



SCIENCE Learning

December Holiday Science Investigations All Grades

Note: These lessons are focused on the December holidays. These have been prepared for December 1, 8, 15, 22, and 29.

Zippy's Zip Line

Background Information: Zippy the Elf is stuck on a shelf. Create a zip line and trolley that will carry the elf safely down from the shelf to the floor. Zip lines work by attaching a trolley to a steel cable that is usually covered with a vinyl coating. Gravity moves the rider quickly down the zip line toward the end. The rider's body speeds up until he reaches his maximum velocity, or speed.

Air resistance creates friction and slows the rider down a little, which means he could have gone even faster! The speed at which a rider can zip down the line is usually between 30 and 90 miles an hour.

What you will need:

- Fishing line/unwaxed dental floss
- Plastic cups
- Plastic straws
- Single hole punch
- Washers
- Painter's tape
- Small figure to represent Zippy



What you will do:

1. Ask the children if they have ever seen socks hanging from a mantle. Explain a mantle is some structure that is on a fire place.
2. Share with them that Zippy the Elf is stuck on a mantle. It is too high for him to jump without getting hurt.
3. Explain their task is to build a zip line which will take Zippy from the mantel to the floor, of course avoiding the fireplace.
4. Ask them these questions:
 - a. How does the length or position of the zip line affect the speed?
 - b. Do you think knitting yarn could be used for the zip line? Why or why not?
 - c. Change the number and positions of the washers. How does this affect the trolley's balance? Try it again. (The trolley is the car Zippy will be riding in)
 - d. Use a stopwatch to record the time of each zip line run.
5. Divide youth into groups of 3-4, distribute the supplies and ask if there are any questions. Respond to those
6. While youth are working, circulate and ask and respond to questions.



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Debrief:

- What did you learn about zip lines?
- What advice would you give to someone who wants to try building a zip line?
- In your own words, how you build the zip line for Zippy the Elf.



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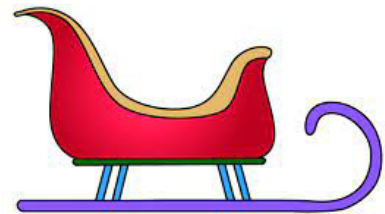
Speedy Sleds

Background Information: Sleds are used to go downhill on the snow. The main forces involved in sledding are gravity and friction. (Does this remind you of the zip line?) The force of gravity pulls in the downward direction, which is what pulls the sled down the hill. The heavier the rider, the faster the sled goes!

Friction is the force that slows you down while sledding. Smooth surfaces, like snow or ice, produce less friction than rough surfaces, like grass or pavement. Snow and ice cause very little friction. The task is for each group to create a sled that can travel down a “hill” (a titled book or cardboard ramp) the fastest.

What you will need:

- Wax paper
- Plastic bags or plastic wrap
- Felt squares
- Pennies
- Elf carton
- Books



What you will do:

1. Bring youth together and ask what they know about sleds. Ask if anyone has ever been on a sled. Invite them to share the experience.
2. Explain they are going to create a sled which will travel down a hill. Ask what they think they could do to create a hill or ramp.
3. Share with them the items they will have to work with. Share that the pennies will be the “people” on the sled. Ask them how they think they might use each of the items.
4. Here are some discussion questions to share with the youth:
 - a. What forces caused the sled to move? To stop? What does adding weight do to the sled?
 - b. Is there another material you would like to try that was not available? What is it? Why do you think it would work better?
 - c. Test your sled. Have the sled run the course more than one time. Make adjustments to make the sled go faster.
 - d. How would you like to decorate your sled?



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- e. Use a stop watch to time your sled.
5. Divide youth into groups of 3-4 and distribute the supplies
6. Check to see if there are any questions.
7. Circulate while the youth are working on the project. Ask and respond to questions.
8. When youth are finished, have them share with their peers.

Debrief

- What did you learn from this investigation?
- What advice would you give to someone just starting this investigation?
- In your own words, describe how you built your sled.



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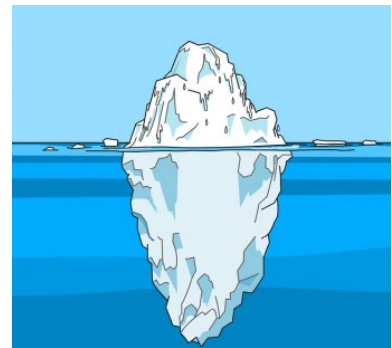
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Polar Bear Relay

Background Information: The project for today is building a floating “iceberg” that will hold as many bears as possible. Icebergs float for three reasons. First, they are less dense than water. An amount of ice weighs less than the same amount of water. Second, icebergs are made from fresh water. The ocean is made of salt water. The saltier water is, the better things float in it. Finally, icebergs are made of more than just water. They have a lot of air bubbles too. That is one reason icebergs look white instead of clear. Air is less dense than water. Trapped air bubbles in the ice help keep the iceberg afloat.

What you will need:

- Straws
- Aluminum foil
- Wax paper
- Painter’s tape
- Bucket of water
- Counting bears
- Craft sticks
- String



What you will do:

1. Bring youth together and ask what they know about icebergs. Ask them where you would find icebergs.
2. Ask them what they know about polar bears—where they live, if they hibernate, what they eat, etc.
3. Share with youth the challenge is to build an iceberg which will float and hold as many bears as possible.
4. Discuss the supplies that are available to them. Talk about how you might use each of these supplies to create an iceberg,
5. Ask them to share their ideas about how to build the iceberg.
6. Discuss the following questions.
 - Scientists have found that arctic icebergs are melting at a faster rate now than 30 years ago. How do you think the will affect the polar bears?



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- Draw your design and try it out. Redraw your design making changes in the materials you use. Did it work better? Why or why not?
 - Polar bears want to travel. Try to change your design so the iceberg can move like a boat.
 - How many polar bears can you fit on the iceberg you made before they fall off or it sinks? How might you change your iceberg so it can hold more bears.
7. Ask youth if they have any questions. If yes, answer them or at least discuss until they come up with their own answers.
 8. Divide youth into groups of 3-4 and distribute the supplies
 9. While youth are working, circulate and ask and respond to questions.
 10. When youth are finished, have them share with one another.

Debrief

- What did you learn from this investigation?
- What advice would you give to someone just starting this experiment?
- How were you challenged?



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Candy Cane Meltdown

Background Information: This is a demonstration of conservation of energy. When dropped from the same height, each ball has a certain amount of kinetic energy, or energy in motion. When you drop the two balls, one on top of the other, the tennis ball bounces much higher than when it is dropped by itself. At the same time, the basketball bounces less than when it is dropped by itself. In other words, the tennis ball gains kinetic energy and the basketball loses kinetic energy. But, the total amount of the kinetic energy is the same.

Something similar happens when playing the ice-skating game “crack the whip.” In this game, three skaters hold hands while skating around the rink. Two of the skaters pull hard on the third skater and let go. The third skater shoots off while the other two slow down. NASA uses the same concept when sending spacecraft to distant planets. They send spacecraft to fly near a large planet so its gravity transfers some of the planet’s kinetic energy to the spacecraft, making it fly faster through space.

What you will need:

- Small Candy Canes
- Small peppermints {Optional}
- Water
- Clear plastic cups
- Stopwatch/Timer and/or Kitchen Scale
- Paper to label cups with water temperature



What you will do:

1. Bring youth together and ask them if they think candy canes will dissolve in water.
2. Ask them if the temperature of the water varies, if they think the candy cane will dissolve more quickly or slowly.
3. Share they are going to investigate how long it takes a candy cane to dissolve.
4. Demonstrate each of the steps to the youth. Ask if they have any questions.
 - a. STEP 1 Fill your cups with the same amount of water but at different temperatures. Make sure to label what you have in each cup.
 - b. Label cups room temperature water, hot water, and freezer cold water.
 - c. WARNING: Younger kids will require adult assistance for handling very hot water!
 - d. STEP 2 Add one candy cane to each cup. Make sure you add the same type of candy cane to each cup.
 - e. Optional: Makeup two cups of each type of liquid if you want to do a comparison between candy canes and the round peppermints.
 - f. STEP 3 Set the timer to record how long each peppermint or candy cane takes to dissolve.



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- g. STEP 4 Observe what happens and be able to share what you observed.
5. When finished, bring youth back together to discuss the investigation.

Debrief

- What did you learn from this investigation?
- What challenges did you have, if any?
- What advice would you give to someone just starting this experiment?



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Solids and Liquids

Background Information: Water is a liquid. A liquid flows from one place to another. You can pour liquid water into a cup and from one place to another. Ice is water too, but it is a solid. It is hard. When liquid water gets very, very cold, it becomes solid ice. A solid is something that has a shape. It does not flow. But when solid ice gets warm, it melts and turns into a liquid again. Water when it is heated becomes a gas, we call it steam. Think about when you take a warm shower and you can see something that looks like “fog”. This is steam. When steam cools off, it becomes water again. Ice, steam and water are all the same with the exception of their form. The form of water is liquid; the form of ice is a solid; the form of steam is a gas, not like what you put in your car.

Challenge: Design and construct a tent that will slow down the melting of an ice cube.

Possible Criteria for Success: amount of difference in time ice takes to melt, size of tent, number of materials utilized....

What you will need:

Invite youth to bring any recyclable items from home (water or soda bottle lids, plastic containers like for yogurt, other items they think they may need to meet the challenge. Save these items if they are unused to add to your maker space supplies.

- Scotch and/or painter’s tape
- Craft sticks
- Playdough
- Timer-consider using your phone)
- Paper
- Straws
- Aluminum foil



What you will do:

1. Assemble the teams. Review the Inquiry Model which they are to apply in the planning and execution of this challenge.
2. Ask the children these questions:
 - a. Is an ice cube liquid water or solid water?
 - b. What can make solid water change to liquid water?
 - c. Can liquid water change to solid water? How?
 - d. What are some ways to keep solid water from changing to liquid water?



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3. Explain to children will be using the supplies to make a tent to protect an ice cube from melting as fast as it would without the tent.
4. Explain they will test the tent's effectiveness by giving each team two paper or plastic cups. You will place one ice cube in each cup. One will go under the tent and the other will be outside of the tent. You will time how long it takes for both to melt.
5. Brainstorm 3 criteria for success that everyone will agree to work toward, no matter what they are making
6. Explain they have one day to complete the challenge
7. Explain the winning teams will be those who create a tent which slows down the melting process.

Debrief:

When the challenge is finished it is important to debrief the engineering process with the youth. The debriefing process begins with a quick review of what was done. Since this is a group project have the group review.

The second step is to reflect on what has been learned. Here are some questions which may help youth reflect.

1. What question did we answer or problem did we solve?
2. How did we work meet the criteria for success?
3. Did the criteria place constraints on materials, time or cost?
4. In what ways did our drawing guide our work?
5. How could it have been more helpful?
6. What data did we collect?
7. In what ways was it the data needed?
8. What other data could we have collected?
9. What did we learn from the data we collected?
10. When we look at our solution compared to the solution of others, which do we think more successfully met the criteria for success and meet any constraints on the solution?

Step three is to determine how the information gained in this Design Challenge can be used during the next one.



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Does The Magnet Stick December 29th

Background Information: A magnet is a kind of metal that pulls on other objects. A magnet will pull and stick to the object if it is made of metal. A clip is made of metal. Some watches are made of metal. These objects and other things made of metal will stick to a magnet. It is fun to predict what the magnet will stick to and what it won't. Trying this out will make this project easier.

Challenge: Mix two colors of paint **WITHOUT** touching the paints. Magnets may not touch the paint either.

Possible Criteria for Success: time it takes to mix the paints, at color was made when paints were mixed, all members of the team participated

What you will need:

- Two or more different colors tempera paint (be sure to have all primary colors—yellow, blue, and red)
- Metal paper clips (something else metal)
- Inexpensive paper plates (dessert or dinner size) magnets

What you will do:

1. Assemble the teams. Review the Inquiry Model which they are to apply in the planning and execution of this challenge.
2. Ask the children these questions:
 - a. What is a magnet?
 - b. What objects stick to a magnet?
 - c. How can you mix paint without touching it with your hands?
3. Share the challenge with the children
4. Brainstorm 3 criteria for success that everyone will agree to work toward, no matter how they do this project.
5. Demonstrate putting two drops of different colors of paint on a paper plate. Put the metal object into the paint.
6. Demonstrate how to use a magnet on the bottom of the plate to show how it can be mixed.
7. Ask youth to do what you demonstrated.
8. Then invite youth to come up with other ways to mix the paint without touching it directly or the object that is mixing it.

Debriefing



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