Science Unit: ***The Earth Around Us: Air, Water & Soil***

Lesson 9: ***Air Cannon***

School Year:	2009/2010
Developed for:	L'École Bilingue, Vancouver School District
Developed by:	James Day (scientist), Elisabeth Sones and Fabienne Goulet (teachers)
Grade level:	Presented to grades 1 - 2; appropriate for grades 1 - 7 with age appropriate modifications.
Duration of lesson:	1 hour and 20 minutes

Objectives

1. Reinforce the previous lesson in which we learned that air has mass.
2. Observe that air, just like any other object with mass, can be made to move.
3. Gain experience building equipment.
4. Discover that science can lead to fun.

Background Information

When looking at an empty box, it can be difficult to realize that the air inside (a gas) has mass (weighs something) and volume (takes up space).

But imagine turning an empty glass upside-down in a sink of water: the water does not rush into the glass because air is already in the glass, taking up space. When that glass is turned right-side-up, bubbles of air rise to the top of the water. You can also tell that air has mass when you stick your hand out of the window of a moving car: you can feel the air hitting your hand as it moves through the atmosphere.

The air cannon also demonstrates that air has mass and occupies volume. When the cannon is 'fired' (i.e., squeezed by the plastic membrane), the air inside the cannon rushes out of the hole because there is no space for it inside anymore. The expelled air exerts a force, or push, on the paper streamers across the room (or your sister's hair, or your parents' candles…).

How else can you use your air cannon to show that air has mass and volume?

Materials (per air cannon)

- cardboard box
- scissors
- duct and packing tape
- heavy plastic drop sheet
- 2 large rubber bands
- 2 paperclips
- hook screw
- small rubber stopper
- crayons
- stickers

In the Classroom

Introductory Discussion

1. Get students to imagine that they are pirates on a ship and have them say their best pirate "Aaaargh"! Ask them what they might have on their ship (cannons) to use to sink a nearby enemy pirate boat.

- What is a cannon?
- Does a cannon have to shoot a cannon ball?
- Could a cannon shoot air?

2. Lead a brief discussion to remind students of concepts from previous lessons.
   - Air has mass. (We learned this from the balloons and balance experiment.)
   - Air moves: wind. (We learned this from our windsock activity.)
3. Describe, in short, the air cannon activity.
4. Briefly explain that sometimes a scientist needs to build his/her own specialized equipment, often so that a certain test can be performed by the scientist. Part of being a professional scientist usually entails making some of the instruments required for our experiments. This activity is intended to show students that they are capable of building their own instruments (whether it be for science or just for fun).

Science Activity

Experiment Title: Building an air cannon.

Purpose of Activity: To demonstrate that air has mass and can be made to move. And, of course, for fun.

Instructions:
Set-up prior to experiment: Depends entirely on the age and ability of the students. For grades 1 and 2: advance preparation was steps 1-6, 8, and 9 (about 6 hours total for 40 air cannons); adults helped students with step 7, 10, and 11; students decorated by themselves. This was labour intensive, but is an extremely popular activity. Instructions below describe how to build one air cannon.

1. Unpack your 10 x 10 x 10 inch cardboard box.
2. Carefully remove all four flaps from one end of the cardboard box, using scissors.
3. Carefully remove two flaps which are opposite from one another from the other end of the cardboard box, using scissors.
4. Securely tape the remaining two flaps together using packing tape. The tape should run along the seam between the two flaps, as well as along the edges of the flaps against the side of the box. Do your best to make this end of the box “airtight”.
5. Cut a circular hole in the middle of the taped end of the box, with a diameter about half the width of the box. Once this hole is cut, you may line the circumference of this hole with duct tape for added strength.
6. Cut the heavy plastic drop sheet to size (about 20 x 20 inch square), so that its edges hang over the edges of the box by a few inches on all sides..
7. Using duct or packing tape, attach the sheet of plastic to the open end of the box (not the end with the hole). The edges of the plastic sheet should sit about only one or two inches below the edge of the box. The center of the plastic sheet, then, will be loose enough to sag into the box by a few inches. Once the plastic has been secured, wrap a few lengths of tape around the plastic/cardboard seam, doing your best to make this seam “airtight”.
8. Put a piece of duct tape in the middle of the plastic sheet.

9. From the inside of the box, push the eye screw through the taped center of the plastic and into the rubber stopper on the outside. Turn the eye screw into the rubber stopper until it is tight. The rubber stopper may now act as a handle with which to pull on the plastic from the outside of the box.
10. Poke two small holes in the box (one on either side) using a pencil, about half way back from the covered end of the box.
11. Tie the two rubber bands together to form one long rubber band. Lace this long rubber band through the eye screw and out through each hole on either side of the box. Pass the rubber band through a paperclip on the outside, on either side of the box, to keep the rubber band in place.
12. Decorate your air cannon with crayons and stickers.
13. To operate your air cannon: aim the box, hole-side forward, and pull the rubber stopper away from the box, stretching the plastic taut, then let go. Blow down targets clear across the room!
14. Have each student draw a picture of their air cannon in their science workbook.

References

1. <http://www.sciencecompanion.com/virtual-workshop-building-an-air-cannon/> Activity from the 'Science Companion (inspiring student to explore their world)' website [Includes resources for pre-K to grade 6 level, in the earth sciences, life sciences, and physical sciences].

Drawing of my Air Cannon

Conclusions:

Air moves.
We can make the air move.
Air can make things move, like:

_____

_____

_____

Photo de mon canon

Conclusion :

L'air bouge.

On peut faire bouger l'air.

L'air peut faire bouger les choses :

_____