

Physical Sciences Trek



Grades: K-2

Time: a pre-visit session of 30-45 minutes and a post visit session of 20-30 minutes (*Note: Time for either session can be adapted. For instance the pre-visit session can consist of a 10 minute preview of the exhibits.*)

Rationale and Context:

This trek is organized around the NGSS crosscutting concept cause and effect. [This video](#) provides an overview of the concept. To help maximize their ECHO experience, students will be introduced to ECHO exhibits that relate to physical sciences before their classroom visit. They will make predictions about how to produce desired results at several exhibits. At ECHO, students will test out their designs or hypotheses and explore exhibits more deeply with the help of additional challenge questions. After their visit, students will process their learning as a group and draw conclusions about forces and motion, waves, matter, and cause/effect relationships. Teachers may choose to continue to explore these concepts using additional resources provided.

Teacher Background Information:

The primary learning goal of ECHO's Awesome Forces exhibit gallery is to help visitors understand the physical laws that govern the natural phenomena we experience everyday on the Burlington Waterfront. Through hands-on interactive exhibits your students will delight in discovering the amazing processes that have shaped the Lake Champlain Basin and our Earth. Many of the exhibits in Engineer It also draw on physical science principles while encouraging visitors to use the Engineering Design Process to solve problems.

Learning/Behavioral Objective(s):

1. Students will engage with ECHO exhibits with a sense of purpose.
2. Students will hypothesize about how to create desired effects with the exhibits.
3. Students will connect the phenomena they observe with physical science concepts.
4. Students will draw conclusions about physical science concepts and connect their learning to a broader cross cutting science concept.

Essential Question: How can cause and effect relationships help predict or explain future events?

Focusing Questions:

How can a push or pull change the speed or direction of an object?

How can I change the sound that a vibrating object makes?

How do mirrors affect the path of a beam of light?

In a set of building pieces, what is the purpose of each type of piece?

Vermont Standard(s): Next Generation Science Standards

Standard	Description
Crosscutting concept	Cause and Effect: Mechanism and explanation
K PS2-1	Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.
1 PS4-1	Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.
1 PS4-3	Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light.
2 PS1-3	Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.
Science and Engineering Practices	Developing and Using Models Planning and Carrying out Investigations Constructing Explanations and Designing Solutions

Vocabulary: Students may gain an understanding of certain vocabulary words through active participation and explanation.

Air pressure

Collide/Collision

Energy

Force

Gravity

Material

Motion

Property

Pull

Push

Speed

Vibrate/Vibration

LEARNING PLAN:

Resources/Materials:

1. Optional free admission for teacher walkthrough visit
 - contact ephillips@echovermont.org
2. [Museum Map](#)
3. [Slide presentation of exhibitions](#)
4. [ECHO Exhibit Preview sheet](#)
5. [ECHO Exhibit Exploration sheet](#)
6. Links to extension activities

Before your ECHO trip:

Introduction

1. *When our class visits ECHO, you will have a chance to explore many science exhibits. Today we're going to preview a few of them and start thinking about some of the challenges you might explore when we are there.*
2. *At many of the exhibits, you'll be able to think about cause and effect. If necessary, introduce or review this crosscutting concept.*
3. Hand out the [ECHO Exhibit Preview sheet](#).

Exhibit Preview

1. [Begin slideshow](#). Show slide of Magnetic Ball Wall, then discuss:
 - a. *What do you notice in this picture?* Take several responses. If no one notices that a ball can follow a path, explain this fact and ask:
 - i. *Can someone show us the path a ball will take?* Invite one or more students up to trace the path they think the ball will take.
 - ii. *How will a ball get from the bottom left of the wall up the pipe?* If you push the orange button in the lower left, a fan starts blowing and the air pressure will force the ball up the pipe.
 - iii. *Let's check our predictions.* Advance to the next slide and play the video.
 - b. *The ramps, tunnels and connectors are all attached to the wall with magnets. Each type of piece has a different purpose. They can be moved around to create new pathways. Ask: What path would you like to create on the ball wall?*
 - c. Allow students time to record ideas on their worksheet. Share and discuss.
2. Show slide of Air Cannon, then discuss:
 - a. *What do you notice in this picture?* Take several responses.
 - b. *This is called an air cannon. Why do you think it's called that?* Take several responses.
 - c. *How do you think the air cannon works?* If no one suggests hitting the drum end, ask:
 - i. *If you hit the drum, what part of it might vibrate?* The stretchy cover
 - ii. *What do vibrating objects make?* Sound
 - d. *If you hit the drum hard or soft, how would that change the sound?*
 - e. Allow students time to record ideas on their worksheet. Share and discuss.
 - f. *In this exhibit the air cannons are more than drums. When we go to ECHO, you will get a chance to explore what else happens when you drum on them!*
3. Show Power of Pulleys slide, then discuss:
 - a. *What do you notice in this picture?* Take several responses. If no one mentions the rope, ask:
 - i. *Why is there a rope next to the chair?* Predictions may vary.
 - ii. *What is the rope connected to?* There's a pulley above the chair.
 - b. *What will happen if you pull the rope?*
 - c. Allow students time to record ideas on their worksheet. Share and discuss.

4. Show Foggy Harbor slide, then discuss:
 - a. *What do you notice in this picture?* Take several responses. If no one mentions the beam of light, ask:
 - i. *How could a beam of light be used to communicate?* Sends a signal over a distance.
 - ii. *What message might it be sending?* Answers will vary
 - iii. *Lighthouses are used to send messages from people on land to boaters on the water. What message might someone on land need to send to someone on the water?* Watch out for rocks or other dangers in the water.
 - b. *This exhibit challenges you to move the beam of light so it hits a target.* Show second Foggy Harbor slide. Explain that the pillars can be spun around and that there are holes or mirrors on some sides.
 - c. *Where would you place a pillar so the light reaches a target?*
 - d. Allow students time to record ideas on their worksheet. Share and discuss.

Closure and Connections

1. *What are you most excited about seeing, doing or learning on our ECHO field trip?*
2. *During our visit, you will get to discover many other exhibits. Some relate to earth sciences and lots of them include animals. If you are looking for more exhibits that explore forces and motion, sound and light waves, matter, and cause/effect relationships, you can look for these exhibits.* Show additional slides.

During your ECHO trip:

1. It may be helpful to have students identify which of the previewed exhibits they are most excited about. They can be split up into small chaperoned groups by their interest. We will help direct your groups to different areas of the museum to begin your ECHO explore time.
2. Give each student or partner group a copy of the [ECHO Exhibit Exploration sheet](#) to guide them as they interact with the exhibits.

After your ECHO trip:

1. *Now that everyone has explored the exhibits at ECHO, let's hear what you thought.* Allow a quick share where everyone can share one favorite exhibit/experience/etc.
2. *Let's discuss what you've learned about forces and motion, sound and light waves, matter, and cause/effect relationships from the exhibits.*
 - a. *At the Magnetic Ball Wall, what designs did you try out?* Encourage discussion of how when creating a new ball wall design, different pieces are suited to different purposes.
 - b. *At the Rushing Air exhibit, how did hitting the drum soft or hard change the sound?* Encourage discussion about how vibrating materials can make sound and sound can make materials vibrate.
 - i. *What else happened when you hit the drum on the air cannon?* If appropriate, introduce the concept of energy being transferred from

the air leaving the cannon to the moon and other materials hanging some distance away.

- c. *At the Power of Pulleys exhibit, what happened when you pulled on the rope?*
Encourage discussion relating how pushes and pulls can change the speed or direction of an object, including starting or stopping it. If appropriate for the group, extend thinking by comparing the effort required when using different pulley systems.
 - d. *How did you adjust the pillars so that light reached one of the targets?*
Encourage discussion relating the effects of placing objects made with different materials in the path of a beam of light.
3. *How can understanding physical cause and effect relationships help us in the real world?* Examples: Mirrors are in cars so the driver can quickly and easily see what's next to or behind them.
- a. This may also be a logical place to make connections with the current science unit under study.

Extensions

Magnetic Ball Wall:

- Create simple marble runs using [cereal boxes](#) or [toilet paper tubes](#).
- Use Lego Bricks as a jumping off point for [discussing how different pieces are suited to different purposes](#).

Rushing Air:

- Watch a [short video](#) that demonstrates how sound vibrations can cause an object to move.
- Explore sound vibrations by making [spoon gongs](#).
- Make a [tin can telephone!](#)

Spinning Table

- Explore [multiple videos](#) created around the theme of Make Things Move at PBS Learning Media. Then try out these [Push/Pull puzzles](#).
- Set up one or more of these [push/pull explorations](#) as a station activity.

Foggy Harbor:

- [Make a periscope](#) and challenge your students to see around a corner.