Experiment

NEWTON'S LAWS OF MOTION

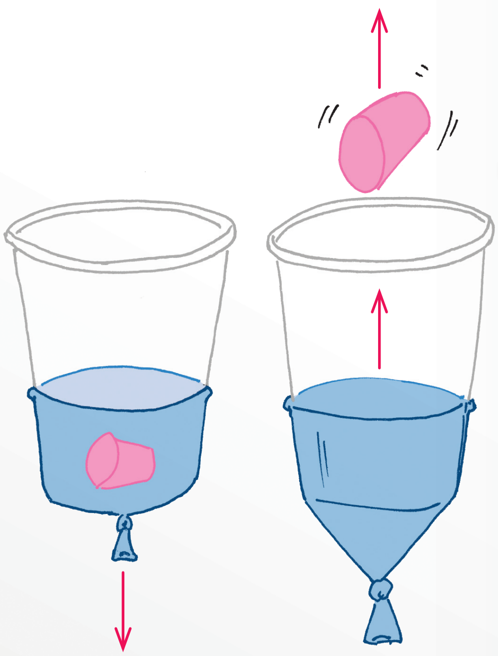
MATERIALS

1. Scissors
2. A paper or plastic cup (12-16 ounce)
4. A. large deflated balloon
5. Small marshmallows
6. Tape

MARSHMALLOW POPPERS

ACTIVITY

1. Cut the bottom out of the cup.
2. Tie a knot in the neck of the deflated balloon, and cut the opposite (rounded) end off of the balloon. Discard the cut off balloon piece, keep the piece with the tied neck.
3. Stretch the balloon over the cut end of the cup. It may be necessary to tape the balloon in place.
4. Drop one marshmallow in the cup so it rests on the balloon.
5. Pull the knot (neck) of the balloon down, then abruptly release.
6. What happens?



CONSIDER NEWTON'S LAWS

An object at rest will remain at rest, and an object in motion stays in motion, in the same direction, at the same speed, unless acted upon by an outside force.

What is the force that causes the marshmallow to launch?

What is the force that brings the marshmallow back down?

Force equals mass times acceleration.

What happens if you launch the marshmallow with a small force by not pulling the balloon down very far?

What happens if you launch the marshmallow with a large force by pulling the balloon down as far as possible?

For every action there is an equal and opposite reaction.

What is the action? What is the reaction?

NEWTON'S LAW'S OF MOTION

Coefficient of Friction

Materials

1. A sturdy blanket
2. A smooth floor surface such as tile, linoleum, or hardwood floor
3. A carpeted floor

Child Tow

Activity

[requires at least two children]

1. Have one child sit on the blanket on the slick floor.
2. Ask the second child to tug the corners of the blanket and drag the first child around the slick floor.

   Is it easy or difficult?
3. Now, move to the carpeted floor. Have the children keep their positions while the second child drags the first child around the carpeted floor.

   Is it easier or more difficult than the slick floor?
4. Have the children switch positions and repeat the activity.

The slick floor has a lower coefficient of friction, while the carpeted floor has a higher coefficient of friction.

Go Beyond

Repeat the experiment outside using a sheet of sturdy cardboard to drag children on different surfaces, such as: grass, gravel, asphalt, concrete, etc.

Experiment

Acids and Bases

MATERIALS

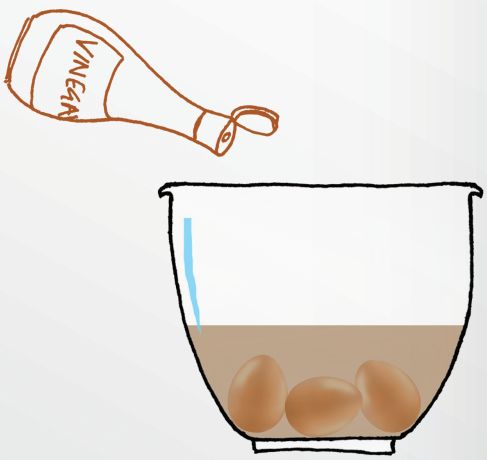
1. Several raw eggs
2. White vinegar
3. Two glass or plastic containers (each one large enough to hold the eggs so the eggs do not touch each other)
4. A loose cover for each container
5. A large spoon
6. Water

Removing an Egg Shell

ACTIVITY

[SAFETY: wear SAFETY GOGGLES when handling vinegar.]

1. Place eggs in one container so they can move freely, not pressed together.
2. Add vinegar to cover the eggs.
   a. What do you immediately observe?
   b. When the solid calcium carbonate of the egg shell contacts the acetic acid of the vinegar, the calcium ions go into solution and the carbonate is used to make carbon dioxide gas. This CO2 gas forms the bubbles you see.
   c. Form a hypothesis: What will happen to the egg shells over the next 2 days?
3. Loosely place the cover on the container
4. Refrigerate the eggs in vinegar for 24 hours.
5. After 24 hours, add vinegar to the second container.
6. Use the large spoon to scoop the eggs out of original vinegar and place them in the fresh vinegar. Be very careful because the egg shell is partially dissolved. Therefore, the egg membrane is all that is holding the egg together. If any eggs leak, throw them away.
7. Carefully pour the old vinegar down the drain.
8. Refrigerate for another 24 hours.
9. After 24 hours, fill the original container with fresh water.
10. Scoop the eggs out of the vinegar and dip them in the water to rinse. You now have a shell less egg!
11. Carefully pour the old vinegar down the drain.



GO BEYOND

Study the balanced chemical equation for the reaction. This is an acid/base reaction. The vinegar (acetic acid) is the acid and the egg shell (calcium carbonate) acts as a base.

Calcium carbonate + acetic acid		calcium acetate (in solution) + water + carbon dioxide bubbles		
CaCO3	+ 2 CH_3COOH	$Ca(CH_3COO)_2$	+ H_2O	+ CO_2 (gas)

Experiment

Plant Requirements

PLANT REQUIREMENTS

MATERIALS

1. Three stalks of celery or white carnations
2. Three clear jars /cups
3. Food coloring (red and blue)
4. Water
5. Three identical potted plants (bean plants work well since they grow quickly).

How Plants Drink

ACTIVITY

1. Create three cups of water for the celery to drink. Place 5 drops of red food coloring in one cup, place 5 drops of blue food coloring in the second cup, and leave the third cup clean. Add water to fill the cups ¾ of the way full.
    a. The cups containing colored water are **independent variables.** These are changed by the scientist in order to test a hypothesis.
    b. The third cup is the **control**. The control in an experiment does not receive any treatment. It is used as a point of reference to which the independent variables' test results can be compared.
2. Place one stalk of celery or a carnation in each cup.
3. Form a hypothesis:
   What will happen if left over night?
4. Test the hypothesis by leaving the celery/carnation for a day or two.
    a. The **dependent variable** is the change that is observed or measured in an experiment.

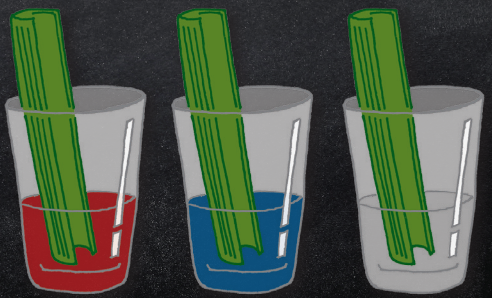
What will happen if you give a potted plant colored water to drink?

5. Create three cups of water to give the potted plants by adding 5 drops of food red coloring to one cup of water, 5 drops of blue food coloring to a second cup of water, and leaving the third cup of water clean. Label the potted plants "red", "blue", and "control".
6. Give each plant a tablespoon of the correct color water every day. Observe.
7. Identify the control, independent variable, and dependent variables in this experiment.

What's the difference in the potted plant and the celery/carnation?

One plant has roots and the other does not. When water is poured into the soil, the roots of the plant absorb it. But roots are natural filters, attempting to absorb only what the plant needs. The water travels up tiny xylem tubes to the stem and leaves. The water transpires (evaporates) off the leaves, making room for new water to move in.

The celery has no roots, therefore it cannot filter the water like the potted plant can.



GO BEYOND

Can we use plants to clean up polluted water?

Experiment

The Water Cycle

1. A bucket of clean water
2. Random household trash (fruit or vegetable remains, coffee grounds, food wrappers, paper, egg shells, etc.)
3. Vegetable oil (used as a substitution for petroleum oil)
4. Kitchen tongs
5. A net or strainer

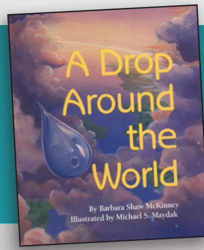
Reversing Water Pollution

1. Ask children to add the trash and oil to the bucket of clean water. Explain that when people dump trash and petroleum products into water ways, it pollutes the water.
2. Stir in the trash and oil so it mixes thoroughly with the water.
3. Ask the children to remove as much pollution as possible using the tongs and strainer.
4. Give them 10-15 minutes to clean the water.
5. Does the water look clean? How do you think a fish or frog would like living in that water?

The best way for water to be cleaned is through the water cycle. When the H2O molecules evaporate, they leave behind the pollutants (of course, this does leave pollution on the land). The clean water then forms clouds and eventually precipitates clean water back down.

How can you help keep the water clean?

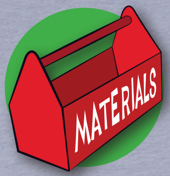
Read A Drop Around the World by Barbara Shaw.



WATER CYCLE

Experiment

Bones in Vinegar



1. A few long bones from a chicken dinner. Remove any remaining meat
2. A lidded jar, large enough to hold the bones
3. Vinegar

Bone in Vinegar

[SAFETY: wear SAFETY GOGGLES when handling vinegar.]

1. Notice how firm the chicken bone is. Can you bend it?
2. Place the bone in a jar and cover with vinegar. Put the lid on loosely.
3. Let it sit for 3 days.
4. Remove the bone from the vinegar. Rinse it off.
5. Can you bend it?
6. Place the bone back in the vinegar and let it set for 3 more days. Rinse and observe again.

Bones contain calcium.

Calcium is what makes bones strong.

Vinegar is an acid that dissolves away the calcium, leaving soft bone tissue behind.

BONES