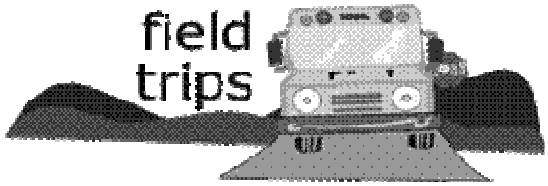


K-2 ENERGY TEACHER GUIDE

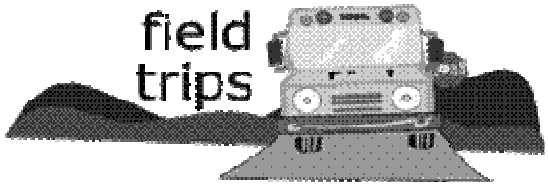
How to Use your Field Trip Guide

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.

Some COSI Exhibits related to Light, Sound & Energy

COSI is a great place to learn about the nature of energy, including light and sound. Explore the exhibition areas to find examples of reflection, refraction, waves, energy transfer, and energy conversion. You may also want to see the Gadgets LIVE Show on the Gadgets stage to learn about potential and kinetic energy. This show can be reserved for groups of up to 200 students.



K-2 ENERGY 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. Energy exhibits include:

The Laser Table – Use mirrors to see how red laser light bounces, and use prisms to see how the light can be spread out. Notice that there is a cloudy mist on the table so that we can see the light. How is this different from the light from a light bulb?

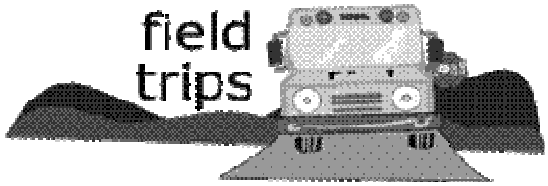
Circuits – Connect all of the pieces to build an electrical circuit and light a light bulb. Learn that a light bulb is made up of several parts, and than you need all of them, including an energy source, to make them work.

Crazy TV – Do not try this at home! Use a magnet to manipulate the light and colors on the TV monitor.

PROGRESS

Travel through time to the small Mid-western town of Progress, and discover the technology of 1898. Around the corner, find yourself a generation later in 1962 and see the changes progress makes. Take a look around Progress and make note of the types of energy being used to make the city work. These include electric lights above the town square, candlelight in the windows, and horse-powered carriages.

Progress provides an excellent opportunity to make comparisons between one place at two different times. Have your students make observations about what they see in 1898 and in 1962. Pay particularly close attention to the sounds you can hear in each area; from the piano and singing birds in 1898, to the jukebox and TV in 1962.



K-2 ENERGY TEACHER GUIDE

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:

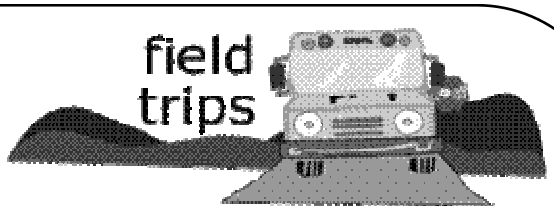
- The dark cave entrance to Ocean. Some young students may be intimidated by this entrance. Reassure them that it will be brighter soon, and encourage them to look at the features of the Cave. What else can they see in the dark?

- Poseidon Fountain – The first thing they will notice is the enormous fountain of Poseidon. What colors do they see? What sounds do they hear? This beautiful sculpture will change its sound and appearance periodically.

- Water Bells - Look at the water flowing in the water bells to the left of the entrance. This smooth water is an example of Laminar Flow. Your kids don't need to understand what this is– observe this smooth water and talk about how it looks and feels.

- The Sonic Fountains Energy is often felt as heat (thermal energy) or it can be observed as movement (kinetic energy). As wet hands move along the brass handles of the sonic fountain, friction occurs. This friction is transferred from the handles to the bowl and finally to the water in the bowl. The energy is able to transfer instead of dissipating as heat because the handles are attached to the bowl in such a way that vibration is possible.

- In Ocean Habitat, listen for sounds of sonar pinging overhead. Students can climb inside the little yellow submarine (two at a time) or into the Nautilus Submersible for a multi-sensory experience.



K-2 ENERGY TEACHER GUIDE

Vocabulary Words

Energy- The capacity of a physical system to do work.
Light- A small segment of the electromagnetic spectrum which creates illumination.
Sound- transmitted vibrations that stimulated the ear.
Bounce– When light or sound hits something and goes back in the other direction.

Standards

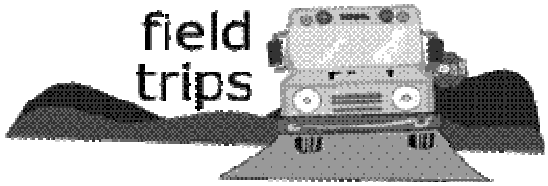
Kindergarten Physical Science
1. Demonstrate that objects are made of parts.

Grade 1 Physical Science
7. Explore how energy makes things work
9. Describe that energy can be obtained from many sources in many ways.

Grade 2 Physical Science
1. Explore how things make sound
3. Explore with flashlights and shadows that light travels in a straight line until it strikes an object.

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.



K-2 ENERGY 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.

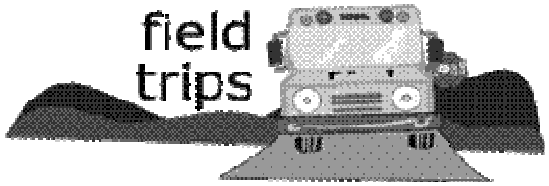
Below are some lessons that you can use as pre-visit or post-visit activities to help connect your field trip to your classroom experiences and extend your students' learning. Consider doing one activity every day for a week before your visit.

Categorizing in the Classroom

Objective: Practice putting objects into categories.
Materials Random objects from around the classroom, boxes or bins.
COSI Connections: What scientific themes can you find among the exhibits in Gadgets? Pick 3 exhibits and find something they have in common.

Procedure:

1. Split students up into partners or small groups.
2. Give each group a box of random objects from around the room that you have collected in advance, or give students the opportunity to go around the room collecting items.
3. Give each group a bin full of small objects. Observe the parts you collect. Are they all the same color? Shape? Size? What makes them different from each other? What similarities do they have?
4. Pick one property (or criterion) that can be used to categorize the parts. The criterion could be any property: size, shape, weight, or even smell! Think of two or three categories that the objects could be separated into. (For example: If your criterion is "Shape" you could have categories like Ball-Shaped, Box-Shaped, Pencil-Shaped)
5. Write the name of each category on the back of a sheet of paper, and place all of the objects on top of it.
6. Once all the categories have been made, groups should switch places with a nearby group and observe the categories that were made. Students should try to guess what categories were made by the previous team.



K-2 ENERGY TEACHER GUIDE

Flashlight Tag

Objective: Understand that light moves in a straight line.
Materials: One flashlight, a dark room (with some open space).
COSI Connections: Laser table in Gadgets
Procedure:

1. Select a student to be "it." This person gets the flashlight, and must remain in a middle section of the room designated by the teacher. All of the other students should spread out around the room.
2. When you say "go" the student with the flashlight must try to "tag" the other students by shining the flashlight on them. The light must hit a part of their body or clothing. Students can avoid getting tagged by moving out of the way or hiding behind other objects.
3. When a student is tagged, he or she becomes an obstacle frozen somewhere in the room. Other students can use these obstacles to hide behind.
4. As an alternative or extension activity, have students stay in one place, and use mirrors to reflect the light back and forth. The person who is "it" shines the light, and the rest of the students attempt to bounce the light from their mirrors to their classmates.

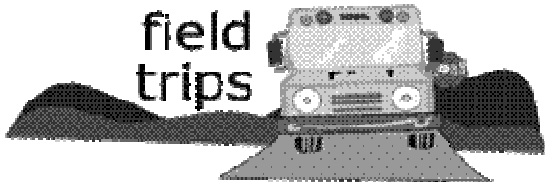
Discussion: What can you say about the light from the flashlight? How does it move? Does it bend around corners? Does it go through objects?

Coat Hanger Chimes

Objective: Understand sound & vibration.
Materials: metal coat hangers, string
COSI Connections: Sonic Fountains in Ocean and Anechoic Chamber in Life

Procedure:

1. Select several different metal coat hangers.
2. Cut two lengths of string about 3 feet long for each hanger, and tie them to different parts of the hanger.
3. Wrap the loose end of the strings around your index finger several times, and stick your fingers in your ears.
4. Bang the hanger up against a hard surface and listen. What do you hear? Were you surprised? Do different hangers make different sounds? What about different surfaces? Different lengths of string? What else could you change?



K-2 ENERGY TEACHER GUIDE

Creative Sounds

Objective: Combine language arts & science to describe sounds.
Materials: Containers with beans or seeds, rubber bands, CD of animal sounds, etc.
Procedure:

1. Ask your students to listen quietly to the sounds around them. What do they hear? Can they tell where those sounds are coming from? How?
2. Make a sound for everyone to hear, like shaking a rattle, banging a book, or playing an animal sound.
3. Ask the students to write down a word for that sound. For example, dropping a book might be "bang!, Smack!, or bap!" A barking dog may be "woof," "arf," or "rah." Do this with several different sounds, and have students write down a word for each one.
4. Ask students to read or write on the board the words that they came up with for each one. Are they all the same? What are some of the different sounds that people heard?
5. Continue the game by asking students close their eyes and listen. Tell students to make a loud or silly sound when you tap him or her on the shoulder. The rest of the students should write down a name for that sound, and guess what direction or which person the sound was coming from. At the end, everyone can make their sounds together for some crazy classroom music.

Some Teacher Resources

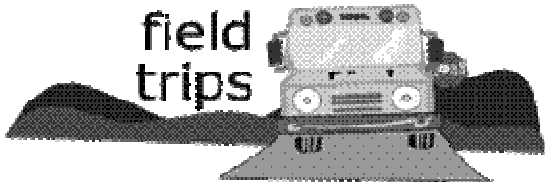
A Light & Shadows activity for grades K-2
http://pbskids.org/arthur/parentsteachers/activities/acts/hand_shadows.html

The Atoms Family Physical Science Resources
http://www.miamisci.org/af/sln/

A Museum exhibit on different forms of energy
http://www.sciencemuseum.org.uk/exhibitions/energy/site/EIZc_studies.asp

www.ohiorc.org
The Ohio Resource Center, an excellent resource for standards-based lesson plans.

http://www.kidskonnect.com/LightSound/LightSoundHome.html
Resources on light and sound



K-2 ENERGY TEACHER GUIDE

Some Books to Check Out

Sound

- The Science Book of Sound by Neil Ardley. j534 121
- Experimenting with Sound by Robert Gardner. j534 403
- Using Sound by Sally and Adrian Morgan. j534 Morgan
- Sound FUNdamentals by Robert W. Wood. j534 Wood
- Sound by Terry Cash & Barbara Taylor. j534.076 207
- Sound Waves to Music by Neil Ardley. j534.078 Ardley
- Sound: A Creative, Hands-on Approach to Science by Wendy Baker & Andrew Haslam. j535.078 134

Light

- Bending Light: An Exploratorium Toolbook by Pat Murphy. j535.324078 Bending

  Light and Color by Clarence Rainwater. j535 773
- Light by Brenda Walpole. j535 924
- Light by David Burnie. j535 Burnie
- The Super Science Book of Light by Graham Peacock and Terry Hudson. j535 Peacock
- Light Fantastic by Phillip Watson. j535.013 924
- Light by Robert Friedhoffer. j535.078 Friedhof
- Light FUNdamentals by Robert W. Wood. j535.078 Wood