



K-2: Science Playground

Curriculum Connections

Life Sciences

The 5 Senses

Students use all their senses, except for taste, to explore the exhibits. (They can taste lunch afterwards!)

Physical Science

Motion

Objects can move in different ways such as straight, zigzag, fast, slow, round and round, etc

Forces of Nature

Objects fall to Earth unless something holds it up---Gravity

** Based on the New York State Elementary Science Core Curriculum and the New York City New Standards™*



National Standards

Content Standard A: Science as Inquiry

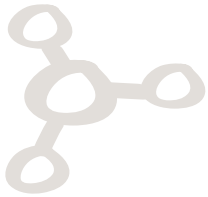
- Abilities necessary to do scientific inquiry
- Understanding about scientific Inquiry

Content Standard B:

- Properties of objects and materials
- Position and motion of objects
- Light, heat, electricity and magnetism

Content Standard E: Science and Technology

- Abilities of technological design
- Understanding about science and technology
- Abilities to distinguish between natural objects and objects made by humans



K-2 Exhibits List

Archimedes Screw
Ball Run
Big Ears
Energy Wave
Giant Lever
Giant Seesaw
Octascope
Palm Pipes
Periscope
Propeller/Water Wheel
Slides
Sound Steps
Speaking Tube
Standing Spinner
Stream Table
Sun Catchers and the Kinetic Sculpture
3-D Spider Web
Vertical Energy Wave
Wave Machine





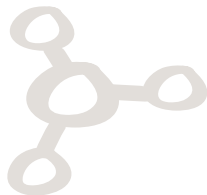
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Whirlpool Column
Whirlpool Dish
Whisper Dishes
Windmill
Wobbly Bridge
Xylophones
Paramecium Moves with Cilia

Guide Theme

The theme of these guides are based on popular crime and detective show investigations on TV; a mystery unfolds, questions are asked, evidence is gathered, conclusions are drawn. This process is similar to what scientists go through with the inquiry method. For more details see About the Guides.



Begin the Investigation At School

A mystery unfolds, questions are asked...

There are several ways you can introduce the topic and start the investigation. Here are some ideas that will help students start thinking about the topic and generate questions:

- Create a mystery about going to a wondrous place where a whisper is heard hundreds of feet away, where you can make whirlpools and waves, a place where music is made with hands and feet.
- Create a mystery about who would win a race to the bottom using a straight slide or a steep curvy slide. (Mystery solved at Slides exhibit)
- Create a mystery about how one student could lift a 700 pound barrel. (Mystery solved at Giant Lever exhibit)
- Demonstrate one of the Laboratory Activities with no explanation-let the questions begin
- Do one of the Laboratory Activities and facilitate a probing discussion



Prepare for Investigation at the New York Hall of Science

Once students have generated questions around the topic tell them they are going to continue the investigation at the New York Hall of Science.

At this point you may want to begin one of the Continuum Activities. These activities have the following features:

- Vary in length and depth
- Provide continuity and purpose for the visit
- Provide a way of assessing student understanding

Orientation and Planning: If you do nothing else, do this!

Here are five reasons to conduct student orientation and planning before going on a field trip:

1. Students focus on exploring and investigation versus the novelty of the location
2. Students don't have to worry about logistics like restrooms, schedule, eating etc.
3. Students who understand the plan and purpose of the visit are more likely to stay focused
4. Students who have clear goals for their visit are less likely to race from one exhibit to another with little understanding
5. Students who get involved in the planning of the visit, take ownership and are less likely to misbehave





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Read more about the Orientation and Planning Process



Investigation at the New York Hall of Science

Evidence is gathered...

Okay. The class has arrived at the next phase of the investigation. The students have questions and seek answers. Everyone knows what exhibits they should visit and why. Everyone knows the schedule for the day. Students have materials to record findings or work on a Continuum Activity if required.

If all of the above is true, congratulations on a successful Orientation and Planning.

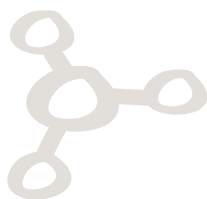
If you are curious about what teachers can do on site, we've put together a little piece called Teacher Role.

Finish the Investigation Back at School

Conclusions are drawn...

There are several ways you can complete the investigation. Some require less time than others. Here are some ideas:

- Student or group oral or written reports on investigation questions and answers
- Student or group illustrations of visit with answers to questions or mystery
- Do one of the Laboratory Activities
- Complete the Continuum Activity



Continuum Activities

Continuum Activities are designed to carry through the entire investigation. Some activities require less time than others.

Investigation Map

Description: Detectives will often map out related events, evidence and suspects during an investigation. This helps them get an overall picture. Students can map out their investigations with a concept map. The concept map will help you assess what students learn.

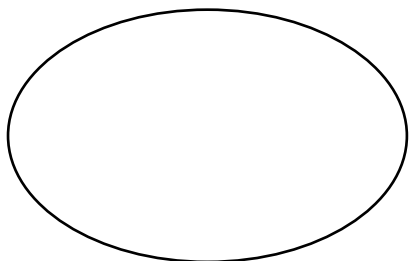
Time: (3)15-30 min. Sessions

Materials Needed:

- Blank paper
- Pencils, crayons

Procedure:

1. Begin with a center circle and write in the name of the main topic. (Students who have difficulty with writing can have an adult assist or draw a representation of the main topic)

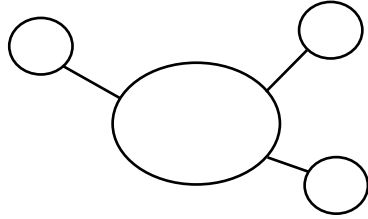




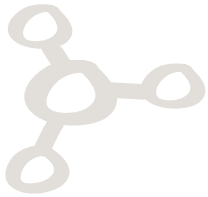
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2. As students generate questions about the topic, they can add offshoot circles. They can also add circles for facts they know about prior to the visit to the New York Hall of Science.



3. When students return from their investigation at the New York Hall of Science they add additional circles of information. Their final map should reflect everything they know about the topic. Teachers can easily assess what is learned based on how the map develops.



Investigation Journals

Description: Investigation journals provide a way for students to record their questions and findings throughout the investigation.

Time: (3) 15-30 min. Sessions

Materials Needed:

- Blank or lined paper
- Pencils or crayons
- On-Site Investigation Handout (print out from this web site and make copies)
- Zip-lock bags (for on-site handout only)
- Soft yarn or thick soft string (for on-site handout only)

Procedure:

1. Ask students if they have ever seen a detective take notes when trying to solve a mystery. Tell students that as “science detectives” they too will make a record of the mystery.
2. Have students begin their journal or report with questions that are generated when they Start the Investigation at School.
3. Students who do not have writing skills can make a large question mark and draw representations of their questions. If an experiment or demonstration is done, non-writing students can sketch what they observe.
4. Older students with writing skills can list their own and other students questions in their journal.
5. We strongly advise students not bring journals to the New York Hall of Science where they can get lost. We have provided an On-Site Investigation Handout that can be copied if students want to record observations or make sketches.
6. When students return from their investigation at the New York Hall of Science have them write answers to questions or draw what they observed.





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Become an Explainer

Description: Student science detectives investigate one exhibit with the goal of being able to explain it when they return to the classroom. Students can choose a variety of methods to explain and make presentations.

Time: (1) 15 min. Session (right before going on Field Trip)

(2) 45 min. Sessions (for in-class presentations)

Materials Needed:

- Interesting object (used for student observation)

(optional suggestions)

- Variety of craft materials (string, paints, glue, tape, colored paper, scissors, etc)
- Variety of clean, household recyclables (meat trays, cardboard tubes, aluminum foil, plastic wrap)
- Any other odds and ends students can construct with
- Poster board or paper
- Markers, crayons

Procedure:

First Session

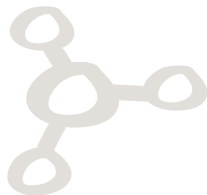
1. Tell students as “science detectives” they will be investigating exhibits at the New York Hall of Science and will choose one exhibit to explain to the class when they return. (students can work in groups or individually)
2. Help students prepare for careful observation of exhibits by showing them an interesting object. (make sure all students can see object)
3. Now ask students to verbally describe what they see. Encourage details.
4. After students have described the object in great detail, tell them they will need to use these same observation skills when they are investigating their chosen exhibit.
5. Go to the New York Hall of Science. (encourage observation and verbal descriptions)

Second Session

1. Upon return to class from the trip, tell students they will spend time preparing to explain one of the exhibits they saw.
2. Here are some suggestions for student presentations:
 - Verbal explanation (with or without picture)
 - Group or individual poster showing how an exhibit worked
 - Group or individual model using materials to represent exhibit (materials can be used to substitute and represent real materials from exhibit— ex. Clear plastic wrap simulates glass, cardboard tube becomes a rocket etc.)

Third Session (optional)

Use this time for students to make their class presentations if they made posters, drawings or models.





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Laboratory Activities

Laboratory Activities are designed for the classroom and generally require simple materials. These activities can be done before or after a visit to the New York Hall of Science. To help students use higher-level thinking and generate questions, facilitate discussion with these types of questions:

- What do you notice here?
- Tell me about this.
- What do you see?
- Why do you suppose this happens?
- What can you conclude from the evidence?



Rolling Bottles

Description:

Students observe an experiment with rolling bottles filled with sand and water to see which one goes farther. The experiment presents an interesting phenomena and is a good way to introduce the idea of friction and the properties of solids and liquids.

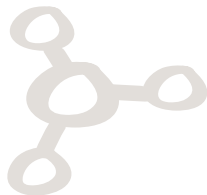
Time: (1) 30 minute session

Materials Needed:

- 2 soda bottles with screw-on caps
- water
- sand or dirt
- long hallway or room with lots of open floor
- measuring tape (optional)

Procedure:

1. Fill one of the bottles with water and put the cap on tightly.
2. Fill the other with sand or dirt. Put the cap on that one too.
3. Now for the fun part. Find a long hallway or room with lots of open floor.
4. Roll the dirt filled bottle.
5. Ask students to notice how far it rolls and the way that it behaves. (You can use a measuring tape to measure the distance)
6. Roll the water filled bottle. Try to use the same amount of push to get it going.
7. Ask students: Does it roll the same distance? Does it stop in the same way?
8. Ask students what happened? (The bottle with the sand rolled farther. It gradually slowed down and finally stopped. The bottle with the water started rolling just fine, but it slowed down very quickly instead of gradually and did not roll as far.)
9. Ask students to give their ideas about why the bottle with sand rolled farther ?
10. Roll both bottles again and tell students to pay close attention to the ingredients inside the bottles.
11. Have students verbally describe what they notice about how the water and sand behave.
12. Point out that the bottle with the sand acted like a solid. As it rolled, all of the sand rolled with it. With the bottle of water, things are very different. When you roll the water bottle, the bottle rolls but the water in the center does not. The friction (or resistance) between the bottle and the water, and between the spinning water and the water in the center slows the bottle and stops it from rolling.



13. Try one more test with the water bottle by swirling the bottle before you roll it. This gets the water spinning so that it will all move with the bottle. In this case the bottle behaves much more like the one full of dirt. The water is moving along with the bottle, so there is less friction. Be warned that if you swirl the water in the wrong direction, there will be more friction and it will stop even faster than it did unswirled.

Adapted from Experiment of the Week #245, Robert Krampf's Science Education Company www.krampf.com

Slip Sliding Away: Friction comparison

Description: Students will observe that friction works against gravity to slow down motion.

Time: 20 minutes

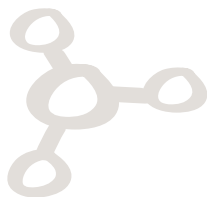
Materials Needed:
(per student pair)

- Slide
- Plastic Bag
- Fabric
- Rubber Mat
- Cardboard

1. Ask the students if they use slides at school or in the park. Inform the students that gravity pulls them down as they are going down the slide making it more fun. However there is a force called friction that works against gravity making it less fun. Inform the students that they will be testing different materials to see which one creates the least friction and the most friction on the slide.
2. Break the students up into pairs and provide the students with the materials they can sit on. (Plastic bags, fabric, rubber mat, cardboard)
3. Ask the students to predict which materials will help them to slide down the slide the fastest creating the least amount of friction and which materials will help them to move down the slide the slowest creating the most friction.
4. Have the students test out the materials and observe their movements on the slide.
5. Let the groups discuss their results.
6. Discuss results with the class and inform the students that friction is a force that can slow down or stop materials from moving when they come in contact with each other.

Note: If this activity cannot be performed with a slide you may substitute a wooden plank as a slide and place it at a steep angle. Have the students slide blocks down the plank with the different materials taped to it.

Adapted from "Physics on the Playground" by Nancy Finton. Scholastic Instructor. August 2004. Pp. 58-60





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Sound and Light Wave Demonstration

Description: Students observe and draw waves created in a ripple tank. This is a good visual demonstration to explain how light and sound travel.

Time: (1) 20 minute session

Materials Needed:

- Overhead projector
- Glass baking pan
- Water
- Blue food coloring (optional, but effective)
- Two blocks
- Pencil

Procedure:

1. Fill the glass baking pan with 1 inch of water.
2. Add blue food coloring for best effect.
3. Place the blocks in the middle of the pan so that each block is touching one side of the pan.
4. Place the pan on the overhead projector.
5. Turn on the projector and position the pan so that it is centered on the screen.
6. Produce waves at one end of the container by dipping the end of the pencil at specific intervals.
7. Have the students observe the ripples and draw them.
8. Have students observe and verbally describe what happens to the ripples when they pass through the opening between the blocks.
9. Explain to students that sound and light travel in waves and are either absorbed by (taken in) or reflected from (bounced off) any surface it encounters. When sound or light encounter most surfaces they reflect in all directions. When light hits a flat mirrored surface it reflects in a predictable path. Other surfaces, such as a curved or bowl-shaped dish, cause sound and light to reflect in special ways. The water ripples in the tank act in the same way. As they travel in between the blocks they bend around the opening created by the blocks. Students observe a pattern on the opposite side of the blocks as the emerging ripples begin to collide with each other.





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Book List

Books you can use throughout the investigation are:

Gravity

Branley, Franklyn M. *Gravity is a Mystery*. Harper and Row Publishers, 1986.
Scholastic Inc. *The Magic School Bus Plays Ball*. Scholastic, Inc. 1995. (Video)

Sound

Broekel, Ray. *Sound Experiments*. Chicago, Children's Press, 1983.
Cole, Joanna. *The Magic School Bus in the Haunted Museum: A Book About Sound*. Scholastic, 1995.
Wyler, Rose. *Science Fun with Drums, Bells and Whistles*. Messner, 1987.

Solar Energy

Berger, Melvin. *Energy from the Sun*. Thomas Y. Crowell, 1976.
Hillerman, Anne. *Done in the Sun: Solar Projects for Children*. Sunstone Press, 1983.
Mason, John. *Power Station Sun: The Story of Energy*. Facts on File Publication, 1987.
Petersen, David. *Solar Energy at Work*. Children's Press, 1985.

Physics

Meyers, Jack. *What Makes Popcorn Pop?* Boyds Mill Press, 1991.

