Follow-up Activities

- Divide the class into groups of two and give each group a small rubber ball and two drinking straws. Tell one student to blow on the ball through the straw and record how far the ball moves. Have the other student blow from the opposite side and record the movement. Then have them blow at the same time and record their observations.
- Demonstrate the power of momentum with a stuffed animal seated in a toy dump truck. Push the truck quickly towards a heavy textbook placed near it. Have students observe what happens to the stuffed animal when the truck is stopped suddenly by the book. Lead a discussion on the use of safety belts in cars.
- Have students use coins and balance scales or a number balance beam to investigate different ways of balancing the scales. Have students relate these experiences to different configurations on the playground teeter-totter (e.g. 2 on one side, balanced by 1 on the other).
- Investigate balancing by having students try to balance on one foot. Use meter sticks or rulers with extra weight attached to one end and challenge the children to balance them on their fingers. Create mobiles with hangers, string and small items of different weights.

Internet Resources

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

- **www.vickicobb.com/earthfallup.html**
  This site contains great information from a children's science author about motion and balance.
- **www.sci.mus.mn.us/sln/tf/b/balance/balance.html**
  This page from the Thinking Fountain site contains instructions for a project that demonstrates balance and motion.
- **www.exploratorium.edu/sports/ball_bounces/ballbounces2.html**
  This page from the San Francisco Exploratorium site explains the science behind bouncing balls.

TEACHER'S GUIDE

Suggested Print Resources

- Cobb, Vicki. *Why Doesn't the Earth Fall Up?: And Other Not Such Dumb Questions About Motion.* Lodestar Books, New York, NY; 1989.
- Riley, Peter. *Forces and Movement (Straightforward Science).* Franklin Watts, New York, NY; 1998.
- Trumbauer, Lisa. *Balance and Motion.* Newbridge, New York, NY; 1997.
- Trumbauer, Lisa. *Forces and Motion.* Newbridge, New York, NY; 1998.

TEACHER'S GUIDE CONSULTANT

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TITLES

- **ALL ABOUT ELECTRICITY**
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TEACHER'S GUIDE

Physical Science for Children™

All About Motion & Balance

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 an "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.

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Program Summary

With the Earth spinning through space, everything on it is constantly in motion. The way we can tell if things near us are in motion is to compare them to other things nearby. If you are traveling in a car, for example, things outside the car seem to be rushing past you, while anyone in the car does not appear to be moving. But why do things start moving in the first place? The answer is forces. A force is a push or a pull. When an object is at rest, the forces acting on it are balanced. When a push or a pull moves an object, the forces are unbalanced.

Gravity is one of the forces that pulls on everything. Throw a ball into the air and eventually gravity pulls it down again. Friction is another important force to consider when thinking about motion. It is a force that works to stop motion. Whenever things are touching, the force of friction is at work. Even when you are skating across slippery ice, the contact between the blade of the skate and the ice eventually slows you to a stop. That's why you have to keep pushing to keep moving!

When all forces are balanced, as in a game of tug-of-war with evenly matched teams, there is no motion. However, when the balance of forces is upset by adding more children to one team, there is motion toward the stronger team. Have you ever tried balancing yourself while walking on a narrow surface? If you can get your center of gravity — the spot in your body where all the weight balances — over your feet, you will succeed. Bicycle riding is all about balance and motion, too. It is hard to get going because you are fighting the forces of gravity and friction, trying to get your body and the bike into balance. Once you get moving, however, staying balanced and in motion becomes easier. When things are in motion, they stay in motion unless something stops them. The heavier an object is, or the faster the motion of an object is, the harder it is to stop. That is because of the object's momentum. It is harder to stop a bowling ball than a golf ball rolling at the same speed because the bowling ball has more momentum. When a car crashes into something, its motion stops suddenly; however, the people inside the car keep moving forward because of their momentum. Car seats, safety belts and air bags were all invented to help stop the momentum of people safely.

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.

motion — A change in the speed or position of an object relative to the things around them.

(Continued)

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

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

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

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

center of gravity — The imaginary spot where the weight of an object balances, such as the center point of a see-saw.

momentum — The mass of an object times its speed; the greater the momentum of an object, the harder it is to slow it down.

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. Are we moving when we sit quietly at our desks?
2. How do objects move?
3. How do you stop a moving object?
4. What would you expect to happen when things are in balance?

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. How can we be moving when we are standing still?
2. What is motion?
3. What are forces?
4. How do forces cause motion?
5. What is balance?
6. What are some of the forces involved in motion and balance?
7. What is momentum?
8. What is an example of motion caused by a pushing force?
9. What is an example of motion caused by a pulling force?

(Continued)

10. When you roll a bowling ball down the alley toward the pins, is that a push or a pull? Explain.
11. What is the force of gravity?
12. Give examples of how gravity pulls on things.
13. What is the force of friction?
14. When you roll a toy car across the floor, why does it stop, even if it doesn't bump into something?
15. Give examples of how friction slows or stops things in your life.
16. When equally strong teams pull hard in a tug-of-war, why is there no motion?
17. What force helped the team that was standing on the pavement, rather than on the slippery grass?
18. Why is it more difficult to keep your balance on a bicycle when you first start pedaling than after you get moving?
19. What is momentum? Give an example of something with a lot of momentum.
20. Why does it take longer to stop your bike when you are moving fast than when you are moving slowly?
21. How do automobile air bags and seat belts protect us?
22. Can you explain how a rocket launch is an example that proves the idea that action in one direction causes an equal reaction in the opposite direction?

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. Discuss the forces that are acting on a box of cereal that is sitting on a kitchen table. Are they balanced or unbalanced forces? Explain.
2. Discuss the fact that the Earth is always moving. Can anything on it ever be still?