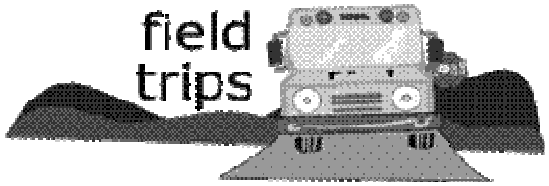



# K-2 Force & Motion TEACHER GUIDE

## How to Use your Field Trip Guide

Field Trip Guides provide structure and suggestions on a particular theme within COSI's exhibition areas. This will allow you, your students and your chaperones to be prepared to explore science and discover fun. We suggest you begin by selecting goals for your visit. These goals may include enhancing aspects of your science curriculum, understanding what it means to be a scientist, or showing your students that science learning can be cool and fun! If you have particular curriculum goals, use this Field Trip Guide to connect what you are doing in your classroom with our pre- or post visit activities. We recommend making copies of the Scavenger Hunt for each of your chaperones, so that they can guide the students through the exhibits and help record information. Our Scavenger Hunts are designed to be open-ended, and focus on process skills and scientific thinking. As a result, there may not be one right answer for each of the questions. This means you will NOT find an answer key for any of the scavenger hunts. Instead, you'll find descriptions the science concepts that we hope you'll experience. If you feel you need more clarification, you can always contact us at fieldtrips@mail.cosi.org.

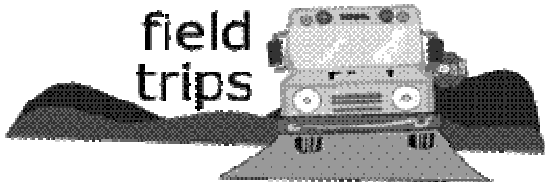
COSI is a big place. As a result, you may not see everything in one day. Take your time- don't rush, and allow your students to explore the things that they find interesting. All too often kids are pulled away to the next area just as they start to get involved in an experience. Rather than trying to see it everything, select just a few areas to spend your day. You will see less, but you will learn more.

## COSI Exhibits related to Force & Motion

COSI is a great place to learn about force and motion. Below are descriptions of exhibits related to force and motion. Push, pull, shove, roll and fly your way into science with these cool experiences. You will find them in Gadgets, Ocean, Big Science Park, Space, and the hallways. You may want to consider making a reservation for one of the following experiences to enhance your explorations of force & motion. All shows require 3 weeks advance notice.

The Gadgets LIVE Show – This dynamic demonstration includes potential and kinetic energy, force and motion, and explosions! Caution: Science can be LOUD! Reservation for up to 200 people at select times.

The Gadgets Café – Your group can spend some time in the Gadgets Café taking stuff apart or trying out our science menu. Reservations available for groups of 6 or less.




# K-2 Force & Motion TEACHER GUIDE

## BIG SCIENCE PARK

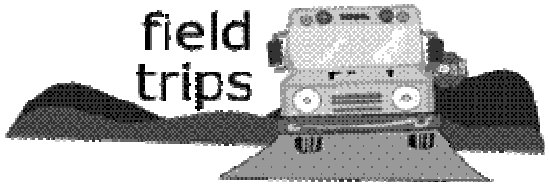
*Big Science Park* is strictly Big Fun for your head and body as big experiments await your exploration. Big Science Park fosters the spirit of learning by putting you into the experiments, so you become a part of the science. As in all of the exhibition areas, there is no food, drink, or smoking in Big Science Park. Some great exhibits for your students to explore include:

- The Centripetal Generotor will allow you and your students to feel *inertia, friction, gravity, and centripetal force* in action. As the 'Rotor spins, your body is forced against the walls, so when the floor drops below you, your body remains suspended. Young children can focus on the idea of gravity, and a push or pull. This is experience is open weather permitting. Certain restrictions apply.
- The Granite Sphere- Are you strong enough to move a 2,500-pound object? Give the granite sphere a push and see how reducing friction can make things easier to move. The inch of water under the sphere allows for the sphere to roll easily than it would if it were in contact with the ground.

## OCEAN

Poseidon's realm takes two forms in this unique learning environment. On one side of the exhibition, Poseidon reigns majestic over a mythical playground, symbolizing the ancient means for understanding the sea. Here, you can explore the physical nature of water through laminar streams, eroding sand, and other activities, and at the same time being totally immersed in a theatrical recreation of the ocean's power. On the other side of Ocean, Poseidon is the namesake of an undersea research habitat, revealing the modern means for understanding the sea. Based on real ocean exploration technology, the "D.S.B. Poseidon" uses submersibles sonar to explore the scientific side of Ocean. Caution: It is likely that your students will get wet. Encourage them to take care not to get others wet in the process. Exhibits include:

- Erosion Table - As water is pulled by gravity to lower levels, it exerts a force of change upon the surface on which it travels. This force of change is called erosion. Where does the sand go? Where is sand washed away faster? Slower? Why? What ideas do you have to stop the flow of water? What do you think will happen when the water is blocked? (Make and share predictions.)
- Ball Fountains - Four plumes of waters allow guests to "defy gravity" by balancing balls in the air. Notice that the ball spins as the water hits it. This spinning adds to the speed of the water flowing with the spin and slows the water flowing against the spin.
- Floor Fountains - Look for water popping up from the floor. The water is pushed up by pumps, and gravity pulls the drops back down.

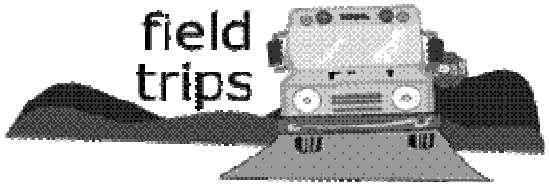



# K-2 Force & Motion TEACHER GUIDE

## GADGETS

Admired for their ability to change how we do things, gadgets are tangible proof of how creativity advances technology. The Gadgets exhibition area contains a variety of exhibits that allow guests to explore the building blocks of more complex gadgets: pulleys, gears, lasers, and electric circuits. Guests can examine the inner workings of everyday gadgets by taking them apart in the Gadgets Café. The café is an inventor's paradise that offers the tools necessary to investigate the gadgets we use daily. Force and motion exhibits include:

- Pulley Chairs - An example of a simple machine that makes life easier. Each chair has a different number of pulleys, so you can try them all and feel the difference. If there are more pulleys, you expend less effort.
- Air Cannon - Have some fun with the Air Cannon in the back of Gadgets. Toss a ball in and turn the handle to launch. Air from the compressor will push the ball. Try two or five or ten balls. What happens?
- Flying Propellers -Control the speed of the flying propellers, causing them to rise, fall, or hover on a pole that reaches the ceiling. The faster the propeller spins, the more air it pushes down, causing lift.
- Newton's Nozzles - Balance a ball inside a path of airflow. Air is pushing up on a ball. Since the ball is curved, the air travels over top of the ball. This action holds the ball in place. This is an excellent demonstration of Newton's third law: for every action there is an equal and opposite reaction.




# K-2 Force & Motion TEACHER GUIDE

## SPACE

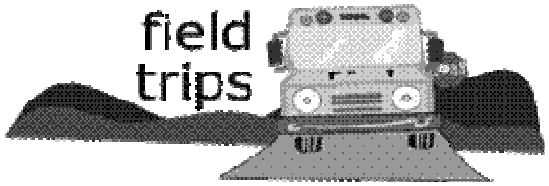
How big is the universe? What drives humanity to the stars? These are questions that have piqued the curiosity of many, and whose answers change as we gain more information about the universe. *Space* offers opportunities to think about these questions while at the same time relive some of history's great space explorations. Enter the exhibit through the Black Hole, a cool spinning sensory experience, or sit in the Living Room and watch the history of space travel. Please ask students to use caution in the tunnel.

Thrusters- All three of Newton's Laws can be applied to the science of the rocket. By pushing the lever that controls the thruster, you are forcing air out of the end of the thruster. This air pushes against the air in the room, moving it forward. Friction between the thruster and the air helps slow it down.

Rocket Launch- The rocket launch exhibit invites guests to "fuel up" a rocket by charging a projectile with compressed air. Rockets go because of Newton's Third Law: For every action there is an equal and opposite reaction. Spent fuel escapes the rocket through a hole called the nozzle. This is the action. The rocket moves away from the spent fuel, in effect pushing against it. This is the reaction.

Figure-8 – Toss a ball into the vortex and watch the pattern of the ball. Gravity pulls the ball down, friction slows it, and inertia keeps it going. Try tossing the ball in different ways. Ultimately, you'll want the ball to follow a Figure 8 pattern.

Balance Beam- Find a balance of *forces* on the Balance Beam. What do you need to do to stay level?




# K-2 Force & Motion TEACHER GUIDE

## Vocabulary Words

These are some Force & Motion terms that you should be familiar with as you explore COSI with your students:

| | | | |
|---|---|---|---|
| UP | DOWN | LEFT | RIGHT |
| PUSH | PULL | SPIN | ROLL |
| GO | STOP | FLY | FALL |
| FAST | SLOW | STRAIGHT | CURVE |

**Process Skills** are the actions that it takes to "do science." These are some of the scientific process skills that your students will be using as they explore the exhibits at COSI.

Observe - Use your senses to gather information.
Measure- Use tools and numbers to quantify objects or phenomena.
Categorize - Place objects into groups based on similarities or differences.
Communicate - Use words, pictures, graphs and diagrams to share your ideas.
Investigate - Follow a scientific method to formulate questions, conduct an experiment.
Apply - put the information you've gathered to use.
Infer – Make an assumption based on your observations.
Question – Wonder and ask about things and find ways to discover answers.
Predict - Decide what will happen in the future based on your observations.

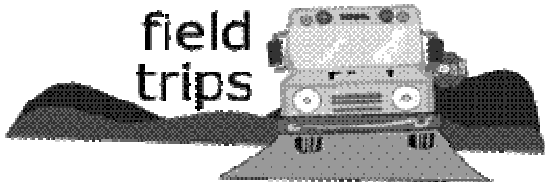
## Standards:

Grade K: Physical Science

4. Explore that things can be made to move in many different ways such as straight, zig-zag, up and down, round and round, back and forth or fast and slow.
5. Investigate ways to change how something is moving.

Grade 1: Physical Science

6. Investigate a variety of ways to make things move and what causes them to change speed, direction and/or stop.




# K-2 Force & Motion TEACHER GUIDE

## Classroom Connections

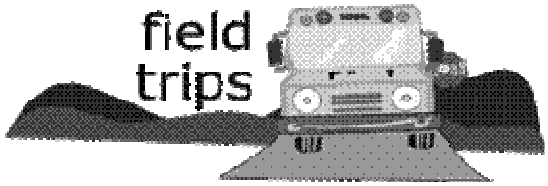
Your visit to COSI should not a one day event, soon to be forgotten. Help your students make connections between the classroom lessons and your field trip by doing activities related to your visit. Before your visit, review the vocabulary words that the students will encounter, and brainstorm things they already know about technology or COSI in general. Give them descriptions of each of the areas and some of your expectations. If possible, review with the chaperones, so they know what to expect. After your visit, have your students draw pictures or write letters of stories about their experience, and list questions they still have that you could explore together.

Below are some lessons that you can use as pre-visit or post-visit activities to help connect your field trip to your classroom experiences and extend your students' learning. Consider doing one activity every day for a week before your visit.

### FALLING FASTER

**Objective**: Understand that all objects will fall at the same rate, but that air will slow things down.
**Materials:** paper
**Procedure:**

1. As a demonstration, hold two different objects, a flat sheet and a crumpled sheet of paper, up over your head. Ask your students which will hit the ground first when you drop them.
2. Listen to responses and explanations, and then drop both objects. What happened? Where their predictions correct?
3. Next, tell students that you will toss both objects up into the air. What will happen? Will they keep going? What if you throw it straight out? Up and out? Down? Have students predict where each will land.
4. Give each student a sheet of paper, and ask them to explore how fast, how slow, or how far they can make it move.




# K-2 Force & Motion TEACHER GUIDE

## RAMP RACERS

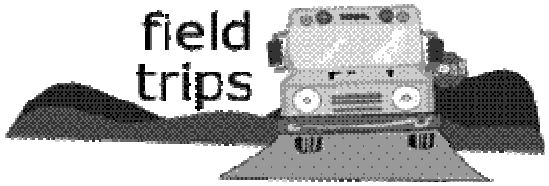
**Objective:** Begin to understand FRICTION and GRAVITY.
**Materials:** Hot wheels or other toy cars, angled surface (ramp) paper, sandpaper, or other textured surfaces.
**Procedure:**

1. Create a ramp using a plank of wood or other flat surface. It should be just steep enough to pull the car down the hill.
2. Give each small group of students a toy car. Ask them to set the car on the floor and see what happens. Is it moving? Why not? What does it take to make it move? (a push)
3. Take the cars and move them to the top of the ramp. Now do they move? What make them move? (a pull from gravity)
4. Allow them time to roll their cars down the ramp and describe what they see.
5. Ask the students to describe the surface of the ramp, and then introduce new surface materials (rough sand paper, smooth wax paper, etc). As a group, they should vote on which surface to try out next.
6. Test the cars on smooth and rough surfaces, and describe any differences. If possible, cover half the ramp with rough and half with smooth, and compare.
7. Friction happens when two things rub together. Friction slows things down. Where is there friction in this experiment? What is the friction doing to the cars? How can you make less friction?

## WORDS in MOTION, MOTION in WORDS

**Objective:** Use language and fine arts to understand science concepts.
**Materials:** paper and crayons
**Procedure:**

1. Ask students to remind you about the things that move from a push or move from a pull.
2. Have each student draw and color a picture of something that falls, flies, or otherwise gets a push or a pull. Some ideas include cars, planes, raindrops, or baseballs. Put all of the pictures together in a big motion collage.
3. Have students write and color some motion words like PUSH, PULL, SPIN, or FLY, and add these words to the artwork.
4. Read some of the stories described in the Resource section of this teachers guide.




# K-2 Force & Motion TEACHER GUIDE

## WHAT GOES UP . .

**Objective:** Demonstrate that what goes up must come down.
**Materials:** Wide open space or room with high ceilings, balls or other toys.

**Procedure:**

1. Have your students stand in a big circle, with you in the center.

2. Have everyone stand on one foot. Now stand on no feet. Can they do it? Why not? Because gravity is pulling them back down to the ground.

3. Bring out a playground ball, and ask what gravity will do to the ball when you throw it up in the air. What are other ways to make the ball move. Toss it back and forth around the circle, and ask students to make the ball move in different ways. Ask them to shout out the kind of movement with each toss (push, bounce, spin, etc). How many different ways could they make it move?

## GETTING READY . . .

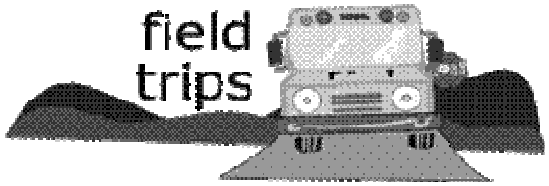
Objective: Prepare students for their day at COSI.

Procedure:

1. Ask your students if they have been to COSI before. For those that have, find out some of their favorite things, and write these on the board.

2. Ask students to tell you some of the things that they have learned over the past week about force & motion. Review directional words like PUSH, PULL, UP, DOWN, and technical words like gravity and friction. Tell them that when they are at COSI they should look for examples of each of these words.

3. Review the safety rules and code of conduct, and answer any questions that they have.




# K-2 Force & Motion TEACHER GUIDE

## Post-Visit Activities & Assessment

A few days after your visit to COSI, take some time to talk about what you saw and did. Encourage students to write a story or draw a picture about one of their favorite things. As a force & motion assessment, ask students to find examples of different forces around the room, school, or at home, and tell you about them. The COSI Team would love to hear about what you learned. Send stories or letters to: Field Trips, COSI Columbus, 333 W. Broad St., Columbus OH 43215.

## Resources:

http://www.kidsolr.com/science/index.html
Lots of excellent science links for kids.

www.howstuffworks.com - Just about everything you've ever wanted to know is described at this informative and understandable website.

www.physics4kids.com This website, although void of activities, has clear and accessible definitions of a variety of physics terminology such as energy, forces, and friction.

http://www.exploratorium.edu/snacks/iconmagnetism.html Some cool activities from the Exploratorium related to magnetism.

http://www.sciencenetlinks.com/lessons.cfm?BenchmarkID=4&DocID=405 A lesson on gravity and other forces related to the launch of an object.