CLASSICS COLLECTION

EDUCATOR RESOURCE GUIDE

DISCOVERY
Center of Idaho

Table of Contents

How to Use the Educator Resource Guide:

This resource guide is intended to help educators and chaperones prepare for a meaningful, informative and fun visit to the Discovery Center of Idaho, one that provides relevant connections to classroom learning objectives. We've included ideas for both onsite interactions and follow-up prompts and activities. Educators can pick and choose which sections, activities or themes to focus on from the pre- or post-visit materials.

**Note that this collection is growing and changing ~ some exhibit materials may not be available at all times!*

Education Statement

The Discovery Center of Idaho's Classics Collection is a brand-new take on some of our most popular exhibits from over the years. Each of these exhibits, designed and built in-house, has been specially curated to engage and excite visitors of all ages, congruent with our mission to provide quality educational experiences & programs that reflect excellence in their development, mastery in their delivery and offer relevant and sustainable interactions that inspire lifelong interest and learning in S.T.E.M. and the arts for a diverse community.

Idaho Science Standards Connections

The Idaho Science Content Standards identified below are an overview of some of the science standards addressed throughout our Classics Collection. In the following pages, you can read about each exhibit and the standards which directly connect to concepts demonstrated through that exhibit. Please remember, this is just a place to start! There are many additional connections, including those across disciplines and among many fields of science that can be addressed during a visit to the Discovery Center of Idaho.

Elementary School		Middle School	High School
K-PS-1.1	2-PS-1.3	MS-PS-2.2	HS-PSP-1.1
3-PS-1.1	3-PS-1.2	MS-PS-2.3	HS-PSP-1.5
3-PS-1.3	4-PS-1.1	MS-PS-2.5	HS-PSP-2.5
4-PS-1.2	4-PS-2.1	MS-PS-3.1	HS-PSP-3.1
		MS-PS-4.1	HS-PSC-1.5
		MS-PS-4.2	HS-LS1-.3

Link to Idaho Science Standards

PREPARING FOR YOUR VISIT

Preparing your students (and chaperones) for their visit:

We believe that learning is fun, but please remember that we are not an indoor playground! Please remind your students not to treat our exhibits as a playground.

The Discovery Center of Idaho is a space that inspires interest and learning in Science, Technology, Engineering, Arts and Math concepts through hands-on play, demonstrations and activities.
Review the exhibit descriptions and activities in this resource guide and consider integrating some of the relevant content into your lesson planning in the weeks leading up to your visit.

**Note that this collection is growing and changing ~ some exhibit materials may not be available at all times!*

Prepare your chaperones!

We've created a short chaperone guide and map that you can share with field trip adults so that they better understand their role as chaperone. How well you prepare your chaperones can make or break your students' experience!

Take a look at this brief video which contains a preview of several exhibits you will encounter during your visit!

PRE-VISIT ACTIVITY SUGGESTIONS

Activity #1:

Design and Build a Paper Airplane

Description: Students will build different paper airplane models (with instructions), and test each model, measuring distance and glide time. Students will combine class results and then analyze their results to determine which characteristics are ideal. They will use this knowledge to inform their own, new paper airplane design creation.

SUPPORTING VIDEO

Supplies:

Sample airplane designs print outs (distribute different designs throughout the class for variety)
2-3 sheets of 8.5 x 11" paper per student
Scissors
Tape measure or cones to mark distances
Stopwatch or phone for timing

Prep Notes:

The airplane flight trials may need to take place in a larger area or outside.

Instructions:

1. Each student will receive one set of airplane design instructions and the materials needed for that design.
2. Set up a launch area with a runway, clear of obstacles, and either extend the measuring tape or set up cones at regular intervals to assess flight distance.
3. Upon completion of the construction, each student will fly their airplane three times, recording the distance of each flight to the nearest foot as well as the amount of time it stayed in the air (see example chart below).
4. Each student can find their average flight distance and glide time by taking the three measurements, adding them together and dividing by three.
5. Students can combine their results in a chart to assess which flight construction has the attributes which are best for distance or glide time.
6. Each student will then receive one more piece of paper to create their own airplane design. Repeat the testing and recording process.

Flight #	Length (feet)	Time (seconds)
1		
2		
3		
AVERAGE:		

Guiding questions:

- What changes did you make in your second airplane design and how did those changes affect the flight distance?
- Did certain designs go farther than others? Why?
- Did certain designs stay aloft longer than others? Why?
- Did you notice a relationship between average distance and average time?

Activity #2:

Magnetic or Not?

Description: Students will use magnets and other assorted objects to determine which items are magnetic. They will then compare the magnetic items to the non-magnetic items to make conclusions about what types of materials are magnetic.

Supplies:
Assorted small materials (ex: rubber band, nail, pencil, key, button, coin, eraser, block, paperclip, etc.)
One or more magnet
Paper or labels with “Magnetic” and “Non-Magnetic”

Prep Notes:
Consider including items that contain metal but don’t appear to be metal, such as a cloth-covered button.

Instructions:

1. Have students look through assorted materials and predict which will be magnetic.
2. Take turns testing out each item by holding the magnet over it; see if the magnet attracts that item!
3. Students can sort magnetic items into one pile and non-magnetic items into a different pile.
4. In small groups, have students look through the items in each pile and assess similarities and differences between the items to draw conclusions about why some materials are magnetic and others are not.

Bonus activity:
Check out this video to see how you can magnetize a screwdriver, then try it out!

Guiding questions:

- What do you notice about the materials in the “Magnetic” pile? How are they similar to one another?
- What do you notice about the “Non-Magnetic” materials?
- Were any of your predictions correct, or were you surprised by your results?

Activity #3:

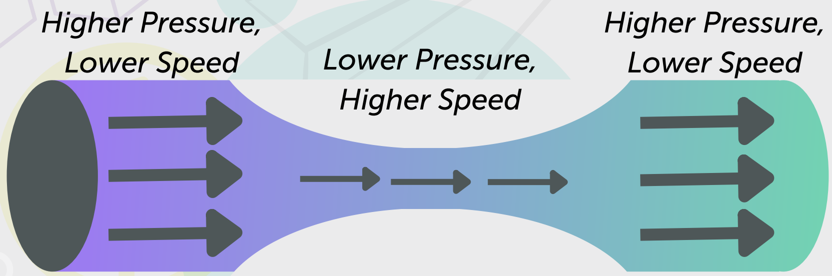
Fun with Bernoulli

Description: Students will explore the relationship between air pressure, speed, and movement using Bernoulli's Principle.

SUPPORTING VIDEO

Supplies:

1 sheet of paper (new or recycled)
2 round balloons
2 pieces of string (18 inches long)
Fun with Bernoulli worksheet



Prep Notes:
Before the activity begins, review with students the Bernoulli principle. Make sure everyone understands the concept. (The faster a fluid moves the less pressure it exerts.)

Instructions:
Part A: The Paper Tent

1. Have students fold a piece of paper (lengthwise) in half and make a paper tent.
2. Ask students to predict what will happen when they blow into the tent. Will it appear to get larger, will it remain unchanged, or will it bend down toward the table? (Alternately, have students turn their paper tents upside down and blow through the V-shaped paper.)
3. Make sure students notice that the tent flattens. This is because the air moving through the inverted V has less pressure, so the higher pressure on the outside of the paper tent flattens the paper.
4. Have students experiment with their paper tents, answer the relevant worksheet questions, and discuss their results.

Part B: Moving Balloons

1. Blow up two balloons. Tie them off, and then attach a string to each one.
2. Have students hold the two balloons together.
3. Ask them to predict what will happen when they blow between the two balloons. Have students record their hypotheses in the space provided on the worksheet.
4. Have students hold the balloons 4-6 inches apart and blow between them. If they hold the balloons too close together, the balloons simply move away from the student. The balloons must be sufficiently far apart so that students can blow between the balloons, not at the balloons.
5. Expect students to see the balloons come together just like the paper V in Part A of the Procedures section.
6. Have students complete the worksheet and discuss the results.

Guiding questions:

- How is what happened with the paper tents similar to what happened with the balloons?
- Given what we have learned, how might this principle be important to engineers who are designing vehicles such as airplanes, trains, or rockets?

The Discovery Center of Idaho and the Idaho STEM Action Center present the Classics Collection, a new take on some of our most popular exhibits from the past. This exhibition has engaging exhibits designed and built by the Discovery Center Team and is sure to delight all ages!

**Note that this collection is growing and changing ~ some exhibit materials may not be available at all times!*

Each exhibit contains signage deliberately designed to help guide learning and facilitate deeper engagement. On each sign, you can find the title at the top, along with a small tag in the top right corner which indicates the exhibit topic. The TEST & OBSERVE area gives examples of questions to prompt student observation, participation, and reflection. The WHAT'S HAPPENING section explains the scientific concept behind the exhibit, and FUN FACTS gives real world examples of the concepts on display!

Standards Connections:

PS1-K-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.

PS1-4-1
Use evidence to construct an explanation relating the speed of an object to the energy of that object.

PS3-MS-1
Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

PSP1-HS-1
Analyze data to support the claim that Newton’s second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

PSP1-HS-2
Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.

Standards Connections:

PS1-K-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.

PS2-MS-5
Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

PS3-MS-2
Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.


AIR CANNON

FORCES & MOTION

TEST & OBSERVE

- How far can you stand from the cannon and still feel the force of the air?
- How could you redesign the cannon to make the air travel faster and farther?
- Can you calculate the speed of the cannon's projectile?

FUN FACTS

Volcanoes, like the Etna volcano in Italy, can blow "vortex rings" more than 600 feet in diameter. These vortex rings are caused by an explosion of steam from a small opening in the volcano's crater.

What's Happening?

Even though we cannot see it, air is full of freely moving, randomly colliding molecules that have mass. The air cannon applies a quick, concentrated force to the air molecules in the cannon's barrel creating as gaseous projectile you can both see and feel.

STEM

F O R C E S & M O T I O N


BERNOULLI BLOWER

FORCES & MOTION

TEST & OBSERVE

- As you adjust the angle of the cone, what do you notice about the ball's movement?
- What happens if you pull the ball partially out of the airstream? Why?
- Can you make a ball spin while floating in the airstream?

FUN FACTS

If you've ever held your hand out the window of a moving car you've likely experienced Bernoulli's principle. As you tip your hand to force air downward, the air applies an upward force on your hand, causing your hand - just like an airplane's wings - to lift.

What's Happening?

The Bernoulli principle states when air speeds up, pressure drops and vice versa. When the air stream hits the bottom of the ball, the air slows down, generating an area of high pressure. The high-pressure air under the ball keeps it afloat, while the air moving around the ball keeps it centered in the air stream.

STEM

Standards Connections:

PS2-MS-2
Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

PS2-MS-5
Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

Standards Connections:

PS1-3-3
Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.

PS1-4-2
Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

PS2-MS-5
Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

PSP1-HS-5
Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.

PSP2-HS-5
Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

PLASMA BALL

ELECTRICITY & MAGNATISM

TEST & OBSERVE

- Turn the flourescent bulb to the vertical position. What do you observe? Now grasp the bulb in your hand. What do you observe?
- Can you make the bulb shine brighter? Dimmer?
- Would an incandescent bulb work in place of the fluorescent bulb? Why or why not?

FUN FACTS

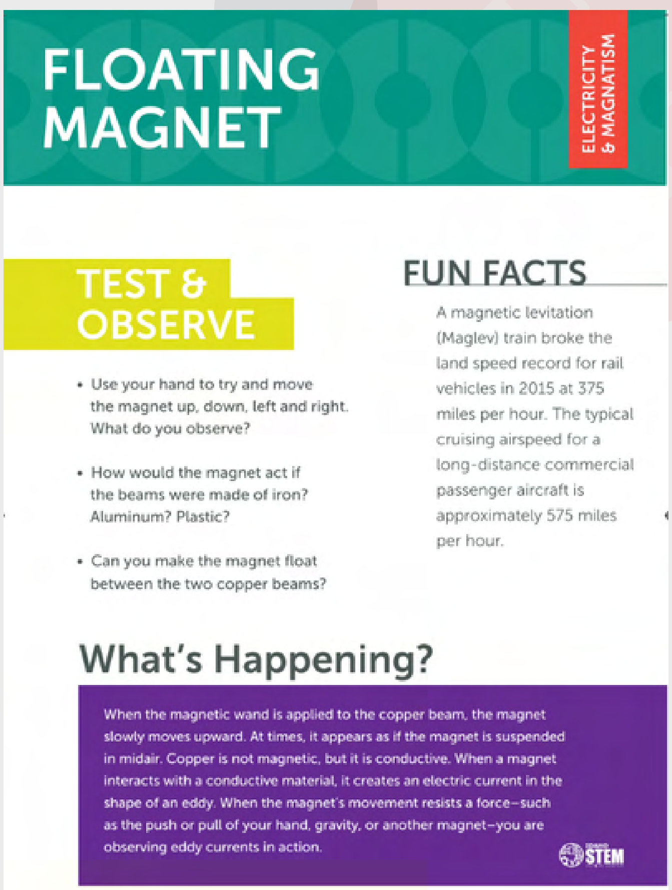
The Tesla coil was invented by Nikola Tesla in 1891. Tesla hoped to create a self-sufficient energy system that could power the whole country. According to Tesla, he created a coil powerful enough to wirelessly power a lightbulb 26 miles away, although it was never documented.

What's Happening?

The plasma ball has a small Tesla coil at the center of the sphere. The coil emits high-frequency, high-voltage alternating electric currents. The glass sphere also contains a mixture of noble gases. When the current moves through the gas, it creates colorful tendrils of light known as plasma. Some electrical activity extends past the sphere which is why you are able to light up the fluorescent bulb.

STEM

E L E C T R I C I T Y & M A G N E T I S M



FLOATING MAGNET

ELECTRICITY & MAGNATISM

TEST & OBSERVE

- Use your hand to try and move the magnet up, down, left and right. What do you observe?
- How would the magnet act if the beams were made of iron? Aluminum? Plastic?
- Can you make the magnet float between the two copper beams?

FUN FACTS

A magnetic levitation (Maglev) train broke the land speed record for rail vehicles in 2015 at 375 miles per hour. The typical cruising airspeed for a long-distance commercial passenger aircraft is approximately 575 miles per hour.

What's Happening?

When the magnetic wand is applied to the copper beam, the magnet slowly moves upward. At times, it appears as if the magnet is suspended in midair. Copper is not magnetic, but it is conductive. When a magnet interacts with a conductive material, it creates an electric current in the shape of an eddy. When the magnet's movement resists a force—such as the push or pull of your hand, gravity, or another magnet—you are observing eddy currents in action.

STEM

Standards Connections:

PS1-3-3
Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.

PS2-MS-5
Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

PSP1-HS-5
Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.

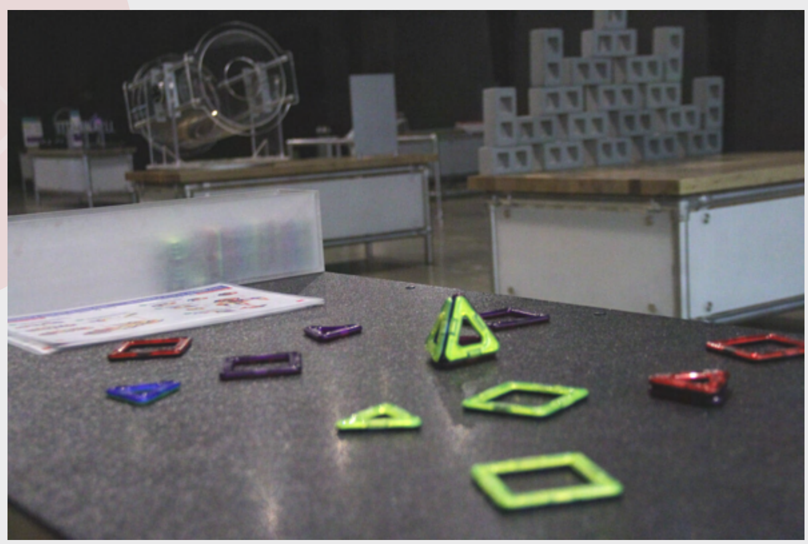
Standards Connections:

PS1-3-2
Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

PS3-MS-1
Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

PSP1-HS-3
Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.

ENGINEERING



Standards Connections:

PS1-2-3
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.

Standards Connections:

PS2-MS-3
Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

PS2-MS-5
Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

PSP1-HS-5
Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.

PSP2-HS-5
Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

WAVES & TECHNOLOGY

Standards Connections:

PS2-4-1
Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

PS4-MS-1
Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.

PS4-MS-2
Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

PSP3-HS-1
Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

Standards Connections:

PS1-3-1
Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

PS2-MS-2
Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

MATH & LIFE SCIENCES

Standards Connections:

PS1-3-1
Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

LS1-HS-3
Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

A consistent theme throughout this collection is the use of different forces which transfer energy from one object to another.

A force is a push or pull acting upon an object as a result of its interaction with another object.

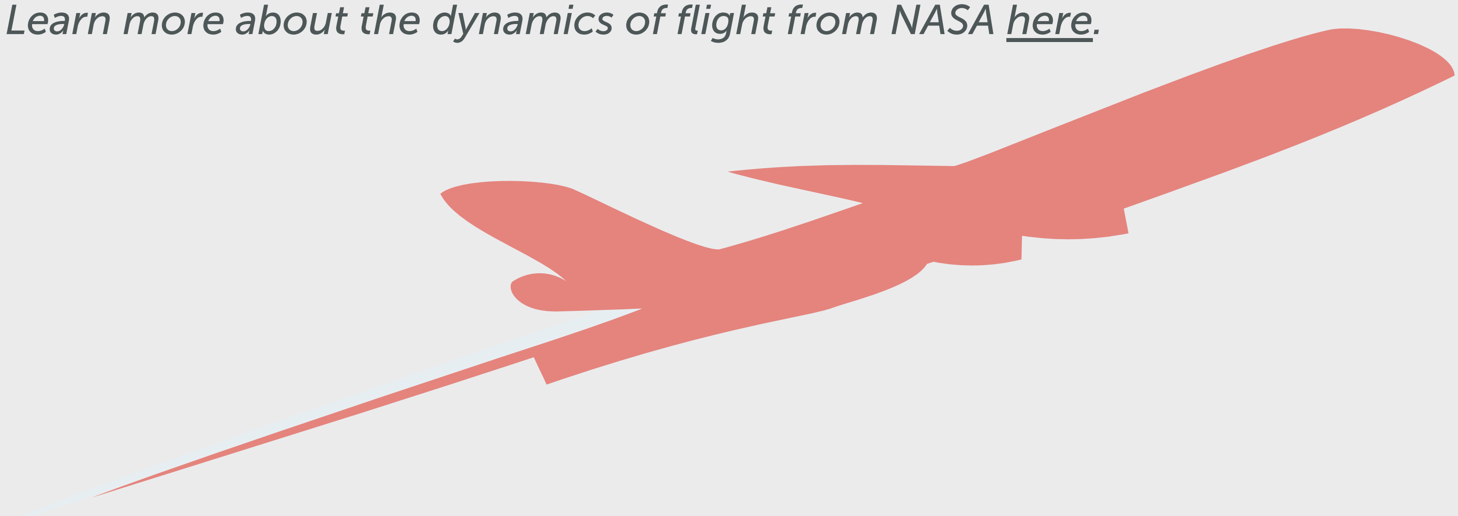
Some of these interactions happen due to physical contact between objects, such as frictional forces and applied forces, while others happen at a distance, like magnetism and electricity.

Explore more about forces by watching this video of many different, HUGE experiments!

HOW DO AIRPLANES WORK?

People who design very heavy machines that fly need to know a lot about air pressure and how to manipulate air pressure using forces of motion. Airplane wings are designed to create a force called "lift", which uses a difference in air pressure to help the plane rise up into the air.

Learn more about the dynamics of flight from NASA here.



WHY ARE MAGNETS IMPORTANT?

Did you know that there are magnets in your TV, your computer and even your doorbell? *Check out this cool informational video to learn more about magnetism and its real-world uses!*

POST-VISIT / FOLLOW UP ACTIVITIES AND PROMPTS

Just because your field trip is over, doesn't mean your discovery time has to end! Here are some tips for building upon the impact of your students' field trip encounters far beyond the bus ride home:

1. Make sure to reference what your students experienced in conjunction with what you're doing in the classroom. For example, if you visited before your unit on physical science, you can remind your students about some of the forces they encountered during their field trip!

2. Include examples from your Discovery Center of Idaho field trip experience on an upcoming assessment to help reinforce their classroom understanding with a tactile experience.
3. If you didn't get to do one or more of the pre-visit activities we provided, you can try them out after your visit as well! It's a great way to continue building physical memories of concepts that may be difficult to understand on paper.
4. Have students design a new exhibit or activity that shows off one or more of the concepts they had the chance to experience during their visit.
5. One of our favorite things to receive are letters from students telling us about all the things they learned and remember from their field trip to the Discovery Center! We love to hear about your favorite parts so we have a better idea of what future students will enjoy!
6. Finally, please complete the teacher survey we will send via email after your trip. Your feedback is so important in helping us find areas to improve and grow, so please share with us your thoughts and suggestions!

DISCOVERY CENTER OF IDAHO

EDUCATION INFORMATION

The Education Department at the Discovery Center of Idaho seeks to provide quality educational experiences & programs that reflect excellence in their development, mastery in their delivery and offer relevant and sustainable interactions that inspire lifelong interest and learning in STEM and the arts for a diverse local, regional and state-wide community.

If you have any questions or need help while planning your class trip to the Discovery Center of Idaho, please contact us at **education@dcidaho.org**