying, "What goes up must come down."

Follow-up Activities

- Give each student a plastic cup half-filled with water and a drinking straw. Ask them to suck some water into the straw and cover the straw quickly with their fingers. Ask the students to try to explain the forces involved in doing this. Are forces balanced when the water is in the straw? Next, have the students lift their finger off the straw and explain what happens. (The pushing force of the air is called air pressure and this is what got into the top of the straw, and the water can flow out because of gravity.)
- Have your class create a two column list of examples of pushes and pulls that affect their lives. See how long the list can grow.
- After a discussion about which types of vehicles are the fastest, have the class indicate and explain what features of boats, cars and planes make them fast or slow.

Internet Resources

Periodically, Internet Resources are updated on our Web site at www.libraryvideo.com

- kids.earth.nasa.gov/archive/air_pressure/index.html
This NASA Web site describes the force of air pressure and contains hands-on lessons designed for students to complete.

- www.life.uiuc.edu/boast1/lesson_kits/magnets/magnets.html
This University of Illinois BOAST Web site lists a number of lessons on magnetism that address local and national standards for grades 1-6.
- <http://spaceplace.jpl.nasa.gov>
This Web site contains lessons and activities designed for students from kindergarten through grade 5.

Suggested Print Resources

- Cobb, Vicki. *Why Doesn't the Earth Fall Up?* Dutton Children's Books, New York, NY; 1989.
- Gibson, Gary. *Pushing and Pulling.* Millbrook Press, Brookfield, CT; 1996.
- Hewitt, Sally. *Forces Around Us.* Children's Press, Danbury, CT; 1998.
- Taylor, Beverly. *Teaching Physics With Toys: Activities for Grades K-9.* Blue Ridge Summit, PA; 1995.

TEACHER'S GUIDE CONSULTANT

Conrad M. Follmer

25 years as a K-5 Science & Math Coordinator for a Pennsylvania public school system, currently an independent consultant to elementary schools.

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All About Forces & Gravity

Grades K-4

This guide is a supplement, designed for educators to use when presenting this program in an instructional setting.

Before Viewing: Research in learning suggests that it is important for the teacher to discover what the students know — or think they know — about a topic, at the start of a new unit, so that their accurate conceptions can be validated and reinforced, and their misconceptions identified and corrected. Therefore, after reviewing the pre-viewing discussion questions provided for your class, create a "Everything We Know About..." list. Preview key vocabulary words and have students raise additional questions they hope will be answered by this program. Most importantly, students should be told that as "science detectives" they must listen closely, so that after viewing the program, they will be able to tell whether or not the facts/beliefs they put on their list were scientifically accurate.

After Viewing: After a brief discussion about the program, challenge your "science detectives" to prove or disprove the accuracy of the facts they put on their "Everything We Know About..." list. Discuss what else they learned and use the follow-up questions and activities to inspire further discussion. Encourage students to research the topic further with the Internet and reading resources provided.



Program Summary

Everything in our world is shaped by balanced and unbalanced forces. A force is anything that pushes or pulls an object. Every time something moves, it is because of unbalanced forces. When forces acting on something are balanced, there is no change in movement. Examples of pushing and pulling forces are football players pushing against each other, trucks pulling in opposite directions and a baseball bat hitting a ball.

There are many different kinds of forces in the world. The force of friction is one that resists motion and acts whenever two things are in contact with each other. This is demonstrated by a potter who uses friction to push and pull on the surface of clay in order to shape a pot. Without friction, it would not be possible to walk, run, or even pet a puppy.

Gravity is the natural force that pulls everything down to the Earth. In the 1600's, Sir Isaac Newton, an English scientist, wondered why things always fell to the ground and never up or sideways. As one of the first people to investigate gravity, he explained that things near the Earth fall to the ground unless another force holds them up.

Magnetism is another force that shapes our world. Some things can be pulled towards a magnet; this is called attraction. When a magnet pushes away another magnet, we see repulsion. The attraction and repulsion of magnetism is a force that can be seen when playing with magnets and can be used to generate electricity to power many things in our world.

Other forces at work all around us include water and air pressure. The weight of the water above scuba divers is a force that increases as they dive deeper. The force of air pressure is stronger at sea level than on top of a mountain because the weight of the air is constantly pushing on everything; the higher up you go, the less air is pushing down on you. People can use air pressure to counteract the force of gravity and actually slow down something that is falling. An investigation with paper parachutes shows how air resistance overcomes the force of gravity. The more air resistance, the slower things fall. In an activity like parasailing, the many forces that are pushing and pulling must be controlled in order to have a safe, enjoyable ride.

Vocabulary

The following words are included for teacher reference or for use with students. They are listed in the order in which they appear in the show.

force — A push or a pull on an object, causing a change in motion.

friction — The force that opposes movement between objects that are touching.

gravity — The fundamental force of attraction between all objects. The more mass an object has, the greater the force of its gravity.

Sir Isaac Newton — (1642 - 1727) English scientist who studied gravity and other forces, and is considered the founder of physical science.

magnetism — A force which pulls on things made of iron and some other metals, and attracts or repels other magnets.

water pressure — The force of water pushing on every surface with which it comes in contact. Water pressure increases with depth because there are more water molecules pushing on objects near the bottom of a body of water than objects close to the surface.

air pressure — The force of the air pushing on all things on Earth. Air pressure decreases with altitude because there are less air molecules pressing down from above.

air resistance — The force that slows down objects as they move through the air.

balanced forces — When opposing forces push or pull equally on an object with no change in motion.

unbalanced forces — When forces pull or push on an object unequally, causing movement of the object.

Pre-viewing Discussion

Before students generate their list of "Everything We Know About..." this topic, stimulate and focus their thinking by raising these questions so that their list will better reflect the key ideas in this show:

1. What causes some things to move and some things to stay still?
2. Why is friction important?
3. How does gravity affect our world?

After the class has completed their "Everything We Know About..." list, and before watching the show, ask them what other questions they have that they hope will be answered during this program. Have students listen closely to learn if everything on their class list is accurate and to hear if any of their own questions are answered.

Focus Questions

You may wish to ask your class the following questions to assess their comprehension of key points presented in the program:

1. What is a force?
2. What is an example of a pulling force?
3. What is an example of a pushing force?
4. How do forces cause objects to move?
5. What is friction?
6. How is the force of friction used to make a pot on the potter's wheel?
7. Why is the force of friction needed for people to walk or run?
8. What is gravity?
9. What caused Sir Isaac Newton to begin his study of gravity?
10. What would happen to objects on Earth if gravity did not exist?
11. How does gravity function as a push or a pull?
12. What is the force of magnetism?
13. How does magnetism function as a push or a pull?
14. What type of energy can be created by using the force of giant magnets?
15. What is water pressure?
16. Why is there greater water pressure on a scuba diver who is deeper under water than another diver?
17. How are the two forces of water pressure and air pressure alike?
18. Is there less air pressure on top of a mountain or at the seashore? Why?
19. What is air resistance?
20. What force can be felt when your hand is held out of the window of a moving car?
21. In the investigation, how did the size of the parachutes affect the force of air resistance?
22. What forces are present when someone is parasailing?
23. What are balanced forces?
24. What are unbalanced forces?