Polymers, Weather and Balance!
Exploring Science through Children’s Literature
THEME: SCIENCE

Developed by
Creative Out-of-School Learning
kat@hypersurf.com
Polymers, Weather and Balance!
Exploring Science through Children’s Literature

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How to Use this Unit

This unit is designed primarily for elementary school students in grades 2-4. With supervision and adaptation, younger children can do many of the activities. 5th graders can read the books to younger children and then lead them in the science experiments.

The shopping list is priced to cover enough consumable materials for at least 20 participants.

Time needed: At least 8 weeks with two 1-1½ hour sessions per week. Before you start the unit, use the scheduling worksheet to organize your activities. If you are going to do a culminating activity, plan backwards from your that activity. Also, make a list of any extra material that you will need for the unit, and gather them before beginning. Be sure to include any movies, field trips or guest speakers.

Recommended scheduling:
When scheduling the various activities, note that there are games, arts and crafts activities and other types of activities suggested for enriching the book material. For example, in the activity suggestions for Mirandy and Brother Wind, it is suggested that you bake some cakes and have a CAKEWALK contest. When you are scheduling your activities, think of the time you will need to do the extra activities.

- Select your culminating activity at the beginning of your unit. Spend at least a week on each book. If you plan to invite family, community members, other program participants to the culminating activity, have the participants make and send the invitations out at least two weeks ahead of time.

Keys to successful use of the unit:
- Use the various books as a jumping off point for other enrichment activities. A few games and arts activities are suggested but think up new ones that touch on the interest of the participants.
- Additional explanations of the various scientific principles involving the various experiments are provided in the unit. The staff members should familiarize themselves with these concepts so that they can answer the participant’s questions. It is not the goal of this unit for the participants to master these scientific principles but to raise their curiosity.
- Bring in books about science and keep them available throughout the unit. Refer to them often. If you have access to the Internet have the participants explore different sites to find more information on the scientific principle involved.
- Many activities are group activities. Groups of four are optimal in encouraging participation and decreasing the amount of sitting around time that often leads to disruption.
- Most activities include literacy or math reinforcement opportunities. Make sure you include them not as an add-on but as an integral part of the activity.
# Scheduling Worksheet

**Culminating Activity:**

**Date:**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Date</th>
<th>Time</th>
<th>Group</th>
<th>Comments</th>
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</table>

**Supplies Needed:**

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Materials

Non-Consumable materials

- **Zack’s Alligator** Activity Kit from Steve Spangler’s website. Includes copy of the book, activity sheets and two large growing alligators
- Copy of the **Record Sheets of Alligator Growth/Shrinkage**
- Polymer growing alligators (One per group of four participants)
- Giant growing alligator
- Dishpans
- Scale
- Book: **George Shrinks**
- Colored pencils/permanent markers
- Scissors
- Cookie Sheet
- Oven/Toaster Oven
- Hot pads/tongs
- DVD: **The Red Balloon**
- 10 inch Bamboo cooking skewers
- Book: **Bartholomew and the Oobleck** by Dr. Seuss
- Bowls
- Tablespoons
- **Book: Mirandy and Brother Wind**
  - “Copter” Paper template
  - Paper Clips
  - Targets – Hulu hoops, paper plates
  - 8 oz plastic tub with lid
  - Gravel/Sand
  - Aluminum pie pans
  - Unsharpened pencils
  - Thumbtack
  - Compass
- Book: **Bringing the Rain to Kapiti Plain**
- Map of Africa
- **Bringing the Rain to Kapiti Plain** Choral Reading Script
- Directions for **Rain Game**
- Directions for **Cloud Formation** Science Experiment
- Large clear jar (Ask the cafeteria staff or a local restaurant for a jar)
- Flashlight
- Pictures of types of clouds
- Book: **Mirette on the High Wire**
- **Experiment Directions** Handout
- A yardstick, cane, or any stick of similar length
- Clay or other weights (even a pen or pencil will work)
- Small maps of the United States
- Variety of irregularly shaped pieces of wood, metal, etc.
- Coat hangers
- A block of wood (4 inches square and about 1/2 an inch thick) with a nail hammered into the center
- 10 penny size or larger identical nails with large heads

**Consumable materials**
- Water
- Sandpaper
- Shrinking Plastic Sheets
- White construction paper
- 9 inch latex balloons
- Cooking oil
- Corn Starch
- Powdered Borax
- White school glue
- Plastic bag of ice
- Matches
- Black construction paper
- Light blue or gray construction paper
- Chalk
- Index cards
- Paper Cups
- Small objects such as beads, small blocks, beans etc.

**Optional**
- Whistle
- Medium sized foam balls
- Hole punch
- Plastic loops
- Zipper pulls/Key Chains
- Green food coloring
- Thin string or twine
- Tape or glue
- Sheets 46 inches by 46 inches of strong paper (You can also use light vinyl or for really inexpensive kites, large kitchen trash bags)
- Strong, straight wooden sticks of bamboo or wooden dowels, 32 inches and 36 inches
- Ribbon or crepe paper
- *Flying Dragon Flies* from Oriental Trading Company 2 pks of 12@3.99
- Fixative
- Balance Beam, low wall, or 2 x 4 board on low blocks
- Books with pictures of Paris at the turn of the century and high wire acts
Shopping List for Science through Children’s Literature

Note: Does not include list of handouts found in the binder, recipe ingredients and common items such as paper, staplers, scissors etc. Prices do not include shipping cost. Based on 2009 prices.

<table>
<thead>
<tr>
<th>Item</th>
<th>Supplier</th>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polymer growing alligators</td>
<td>Steve Spangler Science</td>
<td>5 Pack</td>
<td>$1.95</td>
</tr>
<tr>
<td>Zack’s Alligator Activity Kit</td>
<td>Steve Spangler Science</td>
<td>#WZAC-600</td>
<td>$6.95</td>
</tr>
<tr>
<td>Giant Growing Alligator</td>
<td>Steve Spangler Science</td>
<td>#WALG-500</td>
<td>$3.95</td>
</tr>
<tr>
<td>DVD: The Red Balloon</td>
<td>Amazon.com</td>
<td></td>
<td>$9.99</td>
</tr>
<tr>
<td>10 inch Bamboo cooking skewers</td>
<td>Big Lot</td>
<td></td>
<td>$1.00</td>
</tr>
<tr>
<td>Aluminum pie pans</td>
<td>Dollar Store</td>
<td>3 packages</td>
<td>$3.00</td>
</tr>
<tr>
<td>Unsharpened pencils</td>
<td>Dollar Store</td>
<td>2 packages</td>
<td>$2.00</td>
</tr>
<tr>
<td>Thumbtack</td>
<td>Dollar Store</td>
<td></td>
<td>$1.00</td>
</tr>
<tr>
<td>9 inch latex balloons</td>
<td>Dollar Store</td>
<td>2 bags</td>
<td>$2.00</td>
</tr>
<tr>
<td>Crepe paper</td>
<td>Dollar Store</td>
<td></td>
<td>$1.00</td>
</tr>
<tr>
<td>Paper cups</td>
<td>Dollar Store</td>
<td></td>
<td>$1.00</td>
</tr>
<tr>
<td>Compass</td>
<td>Nasco</td>
<td>#SB33394M</td>
<td>$4.95</td>
</tr>
<tr>
<td>10 penny size nails with large heads</td>
<td>Home Depot</td>
<td>About half a pd.</td>
<td>$3.00</td>
</tr>
<tr>
<td>Medium grade sandpaper</td>
<td>Home Depot (Norton brand)</td>
<td>25 per pack</td>
<td>$2.49</td>
</tr>
<tr>
<td>Shrinking Plastic Sheets</td>
<td>Discount School Supply</td>
<td>25 sheets</td>
<td>$12.99</td>
</tr>
<tr>
<td>Lacing clips</td>
<td>Discount school Supplies</td>
<td>144 pieces</td>
<td>$3.49</td>
</tr>
<tr>
<td>White construction paper</td>
<td>Discount School Supplies</td>
<td></td>
<td>$.79</td>
</tr>
<tr>
<td>Build a Kite kit (Kit for 12)</td>
<td>Discount School Supplies</td>
<td>2 kits</td>
<td>$20.00</td>
</tr>
<tr>
<td>Light blue/grey construction paper</td>
<td>Discount School Supply</td>
<td></td>
<td>$.79</td>
</tr>
<tr>
<td>Black Construction Paper</td>
<td>Discount School Supply</td>
<td></td>
<td>$.79</td>
</tr>
<tr>
<td>Powdered Borax</td>
<td>Lucky</td>
<td></td>
<td>$0.00</td>
</tr>
</tbody>
</table>

$ 83.13

Websites listed
- Steve Spangler Science: http://www.stevespanglerscience.com/
- School Discount Supplies: http://www.discountschoolsupply.com/
- Nasco: www.enasco.com/

You will also need at least one copy of the following books:
- **Zack’s Alligator** by Shirley Mozelle (Included in the activity kit)
- **George Shrinks** by William Joyce, HarperTrophy. 1987
- **Bartholomew and the Oobleck** by Dr. Seuss, Random House. 1949
- **Mirandy and Brother Wind** by Patrician C. McKissack, Rainbow Book. 1988
- **Bringing the Rain to Kapiti Plain** by Verna Aardema, Puffin Book. 1981
- **Mirette on the High Wire** by Emily Arnold McCully, Scholastic, 1992
General Overview

List of Books

- **Zack’s Alligator** by Shirley Mozelle
- **George Shrinks** by William Joyce, HarperTrophy. 1987
- **Bartholomew and the Oobleck** by Dr. Seuss, Random House. 1949
- **Mirandy and Brother Wind** by Patrician C. McKissack, Rainbow Book. 1988
- **Bringing the Rain to Kapiti Plain** by Verna Aardema, Puffin Book. 1981
- **Mirette on the High Wire** by Emily Arnold McCully, Scholastic, 1992

DVD

- **The Red Balloon**, released by Janus Films, 1957

Guest Speakers, Field Trips and Movies

- Visit the Exploratorium.
- Watch *Honey, I Shrunk the Kids* after doing the activities related to **George Shrinks**
- Have a gymnast come and talk about the importance of maintaining balance when performing.
- Have a meteorologist come and talk to the group. San Francisco State University has a program in Geosciences including a certificate program in meteorology for broadcasters that might provide guest speakers.
- When doing **Bringing the Rain to Kapiti Plain**, check the libraries for copies of the Reading Rainbow video featuring the book.
- San Francisco wastewater treatment plant offers free tours for groups 5th grade and above. Check out the following website for more details: [http://sfwater.org/index.aspx?page=157](http://sfwater.org/index.aspx?page=157)
- The Disney movie *AristoCats* is pure fun, and is set in Paris at same time as the story **Mirette on the High Wire**, and can give the participants more of an idea of how the city might have looked.

Suggested Culminating Activity

Hold a Science Exploration Night for parents and community members at which the participants show the guests the different experiments.

### ACTIVITIES

<table>
<thead>
<tr>
<th>Polymers</th>
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<tbody>
<tr>
<td><strong>Zack’s Alligator</strong></td>
<td>Gro- Beasts: Measuring the Growing and Shrinking Alligator</td>
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<tr>
<td></td>
<td>Alligator Alley</td>
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<tr>
<td><strong>George Shrinks</strong></td>
<td>Shrinking Plastic</td>
</tr>
<tr>
<td><strong>The Red Balloon</strong></td>
<td>Skewer through a Balloon</td>
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<tr>
<td><strong>Bartholomew and the Oobleck</strong></td>
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</table>
### Wind, Rain and Clouds

<table>
<thead>
<tr>
<th>Activity</th>
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<tr>
<td>Difference between a Solid and Liquid</td>
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</table>

**Mirandy and Brother Wind**

- Capturing the Wind with Kites
- Copters – Using the Wind to Fly
- Making a Wind Vane

**Bringing the Rain to Kapiti Plain**

- Choral Reading
- Rain Game
- Cloud Formation
- Cloud Watching

### Balancing Act

<table>
<thead>
<tr>
<th>Activity</th>
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<tbody>
<tr>
<td>Mirette on the High Wire</td>
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<tr>
<td>• Center of Gravity by the Yard</td>
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<tr>
<td>• Center of Gravity – On the Move!</td>
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<tr>
<td>• Coat Hanger Balance Scale</td>
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<tr>
<td>• Balancing Nails</td>
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### Academic Skill Development

#### Specific Language Arts Activities

For all the different books and the activities associated with them:

- Reading the books tied to the science topics.
- Learning the vocabulary associated with each of the stories.
- Discussing the story before, during and after reading. (Use the questions listed below as a guide for leading the discussion of the different books).
- Writing observations about what happens in the different science experiments on an index card
- Researching the topics related to both the stories and the science in books and the internet

**Zack’s Alligator**

- Sequencing the story by making a story board of the various activities that Bridget, Zack and his friend did and then retell the story in order
- Writing a short story about the alligator that they are “growing.”
- Researching alligators on the Internet

**George Shrinks**

- Writing a letter that goes along with the gift of a key chain or zipper pull.

**Red Balloon**

- Writing and illustrating a care manual for taking care of a balloon friend.

**Mirandy and Brother Wind**

- Reading and discussing the poem “Wind” by Robert Louis Stevenson
- Reading the directions for making the kite

**Bringing the Rains to the Kapiti Plains**

- Performing the choral reading of *Bringing the Rains to the Kapiti Plains*
Specific Math Activities

- Measuring and weighing the polymer alligators as they grow and shrink in *Zack’s Alligator*
- Graphing the length and weight of the polymer alligators as they grow and shrink in *Zack’s Alligator*.
- Comparing the height of various objects to the height of George, five inches, after he has shrunk in *George Shrinks*.
- Determining the ratio of the various objects before and after they have been shrunk in *George Shrinks*.
- Measuring the distances of flights and the distance from missing the target in *Using the Wind to Fly*.
- Using a scale and other measurement tools in the various balancing activities related to the story *Mirette on the High Wire*.

Embedded Content Standards

Note: You can select any of the standards under **Literary Response and Analysis** sub-strand to emphasize when reading the literature selection.

**Language Arts/Reading**

**Reading:**

*Vocabulary and Concept development*

*Comprehension*

- Read and understand grade-level-appropriate material
- Follow written directions

**Writing**

*Writing Strategies*

- Create readable documents with legible handwriting
- Revise original drafts to improve sequence and provide more descriptive detail.

*Written and Oral English Language Conventions*

- Write with a command of standard English conventions appropriate to grade level

*Writing Applications*

- Write descriptions that use concrete sensory details to present and support unified impressions of people, places, things, and experiences (3rd Grade-expanded version of similar 2nd grade standard)

**Mathematic Content Standards**

*Measurement and Geometry*

- Compare the length, weight and capacity of objects by making direct comparisons with reference objects

*Statistics, Data Analysis, and Probability*

- Demonstrate an understanding of patterns and how patterns grow and describe them in general ways
- Make predictions for simple probability situations

*Mathematical reasoning*

- Explain the reasoning used with concrete objects and/or pictorial representations
QUESTIONS FOR READING

Below you will find a list of possible questions to help you with conversations about the book. They are not intended to be used all at once or every time you read. Use them at your discretion and where they are appropriate. Happy Reading!!

Questions to ask before you read

- Can you look at the pictures and predict what you think will happen in this book?
- What makes you think that?
- What characters do you think might be in our story?
- Do you think there will be a problem in this story? Why or why not?
- Does the topic/story relate to you or your family? How?

Questions to ask during the reading

- What do you think will happen next?
- What can you tell me about the story so far?
- Can you predict how the story will end?
- Why do you think the character did ________?
- What would you have done if you were the character?
- How would you have felt if you were the character? (use different characters)
- As I read __________, it made me picture ________ in my head. What pictures do you see in your head?
- As you read, what are you wondering about?
- Can you put what you’ve just read in your own words?

Questions to ask after reading

- Can you remember the title?
- In your opinion, was it a good title for this book? Why or why not?
- Were your predictions about the story correct?
- If there was a problem, did it get solved?
- What happened because of the problem?
- Why do you think the author wrote this book?
- What is the most important point the author is trying to make in his writing?
- What was your favorite part of the story?
- If you could change one thing in the story, what would it be?
- Can you retell the story in order?
- If you were __________, how would you have felt?
- What is the most interesting situation in the story?
- Is there a character in the story like you? How are you alike?
- Why did you like this book?
Polymers

• The Kids’ Macrogalleria of Polymer Fun: Clear explanation and activities that help explain the science of polymers  
  http://www.pslc.ws/macrog/kidsmac/index.htm
• Amazing Polymers from Science Kids at Home  
  http://www.sciencekidsathome.com/science_topics/amazing-polymers.html

Polymers are large molecules, and this is what one little piece of a polymer might look like if you could see it. It is large compared to other molecules because it is made up of many smaller molecules that are all stuck together like beads. The word "poly" in "polymer" means "many".

The smaller pieces that make up a polymer are called monomers. The word "mono" in "monomer" means "one".

Even though polymer molecules are considered large, they are still too small for us to see, even through a microscope. They are just so small. You can’t see molecules, but you CAN see polymers because they are made up of billions and trillions of these large molecules. When many similar molecules are all put together they form things like plastic and rubber.
Gro Beasts: Playing around with Polymers

Zack’s Alligator

Check out the website at Steve Spangler: http://www.stevespanglerscience.com/product/1408 for activities that you can do to with Gro Beasts: Polymer Alligators or the Teacher source website that has lesson plans
http://www.teachersource.com/Chemistry/GroBeastsPolymers/LargeGroBeastAlligator.aspx

Story Summary: Zack gets an alligator key chain from his uncle. When he puts the small alligator into water, the alligator on the key chain begins to grow and grow and grow. Soon, Zack has a real live alligator named Bridget for a friend. They go for lots of adventures in the park. Returning home later in the day, Bridget begins to shrink and shrink until she can again fit into Zack’s pocket, ready for another day of adventure.

Material
- Book: Zack’s Alligator by Shirley Mozelle
- Polymer Growing Alligators (Grows from 4 inches to 16 inches)
- Graph Paper
- Water
- Dishpans
- Scale
- Optional: Zack’s Alligator Activity Kit from Steve Spangler’s website. Includes a copy of the book, Activity sheet and two large growing alligators
- Optional: Giant Growing Alligator – grows from 12 inches to over 3 feet.

Directions
1. Before reading the book, Zack’s Alligator, have the participants talk about their pets. Tell them that they are going to hear a story about a pet that got bigger and bigger.
2. Go over the following vocabulary before reading the story.
   - Stretched
   - Slugs
   - Wobbled
   - Cartwheel
   - Bobbed
3. Read the book Zack’s Alligator.
4. Look through the book again discussing how Bridget, the alligator, grew bigger and bigger and then toward the end of the book gradually shrunk back down so that Zack could put them back into his pocket.
5. Game: Bridget was a friendly alligator. What would happen if not so friendly alligators came to your program? Play Alligator Alley (directions provided) and find out.
6. Literacy Reinforcement: After reading the story, have the participants list the different things that Zack and Bridget did during their first day together. Assign one event to pairs of participants and have them draw a picture of what happened. Encourage them to add details that might not have been in the story. Have them line up with their pictures in the same sequence as the sequence in the story. Have them retell the story in order by taking turns talking about their picture.
Science Experiment

1. **Math Reinforcement:** Make groups of five. Have each group, fill their dishpans with warm water and place a three inch polymer alligator in the water. Change the water the first couple of days, making sure that the participants use warm water.

2. Using the charts provided, have each group take measurements of mass (weight) and length every day (preferably at about the same time of day) until the alligator reaches its maximum size.

3. After the alligator has reached maximum size, have the participants take it out of the water, and measure and weigh it every day, until it gets back to its original size.

4. Ask the participants about the characteristics of the alligator material and have them come up with ideas on why the alligators “grow” in water. For older participants you can discuss the characteristic of elasticity of polymers. See the information below provided about polymers to get ideas for this discussion. If you want to know more about polymers, check out the following website: Polymer Basics- http://pslc.ws/macrog/kidsmac/wiap.htm

If you want to increase the “science” of the activity, experiment with the water, temperature or amount of sunlight. For example,
- Each group could use a different water source: pond water, salt water, bottled water, distilled water, carbonated, sugar vs. sugar free.
- Each group could use different water temperatures: cold, room temperature, warm – don’t use boiling water.
- Each group could place their dishpan so there it has a different sunlight exposure to sunlight: direct, shadowed, indirect.

*Literacy Reinforcement:* Have them name their growing alligator and write a story about its adventure.

Check out the following websites for more information about alligators.
- **National Geographic Creature Features:** http://kids.nationalgeographic.com/Animals/CreatureFeature/American-alligator
- **Fun Facts about Alligators:** http://www.eclockwood.com/gatorcam/kidspage.htm
- **How Stuff Works: Alligators** – (This website has a lot of ads but also some great pictures and information.) http://animals.howstuffworks.com/reptiles/alligator.htm
These super-slurping, water-absorbing creatures are made out of a special chemical called a superabsorbent polymer. A polymer is simply a very long chain of molecules. Think of this polymer as millions of microscopic sponges that absorb water. Superabsorbent polymers are long chains of molecules that soak up tremendous amounts of water because the water is drawn into and held by the molecules of the polymer. These polymers can absorb as much as 500 times their weight in plain water.

These growing creatures are made out of two different polymers: A hydrophilic (water-loving) superabsorbent polymer that is responsible for the water absorbing action and a hydrophobic (water-fearing) polymer. The hydrophilic polymer in the object is the superabsorber, similar to the polymer found in baby diapers (the actual chemical is a little different, but it is a similar superabsorbent polymer). The hydrophobic polymer does not absorb water, but its job is to keep the original shape of the creature when it swells up with water.

More discussion about Polymers
http://pslc.ws/macrog/kidsmac/basics.htm

Polymers are made up of many many molecules all strung together to form really long chains (and sometimes more complicated structures, too).

What makes polymers so fun is that how they act depends on what kinds of molecules they're made up of and how they're put together. The properties of anything made out of polymers really reflect what's going on at the ultra-tiny (molecular) level. So, things that are made of polymers look, feel, and act depending on how their atoms and molecules are connected, as well as which ones we use to begin with! Some are rubbery, like a bouncy ball, some are sticky and gooey, and some are hard and tough, like a skateboard.
# Record of Alligator Growth

Name ____________________________________________________________

<table>
<thead>
<tr>
<th>Day #</th>
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Alligator Alley

Materials

- 30-40 (or more) small hoops and/or polyspot
- Whistle
- 4 medium sized foam balls
- Optional: Cones to make end lines in a rectangular shape, if the area does not have lines

Directions

1. Scatter all of the hoops around the playing area so that each hoop is close enough to another so that for participants to jump from one to the other.
2. Four participants will be chosen to be the "alligators"; these participants will use the foam balls in order to gently tag participants. All other participants will be spread out on different end lines, so they are not close to other participants.
3. On your start signal, participants will jump from the end line to a hoop, and then proceed to jump from one hoop to another. Their goal is to reach a different end line without getting tagged by the "alligators" (you can choose to also have alligators jump in order to move).
4. Alligators may only tag someone that does not have both feet in a hoop. When both feet are in a hoop, a participant is "safe"; only one person is allowed in a hoop at a time. Taggers may not "guard" a hoop, waiting for a participant to jump out; conversely, a participant may not stay in a hoop for more than a count of ten.
5. When tagged by an alligator, the participant must go back to their beginning line and start once again. They can earn a "point" if they make it safely to a different end line, if desired -- they can see how many points they can earn in each "round" (they just begin again from this new end line). Periodically stop the game; allow each tagger to give the ball to a new participant, and everyone begins again at an end line.
6. During the game, you can specify different types of jumps for the participants to do, or allow them to choose their own jumps.

Variations:

- Participants in wheelchairs can move among the hoops to be alligators. Or, they can use a bean bag or other object to put into a hoop to signify that they are "in" that hoop (alligators or other participants can pick up the bean bag so they can begin once again).
- Participants who do not jump as well have the choice to be given "swamp shoes" that allow them one step between the hoops before jumping to a new hoop.
- For an added challenge, give older participants not only a jump to use in and out of their hoop, but also give them a direction to jump in (i.e. forward, backward, right, or left).

Adapted from game submitted by Brent Johns who teaches at Springfield Elementary School in Panama City, FL. PE Central! http://www.pecentral.org/lessonideas/PrintLesson.asp?ID=338
Polymer Fun with *George Shrinks*

**Story Summary:** When George wakes up one morning, he realizes that his dream has come true. He has shrunk. He's smaller than his toy soldiers and smaller than his baby brother. But he's still the responsible boy his parents trust to obey orders they have left in a note beside his bed.

**Materials**
- Book: *George Shrinks* by William Joyce
- Sandpaper
- Shrinking Plastic Sheets
- Colored pencils or permanent markers
- Scissors
- Aluminum Foil
- Cookie Sheet
- Oven/Toaster Oven
- Oven mitts or tongs
- Optional: Hole punch
- Optional: Plastic loops
- Optional: Zipper pulls/Key Chains

**Directions:**
1. Before reading the book, *George Shrinks*, have the participants image what it would be like to be only five inches tall. *Math Reinforcement:* Show them a ruler and point out five inches. Have them see how big five inches is compared to a book, a desk, a door, a friend’s leg.
2. After reading the story, tell them that they are going to to shrink something.
3. Hand out the plastic sheets. If you are going to use recycled plastic, have them cut out a flat section from the containers. Remember to only use #6 plastic.
4. Have them slightly sand the surface of the plastic. This will provide a better surface for the color.
5. Have them decide on their design. Encourage to keep the design simple. They can trace a picture from a book or draw free hand. The plastic will shrink to about a half to a third of its original size. Remind them that whatever they draw, will shrink down to a third of its original size, so they should not make the details too small.
6. Have them draw the design and color on the plastic. Only use colored pencils or permanent markers. *Water based markers or crayons do not work.*
7. If you plan to make key chains or zipper pulls out of your “shrinks,” punch a hole in the plastic. Remember the hole will shrink too.
8. Cut the design out of the plastic sheet. Place the piece of plastic on a piece of aluminum foil folded to make a tray. Carefully place the aluminum foil with the plastic in a pre-heated 350° oven/toaster oven.
9. **Watch it shrink!!!** The plastic will curl while it shrinks but will flatten out. Leave in the oven for between 3-3 ½ minutes. Carefully take the aluminum tray out of the oven and let cool.

10. **Math Reinforcement:** Have them measure their creation both before and after it is shrunk. Keep a graph of all of the projects and determine the ratio of the original to the shrunk object.

11. Have the participants talk about what happened. What caused the plastic to shrink? Do all things that you put in the oven shrink? What about marshmallows?

12. **Literacy Reinforcement:** For added literacy reinforcement, have the participants make a key ring or zipper pulls as a present for a friend or family member, and then write a letter.


The type of plastic used in this activity is made of polystyrene, a polymer. Polystyrene and certain other polymers shrink when heated because of how they are made. When these plastics are manufactured, they are heated, stretched, and then quickly cooled. The sudden cooling freezes them into the stretched-out configuration (form). When they are heated again at low temperatures, the polymer molecules return to their original configuration (form) resulting in the observed shrinkage.
The Red Balloon:
Skewer through a Balloon- More Polymer Fun

Science experiment adapted from
http://www.stevespanglerscience.com/content/experiment/00000135

Story Summary: “The Red Balloon,” a movie with no words tells a simple story of a young French boy who finds a balloon tied to a Paris lamppost and the adventures they have. The balloon follows the boy everywhere including to school until they run into bullies who want the balloon for themselves.

Materials
- DVD: The Red Balloon (38 minutes)
- White construction paper
- Markers/Crayons
- 9 inch latex balloons
- 10 inch Bamboo cooking skewers
- Cooking oil
- Permanent Fine Point Markers

Directions
1. Watch the movie, “The Red Balloon.”
2. Talk about what it would be like having a balloon for a friend. Then discuss what they would have to do to keep it from popping. List their ideas about caring for the balloon.
3. Literacy Reinforcement: Have the participants develop a “Care Manual” for their friend, the balloon. Each participant could write one “care tip” on a piece of white construction paper and then decorate the page. Staple the pages together and make a “balloon care manual.” Work together to decide on a cover page and decorate.

Tying in the Science
1. Have the participants get into pairs. Have each pair inflate a balloon until it is nearly full size and then let about a third of the air out. Tie a knot in the end of the balloon (where the knot is tied and the opposite end).
2. Have the participants examine the balloon until they notice a thick area of rubber at both ends of the balloon (where the knot is tied and the opposite end).
3. Have each pair dip the tip of the wooden skewer into the cooking oil. The cooking works as a lubricant letting the skewer puncture the balloon without causing too much damage.
4. Have them place the sharpened tip of the skewer on the thick end of the balloon and push the skewer into the balloon. Make sure they are careful not to jab themselves or the balloon with the skewer. Just use gentle pressure (and maybe a little twisting motion) to puncture the balloon.
5. Have them push the skewer all the way through the balloon until the tip of the skewer touches the opposite end of the balloon where there is another thick portion of the balloon. Keep pushing until the skewer penetrates the rubber.
6. Have them then gently remove the skewer from the balloon. The air will leak out of the balloon, but the balloon will not pop.
Continuing the experiment:
1. Talk about how the balloons are made of latex molecules, a type of plastic that stretches.
2. Before blowing up the balloon, have each pair use a permanent pen to draw about 10-15 dots on the balloon. The dots should be about the size of the head of a match. Be sure to draw them at both ends and the middle of the balloon.
3. Have them inflate the balloon half way and tie the end. Observe the various sizes of the dots all over the balloon.
4. Ask the participants to examine the balloon and using the size of the dots, decide where the latex molecules are most and least stretched. Have them come up with a guess on where on the balloon, they can puncture the balloon without popping it.
5. Have them test their guess by carefully puncturing the balloon with the oiled bamboo skewer where they think it will not pop.

Explanation of Skewer the Balloon

Taken from Steve Spangler’s Making Science Fun: Skewer the Balloon
http://www.stevespanglerscience.com/content/experiment/00000135

The secret is to uncover the portion of the balloon where the latex molecules are under the least amount of stress or strain. After drawing on the balloon with the Sharpie marker, you probably noticed that the dots on either end of the balloon were relatively small. You’ve just uncovered the area of least stress... the ends of the balloon. When the point of the skewer is positioned at the ends of the balloon, the solid object passes through the inflated balloon without popping it.

If you could see the rubber that makes up a balloon on a microscopic level, you would see many long strands or chains of molecules. These long strands of molecules are called a polymer, and the elasticity of these polymer chains causes rubber to be stretchy. Blowing up the balloon stretches these strands of polymer chains. Even before drawing the dots on the balloon, you probably noticed that the middle of the balloon stretches more than either end. You wisely chose to pierce the balloon at a point where the polymer molecules were stretched out the least. The long strands of molecules stretched around the skewer and kept the air inside the balloon from rushing out. It’s easy to accidentally tear the rubber if you use a dull skewer or forget to coat the end of the skewer with vegetable oil. When you remove the skewer, you feel the air leaking out through the holes where the polymer strands were pushed apart. Eventually the balloon deflates… but it never popped. Thanks to chemistry, you’re amazing!

Oh, just to prove your point, try pushing the skewer through the middle part of an inflated balloon. At least you went out with a bang.
Bartholomew and the Oobleck
What is the difference between a solid and a liquid?

**Story Summary:** The king is tired of the things that come down from the sky; rain, snow, sunshine and wind. He tells his page boy, Bartholomew to summon the royal magicians to create something new. Bartholomew warns him not to do anything reckless, but the king ignores his pleas. Soon, sticky, gooey, green Oobleck starts falling from the sky, threatening to destroy everything. Bartholomew finally gets the king to apologize for thinking he is more important than nature, and the Oobleck stops falling.

**Materials**
- **Bartholomew and the Oobleck** by Dr. Seuss
- Corn Starch
- Water
- Bowls
- Tablespoons
- Powdered Borax
- White school glue
- Optional: Green food coloring

**Directions:**

1. Before reading the story, **Bartholomew and the Oobleck**, talk about the characteristics of rain and snow.
   - Ask whether rain or snow sticks to things or whether it just lies on top of things.
   - Ask whether snow and rain are solids or liquids.
   - Ask what they think would happen if snow or rain stuck to things after it fell from the sky, and never melted.
2. Introduce the following vocabulary before reading the book:
   - Wrecked
   - Growled
   - Bellowed
   - Musty
   - Shuffling
   - Shimmering
   - Bell tower
   - Proclaims
   - Pelting
   - Chamber
   - Splattering
   - Hubbub
3. Read the story, **Bartholomew and the Oobleck**.
4. After reading the story, tell the participants that the magicians really made two types of Oobleck and they have to figure out the difference. Then have them make the two different types using the following recipes. Discuss the properties of each.
Oobleck Recipe One – Corn Starch
Non-Newtonian fluid

- 2 parts cornstarch
- 1 part water
- Drop of green food coloring

If you want to make a large batch, you would use two cups of cornstarch and one cup of water. For an individual batch, you would use two tablespoons cornstarch and one tablespoon water. Be careful when using the food coloring because it can stain hands or clothes.

Discussion
1. Have the participants experiment with the substance.
   - Pick up a handful and squeeze it. What happens? (It should feel solid.)
   - Stop squeezing it. What happens? (It should start dripping through the fingers.)
   - Rest the fingers on the surface of the Oobleck. Let the fingers sink down to the bottom of the bowl. They try to pull them out fast. What happens?
   - Smack water with a spoon. What happens? (It splashes.) Smack the Oobleck and see what happens. (It should act like a solid, not moving.)
   - Put a small object on the surface of the Oobleck. What happens? Put a little heavier object on it. What happens? Put a little pressure on the object. What happens?

2. Ask the participants whether they think the Oobleck is a liquid or a solid. Talk about the fact that Corn starch Oobleck is called a non-Newtonian fluid. Here are simple characteristics of liquid and solids.

Liquid:
- Takes on the shape of the container that it occupies
- Is easily compressible (little free space between particles)
- Flows easily (the particles can move/slide past one another)

Solid:
- Has a fixed volume and shape (the particles are locked into place)
- Is not easily compressible (little free space between particles)
- Does not flow easily (the particles cannot move/slide past one another)

They should come up with the conclusion that it is neither. Discuss that Oobleck is a non-Newtonian fluid. -- a substance that exhibits characteristics of both solids and liquids. See the discussion below for more information about non-Newtonian fluids.
Oobleck Recipe Two- Borax based Polymers
(Also called Silly Putty)

**Borate solution:**
- 2/3 cup warm water
- 1 ½ teaspoon powdered Borax
- 3 drops food coloring

*Mix together in a 1 cup measuring cup using a wooden spoon*

**Glue Solution:**
- ¾ cup warm water
- 1 cup white school glue

*Mix together in a mixing bowl using a wooden spoon.*

**Note:** You can experiment with the amount of water and borax powder you add. The results will vary on how “drippy” it is.

Pour the borate solution into the bowl with glue solution.

1. Use your hands to gently lift and turn the mixture until only one tablespoon of liquid is left. The Oobleck will be sticky for a moment or two.
2. After the excess liquid has dripped off, the Oobleck is ready.
3. When finished, store in a plastic bag in the refrigerator. When you are through, discard in a waste can. DO NOT try to wash it down the sink. If it dries on carpet or clothing, cover it with a cloth soaked in vinegar to de-gel it, then wash the area with detergent and water.

**Discussion**

1. Have the participants experiment with the Borax-based Oobleck. (These questions are taken from the Science Explorer by the Exploratorium in the ExploraGoo section.)
   - Can they stretch it?
   - Can you pour it from one hand to the other?
   - If you pull it apart quickly, what happens?
   - Can you pull off a piece, form it into a ball and bounce it?
   - If you press it into a small container does it make a rude noise?
2. Tell the participants that this kind of OOBLECk is what is called a polymer, a giant molecule made up of thousands of smaller molecules.

**Summing It Up**

1. Have the participants compare the two different types of Oobleck.
2. Ask the following questions?
   - How were the two OOBLECKS the same and how were they different?
   - Which one did they think would make more of a mess in King Derwin’s Kingdom? Why?
   - If the king had not said he was sorry, how would the people of the kingdom of Didd clean up all the OOBLECk?
Oobleck is often referred to as a 'non-Newtonian' substance. Scientists have attempted to explain the unusual properties of Oobleck and similar substances in various ways. There is extensive literature on the subject including a 1906 article by Albert Einstein.

When most fluids cool they become more viscous. This means that their resistance to flowing increases. Cooking oil is a common example. Such fluids are called Newtonian. But there is another class of liquids called non-Newtonian. Their viscosity, lessen ability to flow, increases not with temperature, but when the liquid is stirred or compressed. But naming the property doesn’t explain it, and some scientists have concentrated on the shape of starch molecules and how they fit together. Others have speculated that the electrical charge of the molecules is the key to Oobleck’s strange behavior.

If you decide to discuss this question with your participants, begin by asking them for their ideas on why Oobleck behaves the way it does. Then ask them to imagine that they can see the individual molecules of cornstarch and water and to think about how they might act when being poured or pushed and pulled. This gives the students the opportunity to formulate their own models.

In one possible model, the starch molecules are compared to sand and water in a plastic squeeze bottle. The grains of sand are closely packed with a little water in between. The water’s surface tension doesn’t allow all the space between the sand grains to be filled with sand. Squeezing the bottle gently forces the sand grains to move against each other. This increases the spaces and allows more water to fill the spaces. The more gently you squeeze the more time there is for the water to fill the spaces and provide lubrication. But if you squeeze the bottle quickly, there isn’t enough water between the sand grains and friction between the sand grains resists the flow. Although sand grains are much larger than molecules of starch, starch molecules are quite large and the mix of cornstarch and water may react very much like a mixture of sand and water. This is one explanation for why Oobleck flows like a fluid, but reacts as a solid when suddenly compressed.

Other scientists base their Oobleck models on chemistry. Cornstarch is made of long chain molecules called polymers. When water is added to cornstarch and the mixture is compressed, the molecules become "tangled" and are unable to slide easily against one another.

A third model suggests that starch molecules acquire an electric charge as they rub together. The faster they are rubbed, the more electrical attraction is created among the molecules. This causes the increase in viscosity.

You could end the discussion by explaining just how difficult it is to observe what’s going on at a molecular level just by observing the properties of a substance. Since there is no conclusive explanation of why the corn starch Oobleck behaves as it does, suggest to your students that perhaps one day one of them will become a scientist and discover an explanation for the strange properties of Oobleck that everyone will agree is the correct one.
Wind, Rain and Clouds
Mirandy and Brother Wind: Capturing the Wind

Note: If possible, wait for windy days to read the book and do the activities

Story Summary: This picture book was inspired by a photo of the author's grandparents winning a cakewalk, a dance rooted in Afro-American culture and her grandfather's boast that, in her dancing, his wife had captured the wind. In the book, Mirandy determines to catch Brother Wind and have him for her partner in the upcoming junior cakewalk. She tries a number of tactics springing from folk wisdom, and finally succeeds in trapping her prey in the barn. At the contest, Mirandy chooses to dance with her friend Ezelbut, with Brother Wind to do her bidding, the two friends win the cakewalk in style.

Material
- Book: Mirandy and Brother Wind by Patricia C. McKissack, Dragonfly Books
- Build a Kite – Kit for 12 from Discount School Supplies
- Optional: Directions for making kites

Directions
1. Before reading the story, Mirandy and Brother Wind, ask the participants if they have ever seen the wind. They might talk about seeing things affected by the wind, (flags waving, branches or cloud moving) but ask if they can actually see the wind. Go outside and have the participants find evidence that the wind is there such as leaves or branches moving, a flag moving, their hair moving. Put a piece of paper on the ground and see if it moves in the wind (remember to have someone pick it up).
2. Tell them that in the story they are going to hear, Mirandy, a young girl wants to capture the wind so that the wind can help her win a dance contest. Ask them how they think the wind could help her dance better.
3. Before reading the book, quickly review the following vocabulary:
   - High steppin’
   - Cakewalk-Dance contest performed by couples who strut and prance around a large square, competing for a cake. – First introduced in America by slaves.
   - Shackles – ring made of metal that is used to secure the wrist or ankle to prevent freedom of movement
   - Strutted
   - Sassy
   - Conjure woman (someone who people believe practices magic by casting spells or using charms)
   - Moping
   - Jubilee – celebration
4. Art Activity: After reading the story, have the participants come up with ideas on how to they would capture the wind. Have them draw pictures of their “wind” traps. Note: In the back of the book, there is a list of other great activities that you do such as putting on your own CAKEWALK contest.
5. Literacy Reinforcement: Read the poem The Wind by Robert Louis Stevenson and discuss.
6. Do the following science activities about “capturing and using the wind.”
*Literacy Reinforcement:* Have them write their observations. Hand out the direction sheet for making a kite, and let them read the directions. Only demonstrate the different steps if they have trouble understanding the directions. The more they do the task by just following the written directions, the more literacy practice they will experience.
The Wind
by Robert Louis Stevenson

I saw you toss the kites on high
And blow the birds about the sky;
And all around I heard you pass,
Like ladies' skirts across the grass--

I saw the different things you did,
But always you yourself you hid.

I felt you push, I heard you call,
I could not see yourself at all--

O you that are so strong and cold,
O blower, are you young or old?

Are you a beast of field and tree,
Or just a stronger child than me?
Capturing the Wind with Kites

Material
- **Build a Kite – Kit for 12 from Discount School Supplies:** Kit includes plastic kite surfaces, tails, handles, strings, poles and instructions to make 12 kites that really work!. Kites measure a big 26"L x 26"H.
- Permanent Markers

Directions:
1. Have the participants each make their own kits from the kit and decorate them.
2. Go outside and fly them.

If you want to make a kite from scratch, here are some directions for a simple one.

Material
- Thin string or twine, Tape or glue, Sheets 46 inches by 46 inches of strong paper (You can also use light vinyl or for really inexpensive kites, large kitchen trash bags), Strong, straight wooden sticks of bamboo or wooden dowels, 32 inches and 36 inches, Ribbon or crepe, paper, Markers/paint/ crayons

Directions:
1. Make a cross with the two sticks, placing the shorter stick horizontally across the longer stick. Make sure that both sides of the crosspiece are equal in width. Tie the two sticks together with the string so that are at right angles.
2. Cut a notch at each end of both sticks deep enough so that the string can be fitted inside the cut.
3. Cut a piece of string long enough to stretch all around the kite frame. Make a loop in the top notch and fasten it by wrapping the string around the stick.
4. Stretch the string through the notch at one end of the crosspiece, and make another loop at the bottom. Stretch the string through the notch at one end of the loop at the bottom. Stretch the string through the notch at the other end of the crosspiece. Finish by wrapping the string a few times around the top of the stick and cutting off the excess string.
5. Tighten the string frame, making sure not to bend the sticks.
6. Place the cross sticks down on top of the paper or vinyl. Using the string frame as a guide cut out the material making sure that you leave about 2 to 3 inches more to glue around the frame.
7. Fold these edges over the string frame and tape or glue it down so that the material is tight.
8. Cut a piece of string about 60 inches long. Tie one end of the string to the top loop.
9. Bring the string down and make another loop in the string above the cross piece, but not attached to the wood. Your flying line will be attached to this loop. Continue to bring your string down and attach again to the bottom loop leaving enough string to attach the ribbons to form the tail.
10. Tie ribbon bows about every 4 inches around the dangling end of the string. You could also make a tail by ending your string at the bottom loop, and then attaching long streaming ribbons to the vertical stick letting the ribbons trail below the kite. Decorate them and go flying.
Using the Wind to Fly
Modified from Roto-Copter Science Explorer, Exploratorium

Materials
• “Copter” Paper template
• Scissors
• Markers/Crayons
• Paper Clips
• Targets – Hulu hoops, paper plates
• Optional: Flying Dragon Flies from “Oriental Trading Company”
• Optional: Markers

Directions
1. If desired, have the participants use different colors to decorate their Copters before cutting them out. When they spin these colors will blend together making a colorful design.
2. Have them cut along the solid lines only.
3. Then, fold A down in one direction, and B in another direction.
4. Fold C and D over each other so that they overlap.
5. Fold the bottom up and slide a paper clip to hold it together.
6. After the participants have made their copter, have them throw it like a baseball. Have them throw them from different heights such as when standing on a chair or on top of a set of stairs.
7. Math Reinforcement: Measure their distances for both their flights and the distance from missing the target. Compete for accuracy and distances.
8. Have them write up their observations.

Explanation: Taken from The Science Explorer, Exploratorium pg. 56.
When the copter falls, air pushes up against the blades, bending them up just a little. When air pushes upward on the slanted blade, some of that thrust becomes a sideways or horizontal push.

http://www.thinkingfountain.org/w/whirlingwonders/whirlingwonders.html
Why doesn’t the copter simply move sideways through the air? That’s because there are two blades, each getting the same push, but in opposite directions. The two opposing thrusts work together to cause the top to spin.

Next time you drop your copter, notice which direction it spins as it falls. Is it clockwise or counterclockwise? Now bend the blades in opposite directions, - if blade A was bent toward you and Blade B was bent away, bend B toward you and A away. Drop the copter again. Now which way does it spin?

Air pushes up on the flat sides of the strip of paper. When the flat side of the paper strip is parallel to the ground, the copter drifts down like a flat piece of paper. But if the copter tilts so that the flat side of the strip is at an angle to the ground, the paper strip gets a sideways push, sending it spinning. Each time the flat strip comes around, it gets another push and goes for another spin. As the copter falls, air collides with the blade and is forced outward. This outward movement causes a push on the copter that makes it spin.
Making A Wind Vane
Adapted from NASA Making a Wind Vane
http://www.nasaexplores.com/show_k4b_teacher_sh.php?id=030102151913

Materials
- 8 oz plastic tub with lid (ask your local deli for contribution)
- Gravel/Sand/Beans
- Aluminum pie pan
- Unsharpened pencils
- Scissors
- Thumbtacks
- Compass

Background Information:
Wind is invisible, so it’s hard to track its movement. A wind vane is a tool to determine the wind’s direction.

Directions
1. Break the group into pairs. Give each pair a set of materials.
2. Have the pairs put a pencil, with the eraser facing up, in the center of the plastic tub. Fill the tub with gravel/sand/dirt around the pencil.
3. Have the participants cut a dime size hole in the center of the tub lid. Then, have them draw lines on the lid and label the top of the tub: N, NE, E, SE, S, SW, W, and NW.

4. Have them carefully put the lid on the tub. The pencil should go through the hole made through the center of the lid.
5. Next have the participants, draw an arrow on the bottom of the foil pan with a marker, and cut it out. Place the center of the wind vane arrow on top of the pencil. Use a thumbtack to loosely fasten the wind vane arrow to the pencil eraser. The wind vane arrow should be able to rotate on top of the pencil.
6. Have the participants take their wind vane outside. Using the compass to determine the north. Set the tub so that the N on the lid of the tub is facing north.
7. Tell the participant that the arrow points into the wind and gives you the name of the wind. An arrow pointing to the north tells you it is a north wind. When the arrow points between two directions, such as north and east, it is a northeast wind.
Bringing the Rain to Kapiti Plain

Story Summary: This story is written in rhyme and is based on a Nandi folktale from Kenya, Africa. The book tells the story of how a young African herdsman pierced a “big, black cloud all heavy with rain” with an arrow and eagle feather to bring the rain and end the drought on the plain that was affecting the life of all the animals and plants.

Note: Reading Rainbow Video of Bringing the Rain to Kapiti Plain is available at the following SF Libraries: CHINATOWN CHILDREN’S, EXCELSIOR CHILDREN’S, MAIN - 2nd Floor - Children's Center, SUNSET CHILDREN’S, WESTERN ADD CHILDREN’S

Material
- Book: Bringing the Rain to Kapiti Plain
- Map of Africa
- Choral Reading Script
- Cloud Watching Handout
- Pictures of types of clouds
- Light blue or gray construction paper
- Chalk
- Markers or crayons
- Optional: Fixative

Directions:
1. Before reading the story, talk to the participants about droughts. Some topics you might discuss are
   a. Where does the water they use at school and in their homes come from? If they say it comes from the faucet keep asking “Where does the water come that is in the faucet?”; Where does the water come that is the pipes?”;”Where does the water come that is in the city?” until finally they reach the conclusion that the water eventually had to originate from rain or snow. Note: If you want to make this a computer project, have the students research where the water comes from in their area.
   b. What needs water to exist? Basically the answer is everything that is alive. Keep asking for examples until they reach that conclusion.
   c. What would happen to things that are alive if there was not enough water?
   d. How could you conserve water?
2. Show where Kenya is on a world map. Kapiti plains are open grasslands to the south and southwest of Nairobi. If you have access to the computer or other books about Kenya show them pictures of the wildlife and vegetation on the African plains. Use “African Savanna” as a search term to get some good pictures.
3. Introduce the following vocabulary before reading the story:
   a. Herdsman
   b. Pasture
   c. Belated
   d. Migrated
e. Drought
f. Stork
g. Leather thong
h. Pierced

4. **Choral Reading:** After having completely read and discussed the book and given all the background information, perform the story as a choral reading. See the Choral Reading Script Handout below
   a. Pass out the handout of the story with the different parts designated. Read the story together a few times until everyone is comfortable with the words.
   b. Divide the participants into four groups and assign the parts to each group. Let them practice their parts together a couple of times.
   c. When they are comfortable reading their parts, have them stand up and perform the choral reading.
   d. *(Optional)* If you are going to perform this story in front of an audience, have the groups draw pictures on large butcher paper of the major scenes described in the book. Have the participants take turns holding up the pictures when they are saying the lines.

5. **Game:** Play the Rain Game – Check out the directions below.

7. **Art Activity:** Do the *Cloud Watching* activity. **Literacy Reinforcement:** Hand out the direction sheet for *Cloud Watching* and let them read the directions. Only demonstrate the different steps if they have trouble understanding the directions. The more they do the task by just following the written directions, the more literacy practice they will experience.

6. **Science Activity:** Check out the directions for *Cloud Formations*
Bringing the Rain to Kapiti Plain
By Verna Aardema

The whole class: This is the great Kapiti Plain, all fresh and green from the African rains--A sea of grass for the ground birds to nest in, and patches of shade for wild creatures to rest in; with acacia trees for giraffes to browse on, and grass for the herdsmen to pasture their cows on. But one year the rains were so very belated, that all of the big wild creatures migrated. Then Ki-pat helped to end that terrible drought--and this story tells how it all came about!

Group 1: This is the cloud, all heavy with rain, that shadowed the ground on Kapiti Plain.

Group 2: This is the grass, all brown and dead, that needed the rain from the cloud overhead—

Group 1: The big, black cloud, all heavy with rain, that shadowed the ground on Kapiti Plain.

Group 3: These are the cows, all hungry and dry, who mooed for the rain to fall from the sky;

Group 2: To green-up the grass, all brown and dead, that needed the rain from the cloud overhead—

Group 1: The big, black cloud, all heavy with rain, that shadowed the ground on Kapiti Plain.

Group 4: This is Ki-pat who watched his herd as he stood on one leg, like the big stork bird;

Group 3: Ki-pat, whose cows were so hungry and dry, they mooed for the rain to fall from the sky;

Group 2: To green-up the grass, all brown and dead, that needed the rain from the cloud overhead—

Group 1: The big, black cloud, all heavy with rain, that shadowed the ground on Kapiti Plain.
**Group 1:** This is the eagle who dropped a feather, a feather that helped to change the weather.

**Group 4:** It fell near Ki-pat, who watched his herd as he stood on one leg like the big stork bird;

**Group 3:** Ki-pat, whose cows were so hungry and dry, they mooed for the rain to fall from the sky;

**Group 2:** To green-up the grass, all brown and dead, that needed the rain from the cloud overhead—

**Group 1:** The big, black cloud, all heavy with rain, that shadowed the ground on Kapiti Plain.

**Group 2:** This is the arrow Ki-pat put together, with a slender stick and an eagle feather; **Group 1:** From the eagle who happened to drop a feather, a feather that helped to change the weather.

**Group 4:** It fell near Ki-pat, who watched his herd as he stood on one leg like the big stork bird;

**Group 3:** Ki-pat, whose cows were so hungry and dry, they mooed for the rain to fall from the sky;

**Group 2:** To green-up the grass, all brown and dead, that needed the rain from the cloud overhead—

**Group 1:** The big, black cloud, all heavy with rain, that shadowed the ground on Kapiti Plain.

**Group 3:** This is the bow, so long and strong, and strung with a string, a leather thong;

**Group 2:** A bow for the arrow Ki-pat put together, with a slender stick and an eagle feather;

**Group 1:** From the eagle who happened to drop a feather, a feather that helped to change the weather.

**Group 4:** It fell near Ki-pat, who watched his herd as he stood on one leg like the big stork bird;
**Group 3:** Ki-pat, whose cows were so hungry and dry, they mooed for the rain to fall from the sky;

**Group 2:** To green-up the grass, all brown and dead, that needed the rain from the cloud overhead—

**Group 1:** The big, black cloud, all heavy with rain that shadowed the ground on Kapiti Plain.

**Group 4:** This was the shot that pierced the cloud and loosed the rain with thunder LOUD!

**Group 3:** A shot from the bow, so long and strong, and strung with a string, a leather thong;

**Group 2:** A bow for the arrow Ki-pat put together, with a slender stick and an eagle feather;

**Group 1:** From the eagle who happened to drop a feather, a feather that helped to change the weather.

**Group 4:** It fell near Ki-pat, who watched his herd as he stood on one leg like the big stork bird;

**Group 3:** Ki-pat, whose cows were so hungry and dry, they mooed for the rain to fall from the sky;

**Group 2:** To green-up the grass, all brown and dead, that needed the rain from the cloud overhead—

**Group 1:** The big, black cloud, all heavy with rain, that shadowed the ground on Kapiti Plain.

**The whole class:** So the grass grew green, and the cattle fat! And Ki-pat got a wife and a little Ki-pat-- who tends the cows now, and shoots down the rain, when black clouds shadow Kapiti Plain.
THE RAIN GAME

This game is played with the staff member as the leader, and with the participants following his/her lead. Have everyone stand or sit in a circle.

The leader begins by first silently rubbing his/her fingers together. The participant to the leader’s right follows the leader and starts rubbing his or her fingers and then the person to his or her right starts and this continues until all the participants are rubbing their fingers together. When the participant to the left of the leader is doing the motion, the leader begins a new motion in the order listed below.

- Rub his/her two hands together, making a very soft sound
- Snap his/her fingers
- Very softly clap his or hands together
- Clap louder
- Slap his/her thighs
- Clomp his/her feet and clap
- Now do all the motions in reverse until it is silent again.

*This game signifies a rainstorm starting soft, getting louder and louder until it is pouring, with lightning and thunder, and then the calm after the storm when it is quiet again.*
Cloud Formation
Adapted from Home Made Clouds: http://teachers.net/lessons/posts/14.html

Concept: Cloud formation results when warm, humid air rises and cools, causing the water vapor in the air to condense and form clouds.

Materials
- Large clear jar (Ask the cafeteria staff or a local restaurant for a jar)
- Bag of ice
- Water
- Matches
- Black construction paper
- Flashlight

Background Information: Sunlight causes water to evaporate into the atmosphere. This air containing the water vapor is heated at the surface of the earth and rises. As it rises, it cools and the water vapor condenses on some form of particulate matter such as dust, ash, or smoke to form clouds.

Making Clouds
Directions
1. Tell the participants that they are going to form a cloud in a jar.
2. Take out the jar and have one of the participants tape the black piece of paper onto one side of the jar. Have another participant pour warm water into the jar until it is one third full.
3. Light a match and hold it in the jar for a few seconds and then drop it in. Have a participant quickly cover the top of the jar with the bag of ice.
4. Have a participant shine the flashlight through the jar. Watch what happens.
5. Ask the following questions. The answers in parentheses are cues for possible answers:
   a. What did you see in the jar? (a cloud)
   b. Where did the cloud come from? (the water in the bottom of the jar)
   c. How did the warm water effect the cloud formation? (Caused the water to evaporate and warmed the air, causing it to rise.)
   d. What did the ice cubes do to help the clouds form? (Cooled the air making the water vapor condense)
   e. What role did the match and its smoke play in the cloud formation? (Gave the water something to condense or grab on to)
   f. What is a cloud made of? (Small water droplets)
Cloud Watching

Directions:
1. Find pictures of different types of clouds. The basic cloud types are cirrus, cumulus, stratus and nimbus. If you have access to a computer, check out the following website for great pictures and information about types of clouds, [http://eo.ucar.edu/webweather/cloud3.html](http://eo.ucar.edu/webweather/cloud3.html) at the National Center for Atmospheric Research.
2. On a partly cloudy day, go outside and find a comfortable place to sit or better yet, lie down. Take a drawing board or hard surface such as a book that you can use as a support when you draw.
3. Watch the clouds move and to look at their shapes.
4. Take a piece of paper and chalk. Select a cloud to draw. Find one that looks like something other than a cloud such as an animal, dragon, or house. Draw the cloud.
5. Go back inside and use your cloud picture as the basis of a more complex picture by adding details transforming it into another object. If you want to, spray your picture with a fixative so the chalk will not rub off.
6. Label your picture with both the scientific name for the type of cloud and then give it an imaginative name.
Balancing Act

HENRY BELLINI

1873

(Survived)

Henry Bellini tight laying down while rope walking across the Niagara River in 1873 courtesy of the Niagara Falls (Ontario) Public Library

Henry Bellini was born in England.

In 1873, Bellini came to Niagara Falls at the age of 32 years. On August 25th 1873, Bellini made his first tight rope walk across the Niagara River using a 1,500 foot long - 2.5 inch diameter rope weighing 2,500 pounds. He combined a tight rope walk with a leap into the churning river below. He tried crossing using a 48 pound - 22 foot long balance pole. Following his leap into the water, Bellini was picked up by an awaiting boat. Bellini made three such leaps during 1873. In the winter of 1886, Bellini jumped from the Upper Suspension Bridge. He was hauled from the water unconscious with broken ribs but alive.


Henry Bellini tight rope walking across the Niagara River in 1873 courtesy of the Niagara Falls (Ontario) Public Library
Mirette on the High Wire
Balancing Act

Note: Make sure that you talk to your participants about how they need to be careful not to try doing a “high wire” act on their own. When doing any of the activities on the balance beam, wall or board, model the use of “spotters.”

Story Summary: One hundred years ago in Paris, a young girl named Mirette meets a retired high wire walker named Bellini who comes to stay at her mother’s boarding house. During the day she would see him walking in the air on the high wire. She wanted him to teach her how to do this but he refused. Mirette decided to learn on her own. After failing repeatedly, she finally was able to walk part of the way on the rope. Bellini was impressed that she did not give up, so he taught her how to walk the high wire. Then Mirette learned Bellini’s secret. He had developed a fear of heights. Because The Great Bellini did not want to disappoint the young girl, he devised a plan so that he and Mirette could perform together.

Materials
- Book: Mirette on the High Wire
- Masking tape
- Index cards
- Yardstick
- Experiment Directions Handout
- Copies of the Map of the United States (one copy per pair)
- Optional: Balance Beam, low wall, or 2 x 4 board on low blocks
- Optional: Books with pictures of Paris at the turn of the century and high wire acts

Directions
1. Tell the participants that they are going to be reading a story about a young girl who learns how to walk across a tightrope and helps a friend overcome a great fear.
2. Ask the participants whether they have ever seen a tight rope act. Ask them how they think someone who is walking across the tightrope is able to keep their balance.
3. Model balancing on two feet and then move to one foot. Demonstrate what happens to the person's shoulders as their body shifts from two feet to one foot. Ask the participants to watch what happens to your body when you move from two feet to one foot.
4. Have the participants pair up and take turns balancing and watching as they move from two feet to one foot.
5. Stretch a piece of masking tape on the floor and have the participants walk across the tape making sure they keep their feet on the tape as if they were on a high wire. Tell them to walk across the tape with their arms close to the sides and then out from their shoulders. Ask them which way is easier.
6. Read the story, Mirette on the High Wire. This book has many concepts that might be unfamiliar to the participants. Explain that the story takes place in Paris over a hundred years ago. Use the pictures to explain the ideas expressed such as the different feats that Bellini
accomplished, (cooking an omelet over Niagara Falls) and tying the “length of hemp with a steel core” using a winch. Be sure to go over the following vocabulary before beginning the story:

- Music halls
- Traveling players
- Boardinghouse
- Mimes
- Devoured
- Leeks
- Vagabond
- Courtyard
- Trance
- Flailed
- Windmills
- Wavering
- Agent
- Niagara Falls
- “nerves of an iceberg”
- Winch
- Commotion
- Hubbub
- Protégée

7. After reading the story, talk about various ideas explored in the story such as
   a. How did Bellini overcome his fear of heights? What are the participants afraid of and how can they overcome them?
   b. Has anyone ever helped them overcome something they were afraid of and how?

8. Have the participants try walking back and forth on a balance beam set close to the floor, a small wall, or a board placed on low blocks. Make sure that you have someone to “spot” the individual walking across the beam. Talk about the necessity of keeping oneself “aligned” in order to keep from falling. Alignment allows the body to maintain the center of gravity so that you can keep your balance.

9. Talk about how Bellini and Mirette were able to walk the tightrope because they were able to maintain their balance and that they are going to do experiments to see how balance works. Break the group up into pairs and do the following experiments.

*Literacy Reinforcement:* Have the participants write down their observations as they do each experiment on an index card. Come back together as a large group and discuss what they discovered.

*In the experiment, Center of Gravity- on the Move, the participants are asked to find the United States Center of Gravity.*

*Answer:* The geographic center of the United States (the contiguous states) is located in north central Kansas.
Center of Gravity by the Yard

Adapted from Exploratorium Science Snacks:
http://www.exploratorium.edu/snacks/center_of_gravity/index.html

Materials
- A yardstick, cane, or any stick of similar length
- Clay or other weights (even a pen or pencil will work)
- Masking tape

Directions
1. Put one finger straight out. Try to balance the stick on the top of the finger above the knuckle. If you are using a yardstick you can write down the measurement of that point. That point is the center of gravity for the stick.
2. Now, support the stick by resting each of its ends on a finger. Slowly slide your fingers together until they meet. Your fingers will meet under the stick’s center of gravity.
3. Attach a weight or a piece of clay to some point on the stick. Again support the stick on two fingers, and then slide your fingers together to locate the new center of gravity. Move the weight or piece of clay to some new place on the stick. Repeat the experiment. Your fingers will always meet right under the center of gravity.

Write down your observations on an index card.

Explanation
The stick's center of gravity is the place where you could balance the stick on just one finger. When you first support the stick with two fingers, in general one finger (the one that is closer to the center of gravity) will be holding a little more of the weight than the other. When you try to move your fingers closer together, the one that is carrying less weight will slide more easily. This finger will continue to slide more easily until it gets closer to the center of gravity than the other finger, at which point the situation will reverse and the other finger will begin to slide faster. Your left and right fingers simply alternate moving until they meet at the center of gravity, where both fingers support equal weight.
Center of Gravity--On the Move!

PURPOSE
To understand the concept of the center of gravity; to be able to determine where the center of gravity is located on a given object; and to predict how it will change when weight is added somewhere on an object.

Materials:
- 3 x 5 cards
- Paper clips
- Pencil
- Ruler
- Small maps of the United States (one per pair)
- Variety of irregularly shaped pieces of wood, metal, etc. (Let the participants look around both inside and outside and find objects that they can experiment with to find their center of gravity)

Directions
1. Take an index card and number each corner 1, 3, 5, and 7 and number the center of each side 2, 4, 6, and 8.
2. Predict where the card's center of gravity is located. (This is the spot where the card will balance flat on your finger tip.) Mark that spot with a pencil.
3. Place the dot on the tip of your index finger to see if it balances. If it does, you have found the center of gravity. If the card does not balance, observe how much it tilts. Also observe in what direction it tilts. Use this information to move the card on your finger tip. When the card balances, your finger is on the center of gravity. Have your partner help you mark that spot. Have your partner repeat steps 2 and 3 on the same card.
4. Attach a paper clip to weight down the spot 1 on the card. You and your partner should each put a dot on the card where you think the new center of gravity will be. Put your initials next to your dots. Place your dot on your finger tip and find the center of gravity as you did before. Now have your partner test his prediction of where the center of gravity is. Mark the new center of gravity. Use your ruler to see if you or your partner was closer.
5. Add a paper clip to any one or more weight spots in any combination. You and your partner should predict where you think the new center of gravity is. Mark the card with a dot and your initials and then find the center of gravity to see who was closer.

Write down your observations on an index card.
**United States’ Center of Gravity**

1. Look at a map of the United States. Assuming the United States is totally flat - for example, no mountains or valleys - in which state would you expect to find the geographic center of the 48 contiguous states, leaving out Alaska and Hawaii?

2. Determine how accurate your prediction is by finding the center of gravity on the map of the United States. With your partner, balance the map on a pencil tip in order to define more narrowly the center of gravity. Place the map upside down on the pencil tip to pinpoint the center more accurately.

3. How would features such as the Rocky Mountains or the Great Lakes that have a greater weight than the more regular flat lands of the country affect where the geographical center of the United States?
   - How would the Rocky Mountains affect the geographical center of gravity if you allowed for their presence on the USA map? (Remember, mountains have more land mass than the flat land around them). Put paper clips where the Rocky Mountains are on the map and see if the geographical center of gravity changes.
   - How would the Great Lakes (water is heavier than earth) change the geographical center of gravity? Put paper clips where the Great Lake area is on the map and see if the geographical center of gravity changes.

   **Write down your observations on an index card.**

**Balancing Irregular Objects**

1. Look around for different irregular objects like funny shaped sticks, bottles, plastic cups, etc.

2. Predict and then find the center of gravity of these objects by placing your 2 pointer fingers (palms facing each other) under each end of an object, so that you can hold it up in front of you. Gradually move your hands together, keeping the object balanced so that it does not fall. When your hands meet, you have found the center of gravity.

   **Write down your observations on an index card.**
Coat Hanger Balance Scale

Material
- Coat hangers
- String
- Paper Cups
- Small objects such as beads, small blocks, beans etc.
- Index cards

Directions
Pair up with a partner

Making your scale

1. Cut 4 lengths of string, each one yard long.
2. Take two cups and poke 4 holes in each cup with the nail. The holes should be evenly spaced near the rim.
3. Thread one string through one hole of the cup and knot it in place. Pass the string over the hanger as close to the end of the hanger as possible. Then, thread the end of the string through the opposite hold and knot in place. Repeat with the other string.
4. Secure the strings lying across the hanger with masking tape so they cannot slide.
5. Repeat the process with the other cup and strings on the other end of the hanger.

Using your Scale

1. Hang the hanger somewhere that it can hang freely. You can put a stick or rod over the backs of two chairs and hang it from there. Make sure the hanger is balanced. You might have to move the cups or add more masking tape to one side or the other to make sure they cups are hanging evenly.
2. Start experimenting with your scale. For example, you might put different types of objects in each cup to find out which is heavier. You might put one type of object in one cup and see how many objects of a different type that you would need to balance it (e.g. feathers and buttons).
3. Remember, if the hanger tilts to the right, the object in the cup on the right is heavier than the object in the cup on the left.

Write down your observations on an index card.
Balancing Nails
Taken from Steve Spangler’s Making Science Fun
http://www.stevespanglerscience.com/experiment/00000083#
Check out the website for a short video demonstrating how to do this activity.

Materials
- A block of wood (4 inches square and about 1/2 an inch thick)
- 12 10 penny size or larger identical nails with heads per team

The object of the challenge is to balance all of the nails on the head of a single nail. All of the nails have to be balanced at the same time and cannot touch anything but the top of the nail that is stuck in the base.

Directions
1. Hammer one of the nails into the center of the block of wood. It's a good idea to measure and pre-drill the hole to avoid splitting the wooden block.
2. Place the wood block flat on a desk or table. The challenge is to balance all of the nails on the standing nail in the wooden block. To win the challenge, none of the 11 nails may touch the wood block, the desk or table, or anything else that might help hold them up. No additional equipment other than the wood block and the nails may be used.

How does it work?
The trick to balancing the nails has to do with their "center of gravity" or balancing point. Lay one nail on a flat surface and place other nails across this nail, head to head as shown in the photograph. Finally, place another nail on top of this assembly, head to tail with the second nail. Carefully pick up the assembly and balance it on the upright nail.

Gravity pulls any object down as if all of its weight were concentrated at one point called the "center of gravity." Objects fall over when their center of gravity is not supported. For symmetrical objects like a ball or a meter stick, the center of gravity is exactly in the middle of the object. For objects that are not symmetrical like a baseball bat, the center of gravity is closer to the heavier end.

The stability of the nails depends on their center of gravity being right at or directly below the point where they rest on the bottom nail. Add too many nails to the left or right and they become unstable and fall off.