Magic School Bus Lesson Plans

Teacher Prep:
1. Print 1 copy of lesson plans and experiment pages for teacher. (pages 1-54)
2. Print 1 copy of worksheets for each student. (pages 55-103)
   *three lessons do not have a corresponding worksheet*
3. Each lesson, read through experiment and gather supplies ahead of class.

Each Class:
1. Students watch video. Teacher sets up experiment.
2. Do experiment together, while discussing concepts.
3. Students complete worksheet.

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Going Hands-On

When Ms. Frizzle jets away into space, she talks with the kids by radio. She gives hints for her students to find her - and to identify the planets as they go. In this activity, your kids identify the planets by making two models of the Solar System. The first shows the order of the planets and the second show the planets' relative sizes.

What You Need

- Copies of DISCOVER THE PLANETS page
- Stick-on labels
- Markers
- Items to represent planets: basketball (Jupiter), soccer ball (Saturn), 2 softballs (Uranus, Neptune), 2 Ping Pong balls (Earth, Venus), 1 jacks ball (Mars), 2 marbles (Mercury, Pluto)
- Books on the Solar System

Talk About It

Ask: What are the names of the planets in the Solar System? What order are they in?

What To Do

1. Give children copies of the DISCOVER THE PLANETS page.
2. Have kids do "Be a Planet" in groups of 10. Children can be the Sun or one of the nine planets. Each child makes a label showing the planet (or the Sun) that he or she stands for.
3. Give groups the balls and marbles to do "Make a Model." Children can show the approximate size of the planets in relation to one another by lining up the round objects in the order of the planets. Kilometers show the planets' diameters.

Next Stop

Kids can write about a planet they like, telling its name, its location from the Sun, and what is special about it.
Going Hands-On

When the Magic School Bus shrinks and goes into Arnold's mouth, the children watch his teeth chew Cheezie Wheezies while the Bus swerves to avoid being crushed! The kids meet up with much smaller pieces of the Cheezie Wheezies again in the stomach. It's all part of the normal digestive process. In this activity, children can explore the mouth, where digestion begins.

What You Need
For Each Group

- Small mirrors
- Paper plates
- A piece of apple, banana, and celery for each child
- Copies of FOOD CRUSHERS page

Talk About It

Ask children:
Where do you think digestion begins?
What happens to food in the mouth?

What To Do

1. Give children copies of the FOOD CRUSHERS page. Have them wash their hands before beginning activity.
2. Have kids look at their teeth in the mirror.
3. Pass around plates with the food.
4. Help children make and record their observations on the activity page.

Next Stop
Ask children: How does chewing food help the body digest it? What happens to the pieces of food along the digestive tract?
Going Hands-On

The Magic School Bus gets inside Ralphie's body by going through a cut on his leg. Germs can get in the body that way, too. But usually the skin protects the body. Set up this activity to show how skin protects our bodies the way apple skin protects an apple.

What You Need

- 2 sheets of paper
- 2 apples with no cuts or blemishes
- table knife
- copies of Skin to Germs: KEEP OUT!! Page

Talk About It

As you set up the activity, ask: What do you think will happen to each apple in one week?

What To Do

1. Label the sheets of paper A and B.
2. Wash hands and the apples. Place one apple on each sheet.
3. With the knife, peel back the skin to leave four openings about 1/2 inch in diameter on apple B.
4. Get an assistant with unwashed hands to rub her hands all around the apples.
5. Watch the apples for a week. Do not touch them. Each day, kids can write down their observations.

Next Stop

Ask kids: What is the purpose of the skin on an apple? How does the skin of an apple work like the skin of your body?
Going Hands-On

The Magic School Bus kids really get into the food chain: They’re swallowed by a tuna fish. With this activity, your kids get to eat while they act as links in the food chain. The popcorn bags stand for food energy that is passed along the links in a food chain from the sun, to plants, to plant-eaters, to meat-eaters.

What You Need

- Copies of POPCORN CHAIN page
- Scissors
- Markers
- Yarn
- Tape
- 12 baggies of popcorn

Talk About It

Ask children: What is a food chain? What are some examples of plants and animals that are links in a food chain? What might happen in a food chain if one link is harmed by pollution?

What To Do

2. Kids color and cut out their symbols and tape them to yarn to make necklaces.
3. Have children spread out around the room, or go outside if possible.
4. The sun holds all 12 bags of popcorn. She gives one bag to each plant.
5. The plants eat half of the popcorn to have energy for growing and living.
6. Each plant-eater takes a bag from two plants and eats half of the remaining popcorn.
7. Each meat-eater takes a bag from two plant-eaters and eats the rest of the popcorn.

Next Stop
Kids can trace a food chain from a favorite food. They might try pizza, a jelly bean, or tuna fish.
Going Hands-On

What does an animal need in its habitat? Wanda learns that her pet bullfrog needs food, water, shelter, and a place to raise its young. Your kids can work in groups to set up temporary indoor homes for earthworms. They can observe the earthworms in an environment similar to the natural one.

What You Need

- One-quart jar
- Moist soil from where earthworms live
- 4 or 5 earthworms
- Pieces of grass or dead leaves
- Black construction paper
- Tape or rubber band
- Food: dry oatmeal, cornmeal
- Water
- Copies of EARTH-WORMERY page

Talk About It

Ask children: Where does an earthworm live? What does it need to live?

What To Do

1. Dig up moist soil and earthworms.
2. Give children materials to make the habitats and help them set up according to the directions on the Earth-Wormery page.
3. Children can record their observations.

Next Stop

Help children choose a small area outdoors where they can observe animals. Have them look quietly for five minutes. They can bring notebooks and record what they see.
Going Hands-On

Ms. Frizzles class finds out how rot makes rich soil for new growth. Your kids can discover the connection between rot and leaves mixed in damp soil. Children can continue this experiment for a month or longer.

What You Need

- Two 2-liter plastic soda bottles cut and labeled as shown
- 3” x3” piece of pantyhose
- Rubber band
- 1 cup garden soil1 cup garden soil
- 2-3 handfuls of dead leaves
- 1 cup rain water (or tap water left out overnight)
- Crayon
- Large spoon
- Copies of THE LEAF-DECAY CONTRAPTION page

A Rotting Log Supports Life by Wanda

Plants and animals live in a log. They also break the log down into smaller pieces that become part of the soil. New plants grow in this soil. So a rotting log is a plant and animal habitat and an example of nature's recycling!

Talk About It

Ask children: What rotting things have you seen? Where did you see them? Did you find fungi or insects in the decaying material?

What To Do

1. Help children set up and maintain the Leaf-Decay Contraption.
2. Ask kids: What do you think will happen to the leaf and soil mixture? Make a large chart to record the kids’ weekly predictions and observations.
3. After completing the activity, discuss with children: Why do you think the leaf and soil mixture changed the way it did?

Next Stop

Besides leaves, what other things rot? Children can start a compost heap with discarded vegetable scraps from lunches or snacks, and watch the decomposition.
Going Hands-On

For once, Arnold is prepared for a field trip! He's wearing desert survival gear. But the class discovers that desert animals have 'built-in' adaptations, or ways of surviving. One adaptation many desert animals have is the ability to get water from their food. Have children work in small groups to find out if foods they eat contain water.

What You Need
For Each Group

- 4 bite-size pieces of different foods (Try apple, turkey, cheese, bread, chips.)
- 4 plastic sandwich bags that zip close
- gooseneck lamp with 75-watt bulb
- copies of WHERE'S THE WATER? Page

Talk About It

Ask children:
Ask children if they think there is water in the food they eat. Why? Together, make a list of foods that kids think contain water.

What To Do

1. Give each group the materials.
2. Arrange a spot for kids to place bags about 20 inches under the lamp.
3. Help kids discover if the foods contain water. Have them write their responses on the WHERE'S THE WATER? page. (The moisture from the food evaporates and condenses in the sandwich bag.)

Next Stop
Ask children: What foods would you want to take with you if you were going on a hike in the desert?
Going Hands-On

When the Magic School Bus Kids play giant musical instruments, they see and feel the vibrations. Your kids can see - as well as hear - the results of vibrations in this activity. Have children work in small groups.

What You Need

- Clean empty soup can
- A can opener
- Plastic wrap or a balloon with open end cut off
- Rubber band
- A few grains of rice
- A radio or tape cassette player
- Copies of SEEING WITH SOUND page
- Objects for making musical instruments: rubber bands, wooden or cardboard boxes, cans, jars, pebbles, beans, paper clips

Talk About It

Have children put their hands on their throats, then speak, sing, or hum. Can they feel the vibrations?

What To Do

1. Remove the top and bottom lids of the cans. Don’t leave any sharp edges.
2. Cover one end of each can with plastic wrap. Secure it in place with the rubber band.
3. Give each group a can, the rice, and a radio or tape player. Give each child a copy of the SEEING WITH SOUND page.
4. After children try the experiment and write their responses in the char, they can make their own instruments. Give them the objects to put together any way they want.

Next Stop
Children can work in groups to make up their own Concerto for Invented Instruments.
Going Hands-On

Is it baking — or is it chemistry? Ms. Frizzle's class learns that baking is like doing a chemistry experiment. Your kids can make chemistry happen as they follow this recipe for pretzels. You or another adult can help groups of four to eight kids bake batches of pretzels. If you do not have access to an oven, make the dough with children and let them carry portions home in plastic bags to make with their families.

What You Need

- Copies of PRETZEL CHEMISTRY page
- Utensils and ingredients from the recipe
- An oven

Cooking Is Chemistry by Carlos

In chemistry, parts are mixed together to make something new. In the kitchen, the parts are called ingredients. When we cook, we mix ingredients together to make a completely new thing. Flour, sugar, salt, eggs, milk, and other ingredients are mixed together to make a cake.

Talk About It

Ask children:
As you follow the recipe, encourage children to talk about the changes they observe, and ask:

What To Do

1. What happens when you add yeast and honey to the warm water? (The mixture makes bubbles)
2. What happens after you knead the dough and let it sit? (The carbon dioxide makes the dough rise.)
3. What happens to the pretzel shapes while they're baking? (They get fatter.)

Next Stop

Kids can put vinegar and baking soda in a soda bottle, and place a balloon over the top of the bottle. What happens?
Going Hands-On

What a difference friction makes! When Ms. Frizzle's kids get off the Bus into the world of nonfriction, they can't even walk. Your kids can work in small groups to find how movement changes when there is more and less friction.

What You Need

- Shoe box
- Popsicle stick
- Large rubber band
- Tape
- A copy of FRICITION ACTION page
- Ruler
- Table
- Small stones to fit inside box
- Rounded pencils or straws

Talk About It

Help children think about friction by asking: Where would be a good place to slide? Why?

What To Do

1. Prepare a box for each group. Cut a small hole in one end. Pull the rubber band through the hole, loop it around the stick, and tape the stick in place
2. Give each group a copy of the FRICITION ACTION page
3. Help children follow the directions for the activity.

Next Stop

Discuss other ways besides rollers to make less friction between the box and the table. Try putting marbles, sugar, or ice under the box.
Going Hands-On

Ms. Frizzles class hangs on inside the tiny Magic School Bus as it hitchs a ride on a wind-traveling seed. The seed travels by clinging to an animal - in this case, a man on a bicycle!

What You Need

- 1 Different seeds (such as maple tree, sunflower, cockleburs)
- Cups of water
- Stuffed animals
- Copies of SEEDS ON THE MOVE page

Talk About It

Ask children: Have you ever seen seeds travel? How did they move?

What To Do

1. Each child chooses three seeds to test.  
2. On the chart, children write the name of each seed and draw a picture of it.  
3. Have kids guess how they think each seed travels, then circle wind, water, or hitchhiker under PREDICTION on the chart.  
4. Kids test each seed and circle results under OBSERVATION on the chart.

Wind Test: Hold the seed in the air and let it drop. If it drifts, it shows how a seed can travel by wind.

Water Test: Drop seeds into a cup of water and stir. The ones that float show how seeds can travel by water.

Hitchhiker Test: Put a stuffed animal on top of each seed, press down, then lift up the animal. The seeds that stick show how seeds can travel by sticking to an animal.

Finding Seeds
Do this activity in the autumn. You can find wind-traveling seeds from late fall flowers. Pick up hitchhikers by walking among weeds in a vacant lot of field. Buy sunflower or other seeds that can float to demonstrate how seeds can travel by water.

Next Stop
Give kids materials to make their own wind traveler, water traveler, or hitchhiker seeds. Have a friend test the seeds to find out how they travel.
Going Hands-On

What's the best way to get to know ants better? The Magic School Bus kids try working with the ants. They watch the ants and figure out what they're doing. Your kids can observe ants doing some tasks by making them a temporary indoor home.

What You Need

- one-quart (or larger) glass jar
- shovel
- anthill
- piece of aluminum foil
- rubber bands or tape
- black construction paper
- cotton ball soaked with sugar water
- bits of fruit or honey-soaked bread
- copies of BE OBSERV-ANT page

Talk About It

Ask children: What do you think the ants will need to do in their indoor home?

What To Do

1. Scoop up part of an anthill and put the soil and ants in the jar. Make sure these are not fire ants or other ants that can hurt you.
2. Cover the top of the jar with the foil and secure with a rubber band. Punch pin holes in the foil.
3. Put black construction paper around the jar to give the ants a dark environment. Secure the paper with tape or rubber bands.
4. Put the cotton ball on the soil. Ask kids: What do you think the ants will do with this sugar water-soaked cotton?
5. Place food pieces on the soil. Ask kids: What do you think the ants will do with this food? Put the cover back on the jar.
6. Remove the black paper each day so small groups of kids can observe the ants.
7. Keep the ant home for a week, then return the ants to where you got them.

Next Stop

Observe ants outside. Kids can place pieces of honey-soaked bread nearby and see how the ants react.
Going Hands-On

Weatherman (a.k.a. Ralphie) mixes heat with air to create an updraft, and The Magic School Bus rides high into the sky! Your kids can see a small updraft by making wind spirals.

What You Need

- A copy of WIND SPIRAL page
- Crayons or markers
- Scissors
- Needle
- Thread in 1-foot-long pieces
- Gooseneck lamp with 75-watt light bulb

Talk About It

Ask children: Why does the warm air from the lamp affect the spiral the same way blowing from underneath it does?

What To Do

1. Have kids decorate and cut out their spirals.
2. Help them pull the needle and thread through the X on the spiral.
3. Demonstrate how the spirals can turn in moving air. Hold one spiral up high by the string. Blow gently from underneath.
4. Turn the lamp facing up. Let each child hold her spiral over the light bulb.

Next Stop

Next time it rains, your kids can make a rain gauge. Place a clear glass jar outside in an open space. Use a ruler to measure how much rain fell.
Going Hands-On

Time: 30-40 minutes
Group Size: Four

Ms. Frizzles class finds a volcano underwater. Your students can make models of underwater volcanoes, and then create their own eruptions.

What You Need

- 1-pound box of baking soda
- 12-ounce jar of vinegar
- Small bottle of red food coloring
- Copies of ERUPTION!
- Sheets of newspaper

For each group:

- 1 teaspoon
- 1 shoe box
- 2 fist-sized balls of modeling clay
- (Alternative: aluminum foil)

Talk About It

Ask children:
How are islands created? Why don’t they float away in the ocean currents?

What To Do

1. Cover desks with newspaper. Direct groups to build models showing how an underwater volcano reaches from the ocean floor to above the water’s surface (see example below). Ask: Where would the crust be in your model? (below volcano) Where would magma come from? (pushes up between crust pieces)
2. After groups have built models, ask: What do you think causes a volcano to erupt? (pressure of magma gases)
3. Help groups create “eruptions.” Ask: What do you think caused the “lava” (what magma is called once it explodes into the air and loses gases) to flow? (Gas created by mixing baking soda with vinegar pushed up.) How are your eruptions and real eruptions alike? (gases giving a push) How are they different?

Next Stop
Encourage students to use crayons, markers, modeling clay, and construction paper to add details above and below the water’s surface.
Going Hands-On

Time: 40 minutes  
Group Size: Four

Ms. Frizzle's class uses a fantastical machine to see inside the human body. Your children can explore bones and joints by comparing their own hands and arms with a chicken wing.

What You Need  
For Each Group

- Copies of GIVE ME A HAND
- 1 chicken wing per group

Ahead of Time
Boil chicken wings for 5-10 minutes. Push meat off, but leave bones intact.  
Boil two minutes in soapy water.

Talk About It

Ask children:  
How many bones and joints do you think your body has? (206 bones; more than 230 joints)

What To Do

1. Show students chicken wing. Ask: What different parts do you see? (hard parts - bones; places where bones connect - joints; stringy material - ligaments)
2. Give each group one chicken wing and copies of the activity page.
3. Have children record the similarities and differences between their own arms and the wing, including size, number of bones and joints (we have 32 bones and 20 joints from shoulder to hand; wings have 10 bones and 6 joints, including tiny bones at tip), movement, skin, etc.

Next Stop
Have children "make a muscle," place hand on the muscle, and bend their forearms up and down. Ask: What do you feel? (muscle movement) One what other parts of your body can you "make a muscle"?
Going Hands-On

Whoops! Arnold accidentally carries a fossil with him back in time, where it turns back into what it was originally - a dinosaur egg. Here, your kids can make two types of "fossils."

Make An Imprint Fossil
Time: 20 minutes
Group Size: Four

Sometimes, animal remains trapped in stone dissolve away. That leaves an imprint fossil - a hollow imprint of the remains in the stone. Footprints can also leave imprint fossils.

What You Need

Objects for making prints: twigs, shells, pine cones, chicken bones (boiled clean)

- A paper bag
- A small handful of modeling clay (at art and toy stores) per child
- 1 plastic baggie per child

Talk About It

Ask: What do you know about fossils? Where do you think fossils come from?

What To Do

1. Place the objects in a paper bag.
2. Give each student a lump of clay and a plastic bag.
3. Let each student choose an object from the paper bag, without showing it to the others.
4. Have them put their clay in the plastic bag and flatten it.
5. Students press objects into clay through the bag.
6. Students remove clay from the bag. Ask: How is your imprint like your object? Different?
Going Hands-On

Time: 40 minutes
Group Size: Up to 14

As BatKids, Ms. Frizzle’s students use echolocation to find their way through the dark. Your kids can use sound to find their way through the room.

What You Need

- A scarf for the "bat"
- 2 metal spoons for the "moth"
- Copies of SEEING WITH SOUND page

Talk About It

Ask: How could you get around the room if it were too dark to see?

What To Do

1. Create an open space by pushing students’ desks to one side.
2. Give each child a copy of the activity page.
3. Pick one child to be the "bat" and another to be the "moth" (bat food). Remaining kids can be "objects" in the bat's environment.
4. Blindfold the bat and have "objects" stand in groups of three with their backs to each other, each facing a different direction.
5. Help students try SEEING WITH SOUND. The bat should clap often, as it tries to tag the moth without bumping into objects. Objects and moths only clap or clink spoons when the bat faces them directly.
6. Once the bat bumps into an object or tags the moth, choose a new bat and moth.
7. Ask: How is this activity like echolocation? different? (Unlike kids, bats bounce their own sounds off objects and get "sound" messages back from many objects at the same time.)

Next Stop

Ask: Why do bats come out at night? (Predators and prey can’t see in the dark, but bats can locate them with echolocation.)
Going Hands-On

Time: 30 minutes  
Group Size: One

What You Need
Per child:

- Several sheets of construction paper
- Scissors
- Crayons
- Copy of TRICKY BUTTERFLIES page
- Sheet of notebook paper
- Several containers of glue for the group

Talk About It

Ask children:
How does the way butterflies look help protect them?

What To Do

1. Ask: How would a butterfly have to look to blend in with a log? With a field of yellow flowers? (Kids should think about wing color, pattern, and shape - rounded wings may blend in with flowers.) What might happen to bright colors when a butterfly folds its wings? (Some wings are bright only on top and dull underneath, letting the butterfly blend in with dead leaves or logs.) Why do butterflies need these colors and designs?

2. Give each group the materials and have children design butterflies that can protect themselves: Trickers (have eye spots, startling colors, or resemble foul-tasting butterflies) or Hiders (camouflage).

Next Stop
Have kids swap butterflies with each other. Ask: What can you tell about how the other children's butterflies protect themselves?
Going Hands-On

Time: 30 minutes
Group Size: Four

During their trip through the waterworks, The Magic School Bus kids see how water gets cleaned up. Your kids can filter water to remove some natural impurities. Ahead of time mix water, pebbles, leaves, and soil together in jars.

What You Need
For Each Group

- Small jar lids or soda-bottle caps
- Zip-lock baggies
- Masking tape
- Bowl of water
- Eyedropper

Talk About It

Ask children: What happens when water is heated? When is cools?

What To Do

1. Distribute materials and have kids place five to eight drops of water in lids.
2. Carefully, they place lids into baggies and seal tightly.
3. Have students choose a window that gets plenty of sun (where kids can observe bags easily). Help them tape bags to the inside of the window.
4. Leave bags in the sun for most of the day. Near the end of the day, have the kids observe the bags. What do they see? (Much of the water should be gone from lid; top of the bag may look "cloudy" - that's water vapor. You may also see droplets on sides of bag.) Ask: What happened to the water? (evaporated)

Next Stop

Ask students: What might have happened if we had left the baggies open? (Water would evaporate into the air in room.) Try it!
Going Hands-On

Time: 10 minutes every day for eight days
Group Size: Three or four

Microbes turned Arnold's tomato into a goopy, ploopy mess. Here, your students can discover what microbes need to grow - and how cold affects microbe growth - by growing bread mold.

What You Need

- Masking tape
- Marking pens
- Copies of GETTING MOLDY
- Refrigerator

For each group:

- Two slices of bread (try bakery bread - no preservatives)
- Two zip-lock baggies

Talk About It

Ask kids: Where have you seen mold? How do you think it got there? (Molds are large groups of microbes; microbes are in the air we breathe, on everything we touch and see.) What do you think cold does to mold?

What To Do

1. Have each group put a slice of bread into a baggie, seal the bag, and label it WARM. Place that slice on a shelf or desk where kids can observe it easily.
2. Groups place second slice of bread into a baggie, seal bag, and label it COLD. Place baggie in refrigerator.
3. Have students observe both baggies daily, and draw what they see. (Bread contains water; they may see moisture in the bag.)
4. After mold is visible ask: What's on the bread? How is the mold changing the bread? Is there more mold on one slice? (WARM) Why? (Cold retards mold growth.)
5. Dispose of bread and bags properly.

Next Stop

If you are near a pond, collect some water in a quart jar. Examine some of the water with a microscope or a magnifying glass. (You should see plenty of microbes!) Ask: How can you find out more about what you see?
Going Hands-On

Time: 40 minutes
Group size: Four

Since your students can’t travel through The Magic School Bus’s engine, to see what gets the wheels turning, they can explore another way to turn wheels: propulsion. Here, they’ll see how the push from air-filled balloons turns the wheels of milk-carton “buses.”

What You Need

- 1 pint milk carton per group
- Cardboard
- Balloons (long, thin)
- Straws
- Copies of THE GREAT BALLOON RACE
- Scissors
- Table
- Masking tape
- Rulers

Ahead of Time:

- Punch four “axle” holes in the milk cartons. Holes should allow straws (axles) to turn easily.
- Punch a fifth straw hole in the back of the carton.
- Blow up balloons and let them deflate. Insert a straw one inch into the nick of each balloon. Secure the straw with tape or a rubber band.

Talk About It

Ask: What, besides a gas engine, can be used to move something on wheels?

What To Do

1. Distribute materials. Help kids cut holes in the middle of wheels. Demonstrate how to blow up a balloon through a straw.
2. After students have assembled buses, let them test “engines” on an uncarpeted floor. They can measure and record the distances buses travel. Ask: What’s causing the bus to move? (Air, forced out of the balloon, propels the balloon - which pushes the bus.) What else is moved by propulsion? (rockets, jets)
4. Hold three rounds of THE GREAT BALLOON RACE!

Next Stop

Have students create a scrapbook of engines powered by gas and other power sources (alternative fuels, electricity, pedal power in bicycles).
Going Hands-On

Time: 30 minutes
Group size: Four

The Frizzle's class does some flying and gliding during their adventure. Here, your students will see how gliders coast by exploring the way different paper objects fall to the ground.

What You Need

- Copies of *Falling, Floating, Gliding* (Activity Sheet)
- Sheets of 8" x 10" notebook paper

Talk About It

Ask: What are some things that glide? (hang gliders, gliders, some birds) Ask: What is the difference between gliding and flying? (Gliding is coasting freely on the air while being pulled downward by gravity; sustained flight needs a power source for propulsion.)

What To Do

1. Ask: What paper gliders does your group know how to make? Have each group make a glider, following the activity page instructions or using their own designs.
2. Show students a glider, a flat sheet of paper, and a crumpled paper ball. Ask: How might shape change the way something falls? Have them record their predictions of how the three shapes will fall.
3. Have three kids in each group hold the shapes above their heads and drop them at the same time. The fourth child records observations. Test three times.
4. Have students thrust their gliders forward. How is this different from when they dropped the gliders? What if they thrust harder? (more air moving over and under wings)

Next Stop

Challenge students to make gliders glide farther (by folding them differently, cutting flaps, changing wing size, etc.).
Going Hands-On

Time: 30-40 minutes
Group size: Four

When a breeze sends Ralphie’s hat sailing, The Magic School Bus kids realize wind can move objects. By making pinwheels, your students can harness enough wind energy to lift paper clips.

What You Need

- Box of jumbo paper clips
- Box of standard (#1) paper clips
- Copies of PINWHEEL POWER

For Each Group

- Manila folder
- Masking tape
- Half-pint milk carton
- Scissors
- Foot-long piece of string
- Quarter

Talk About It

Ask: How can wind energy power something? What are examples of wind energy?

What To Do

1. Pass out materials and help students make pinwheels. Demonstrate how to draw the six-inch circle, cut the circle into fourths, and fold each fourth in the same direction.
2. Help children poke the jumbo paper clip through the center of their pinwheels, and tape the clip down securely.
3. Encourage kids to start their pinwheels turning. Ask: How could you make your pinwheels turn something else?
4. Help students make paper-clip picker-uppers. Once pinwheels are secured in milk cartons, help kids tape string securely to pinwheel.
5. After they've lifted a small clip, challenge students to lift several paper clips.

Next Stop
Ask: What might happen if your pinwheel were bigger? (can harness more wind) Try it!
Going Hands-On

Time: 30 minutes
Group Size: Four

If the asteroid Ms. Frizzles class followed crashed to Earth, it would create a huge crater. Your kids can explore the craters that objects of different sizes and weights - marbles, Ping-Pong balls, and aluminum-foil balls - create.

What You Need

- Small jar of cinnamon
- Marbles, small and large
- Aluminum-foil balls
- Ping-Pong balls
- Spoon
- Copies of CRATERS

For each group:

- 4 cups of salt and 4 cups of flour
- Shoe box

Ahead of time: Mix flour and salt together in shoe boxes. Smooth the surface flat and cover with a light layer of cinnamon.

Talk About It

Hold up the balls. Ask: What might we see if we dropped these into the shoe boxes?

What To Do

1. From crouching positions, kids drop the balls into the shoe boxes and then carefully remove balls. Ask: What do you see? (craters of different size and depth; some bigger than objects; may see "spokes" of cinnamon or small mounds of flour/salt mixture around craters) Have students draw their craters.
2. Ask: What might happen if we dropped the balls from higher up? (They would fall harder.)
3. Have kids drop balls into the box from shoulder height. Ask: What do you see? (bigger, deeper craters) Why did that happen? (Balls had more time to pick up speed; faster balls make bigger holes.) Have kids draw these craters and compare with their first craters.

Next Stop

Ask: What might happen if we dropped objects that aren’t round into the shoe boxes? Try it!
Going Hands-On

Time: 30 minutes
Group Size: Entire class
Ms. Frizzle's class discovers that cold-blooded animals like lizards, turtles, and alligators need to live in environments where they can warm and cool themselves to maintain their proper body temperature. Your kids can think about how a lizard might respond to your environment.

What You Need

- Copies of LIZARD LIFE
- Pencils
- Crayons
- Drawing paper

Talk About It

Ask children:
What do lizards need in their environment to keep their bodies at the right temperature? (places to warm up and cool down; shelter in extreme cold or extreme heat)

What To Do

1. Distribute materials and help kids follow activity-page directions. Have them observe the environment outside the school. Ask: Where might a lizard warm and cool itself in this environment?
2. Ask: How does the temperature outside change during the day? (Mornings and evenings are usually cool, middays are warm.) What would this mean for a lizard? Have children draw the places outside the school where a lizard might regulate its temperature at three different times of the day.
3. Have students think about how the temperature changes during the year. Ask: Why could or couldn’t a lizard meet its needs in this environment all year round?

Next Stop
Ask: What reptiles live in our area? Help students contact local parks or wildlife departments to find out. Ask: What other animals are cold-blooded? (amphibians, fish, insects) How could we find out more about them?
Going Hands-On

Time: 20-30 minutes
Group Size: One or two

While trying to sink the Bus, Ms. Frizzle’s class learns that shape and weight are two factors that determine whether an object floats. Your kids can change the shape - but not the weight - of clay balls so they float.

What You Need

- Modeling clay (at art and toy stores)
- Several rolls of pennies
- Bucket filled with water
- Various objects: nuts, soap, fruit, vegetables, paper clips, jar lids

Talk About It

Gather objects. Ask: Which do you think will float? Sink? Have kids test the objects and sort them into sinkers and floaters. Ask: What might make one object sink and another float?

What To Do

1. Drop a fist-sized clay ball into the bucket. It will sink. Ask: How can we make the clay float?
2. Give each team a fist-sized clay ball. Ask: What will happen if you change the shape of the clay balls? How can you change your clay ball’s shape to make it float? Try it!
3. Give each team a fist-sized clay ball. Ask: What will happen if you change the shape of the clay balls? How can you change your clay ball’s shape to make it float? Try it!

Next Stop

Give each team 20 pennies and challenge them to change their boats so they’ll hold the most pennies. Ask: What happens as you add pennies? (Boats sink lower in water.) How can you change you boat to float more pennies? (Change the shape: Make the boat bigger and the sides higher, to push more water out of the way. High sides also keep water from swamping boats.)
Going Hands-On

Time: 30 minutes
Group Size: Up to 8

How do The Magic School Bus kids communicate where nectar flowers are? By dancing like bees! Challenge your kids to dance the Honey-Bee-Bop to communicate the location of hidden flowers.

What You Need

- Posterboard
- Crayons
- Scissors
- Tape
- Tape measure
- Copies of THE HONEY BEE-BOP page

Talk About It

Ask: Could you dance the directions to the cafeteria (or other familiar place)?

What To Do

1. Divide kids into "hive" groups of about 8 each. Have kids color, cut out, and tape together flowers to make the hive’s flower field. Make some extra bunches, too.
2. Pass out copies of the activity page. Look at the Distance Key, and help kids visualize distances. Ask: How tall are you? How many “you’s” fit between here and the door? Have kids measure the distance with their bodies. Let them estimate other distances and check with a tape measure.
3. Pick one kid in each hive to be the “scout bee.” The scouts hide their hive’s flowers. For a more challenging activity, hide several extra bunches. The scout must communicate the location of the flowers to its hive by dancing the Honey-Bee-Bop.
4. Remaining kids are “worker bees.” They must find the flowers.
5. Each hive watches the dance of its scout to get directions to its flowers. Then the hives "fly off" to find their flowers. In a large space, increase the Distance Key for the dance.
6. Try again with new scout bees. Ask: Can you communicate or estimate distances better?

Next Stop

Celebrate with honey and crackers. Calculate how many trips one bee would make from hive to flowers for the honey you are eating. Figure 25 trips for the honey on each cracker.
Going Hands-On

Time: 30 minutes
Group Size: 2-4

The Magic School Bus kids are freezing! When they discover that heat flows from hotter to colder things, they find ways to block heat escape routes. Your kids explore how insulation works to keep in body heat.

What You Need

- Spatula or spoon
- Large bowl of ice water
- Copies of THE INSPIRATION OF INSULATION page

For each group:

- 4 sandwich-size zipper plastic bags
- 12-15 cotton balls
- water and ice
- 1 cup solid shortening

Ahead of time:
Comfort in the Cold, by Arnold For each group, tightly seal some ice and water in one zipper bag. Put the shortening in a second bag.

Talk About It

Ask: How do layers of clothes, fur coats, and fat keep humans and animals warm when it's cold outside? (Fat and trapped air in fur or clothing layers block the flow of body heat into the cold.)

What To Do

In two demonstrations, kids explore how air and fat can slow the flow of body heat into ice water.

2. Ask: How do polar bears keep warm in the Arctic? (Air spaces in their fur trap body-heated air.) How are the cotton balls like polar bear fur?
3. The "Walrus Mitt" seals a hand inside a layer of fat to imitate walrus blubber. Pass out materials. Help kids follow activity-page directions. Show how to zip the shortening and empty bags together to make the mitt.
4. Ask: How do walruses keep warm in icy cold water? (Blubber slows the movement of body heat.)

Next Stop

Challenge kids to insulate jars of warm water so that they keep the heat as long as possible. Dip a finger in each of the jars after an hour. Which stayed the warmest? Why?
Going Hands-On

Time: 30 minutes initially, then 10 minutes a day for observation
Group Size: 4-6

Carlos is afraid of spiders — until he discovers they are would-champion trappers. Your kids observe spiders in their habitats, in spider hotels that you make, or in both.

What You Need

- Magnifiers (optional)
- Scissors
- Stapler
- Dark-colored poster board
- Simple field guides/books on spiders
- Copies of TAP INTO A TRAPER page

For the spider hotel:

- Clear jar big enough to hold your spider’s web
- Nylon stocking
- Rubber band
- Spider furniture: rocks, soil, twigs
- Live prey: housefly, garden insect, mealworms
- Water spray bottle

Ahead of time: Scout for spiders. They are everywhere, especially in summer and early fall when insects abound. Inside, look behind doors and at corners of ceilings and walls. Outside, look on shrubs, grass, weeds, branches.

Talk About It

Ask: Where have you seen spiders or webs? Why do spiders live there? (insects, other prey are around) What would you like to know about spiders?

Ask: If I walked into your room, what could I discover about you from all your things? Would I know as much from just one thing?

What To Do

1. Make “Spider Field Logs as indicated.
2. Read Ms. Frizzle’s Spider Rules (Field Log, page 2). The Venom of black widow and brown recluse spiders are dangerous. But both have easy-to-identify markings. Neither will bite unless disturbed. They are found mostly around manmade structures.
3. In the field, hold dark-colored poster board behind webs to make them show up. Demonstrate how to use magnifiers.
4. For fearful kids, pose spider puzzles: What anchors this web? Why is this a good place for a web? Or assign jobs - hold the poster board, make spider hotels, take notes.
5. After examining webs together, let kids look for other spiders. Challenge them to find spiders that are not in webs. Most of these hide and pounce on prey.
6. Help students with field log activities. Make spider hotels and catch spiders. Keep them one to a hotel. Release after a few days.
Going Hands-On

Time: 30 minutes
Group Size: 2-4

The Magic School Bus kids discover that the right bridge design can carry them across an alligator-infested bathtub. Challenge your kids to bridge a chasm with gumdrops and toothpicks.

What You Need

- 1 bag gumdrops
- Half a box of round toothpicks
- Ruler
- 2 equal stacks of books
- Small cup
- Paper clip
- Pennies or other weights
- Copies of GUMDROP BRIDGE page

Talk About It

Show kids the gumdrops and toothpicks.
Ask: Could you build a strong bridge with gumdrops and toothpicks?

What To Do

1. Pass out gumdrops, toothpicks, and activity sheets.
2. Each group makes two equal stacks of books high enough to hang a cup from the bridge. Make the stacks 10 inches apart.
3. Ask: How long and strong a bridge can you build if you just string gumdrops and toothpicks together? Try it.
4. Challenge kids to create a better bridge design and build the strongest bridge they can between the book stacks.
5. To test bridge strength, straighten one arm of a paper clip to make a hook. Poke it through the cup, and hook the cup on the middle of the bridge. Add pennies to the cup until the bridge collapses.
6. Challenge teams to make a stronger bridge. Ask: How will you change your design? What shapes will you use?

Next Stop
Challenge teams to build the tallest tower they can with gumdrops and toothpicks. Does “triangle power” help in building tall towers?
Going Hands-On

Time: 30 minutes  
Group Size: 2-4

Arnold and Janet disappear! Or so it seems. When Ms. Frizzle’s kids discover how light bounces, they shed light on a ghostly trick. Your kids explore reflecting light.

What You Need

- Flashlight  
- Small flat mirror  
- White index card  
- Copies of BOUNCE THE LIGHT page

Talk About It

Some kids believe we see objects because our eyes are like flashlights: We “shine” them on things. These activities help kids explore how light actually travels from a source (flashlight), hits an object, and bounces off into our eyes. Ask: How could you shine a flashlight in front of you and make the light go behind you?

What To Do

1. Pull shades, and place group materials at stations in darkened areas.  
2. Display the materials. Go over the activity sheets, then let teams explore light on their own.  
3. Circulate to help kids and to keep them focused on the questions.  
4. Kids will see: 1. light only at the wall; 2. no shadow in air; 3. light on mirror and card.  
5. Challenge kids to “Bounce the Light.” Tell groups to shine a flashlight on a wall in front of them. Ask: How can you make the light shine equally brightly behind you WITHOUT MOVING THE FLASHLIGHT? Have them draw a picture of how the light bounced on the back of the activity sheet.

Next Stop

In a darkened room, shine a flashlight onto a wall. Ask: Where do you see light? (at flashlight source and on wall) Can you see light travel from the flashlight to the wall? (not unless dust in air reflects light to our eyes) What could we do to see the light beam? Let kids experiment with ideas. Then ask a nonallergy-prone child to clap two dusty erasers together while you shine the flashlight through the dust-filled air. Ask: Why do we see the light beam now?
Going Hands-On

Time: 15+ minutes to make artifact box, 20 minutes for activity
Group Size: 5-6

What artifact did Arnold find in the trunk of his great-aunt Arizona Joan? The Magic School Bus kids test their guesses. Your kids explore how artifacts tell a story.

What You Need

- Shoe box with lid, or paper bag
- Copies of ARTIFACT DETECTIVES page

Talk About It

Ask: If I walked into your room, what could I discover about you from all your things? Would I know as much from just one thing?

Ask: If I walked into your room, what could I discover about you from all your things? Would I know as much from just one thing?

What To Do

1. Pass cut boxes or bags. Let each group name their team. Write the name on the box.
2. Ask: What are activities and events that occur here? What things do we use for each?
3. Each group chooses an activity privately. Each team member puts an object associated with that activity in the box. If the object is not available, draw it or write its name.
4. Ask each group to pass its box to another group. That group huddles to examine and record the artifact clues on the activity page, then infer the activity.
5. Ask this group to remove one object from box, and put it out of sight. They pass the box, minus one object, to another group.
6. This group tries to guess the activity from the remaining objects. They then remove one object and pass the box to a new group. Continue, with one object removed at each pass, until each group has seen all the boxes.
7. Ask: Were you able to guess the activity from the last boxes you saw? How many clues to the activity did they contain? Why do archaeologists need as many artifact clues as possible?

Next Stop

On separate paper, ask kids to reprint their "Personal Archaeology" list. Distribute lists randomly. Ask kids to describe the person, and identify him or her, if possible.
Going Hands-On

Time: 30 minutes
Group Size: 5

While playing light-beam pinball, The Magic School Bus kids discover that green light bounces off a green shamrock and into their eyes, so they see green. Here, your students spin separate colors into a new color.

What You Need

- Color wheel pattern
- Thin cardboard (e.g., used manila folder)
- Paste or glue stick
- Scissors
- Long pencil with eraser
- Color markers or crayons
- Modeling clay or rubber bands (optional)
- Copies of COLOR MIXER page

Talk About It

Record kids’ ideas: Where does color come from? (the rainbow colors contained in “white” light) Why are apples red and blueberries blue? (The red light in light is reflected off the apple and into our eyes. The same goes for the blue.) What color might you get if you mixed red and blue light together?

What To Do

1. Pass out copies of the activity page and cardboard. Help kids follow directions to paste, cut out, and poke holes in the wheel pattern.
2. Follow coloring directions for the wheels.
3. Have students poke their pencils through the hole and spin the wheels on a smooth surface. Try the eraser end for easier spinning.
4. Before each spin, have kids predict what color(s) they will see as the wheel spins. (Red, green, and blue or red, yellow, and blue combinations produce grayish white. Our eyes and brain cannot separate the spinning colors, so they look whitish. Likewise, “white” light is all the rainbow colors entering our eyes together.)

Next Stop

Separate white light into a rainbow by placing a glass of water on the edge of a window sill. Move the glass around until you see the rainbow. Catch the rainbow on white paper. Ask: How many colors do you see? Can you change the order of the colors?
Going Hands-On

Time: 20 minutes
Group Size: 4-6

The Magic School Bus becomes a salmon looking for its tiny home stream. How? By knowing the scent and taste of home. Your kids discover that a homey smell can lead them, too.

What You Need

- 3 tablespoons ground cinnamon
- Range, hot plate, crock-pot, or electric fry pan
- Pan with lid (for range or hot plate)
- 1 tablespoon odorless cooking oil (optional)
- Thin Cardboard (e.g., old manila folders)
- Paper fasteners
- Scissors
- Glue
- Crayons
- Copies of JOURNEY HOME WHEEL page

Talk About It

Ask: What senses do you use to find your way? If you close your eyes, what other senses might tell you where you are? Could you find your way to a bakery by following your nose?

What To Do

1. Heat cinnamon over low heat. Watch so it doesn’t burn. Heating in oil may release more scent.
2. When heated to a strong fragrance, clamp a lid on the pan and hide it. Remove the lid after it’s hidden.
3. Challenge a group to follow their noses to the hidden scent.
4. Repeat for all groups. If the odor fades, heat new cinnamon. Sharpen the game by timing the groups to see which find the cinnamon fastest.
5. While one group follows their noses, others can make a Journey Home Wheel (see activity sheet).

Next Stop

Assign teams to research migration routes of salmon, whales, monarch butterflies, Arctic terns, ducks, scarlet tanagers, and other migratory animals. Do any pass through your community? What dangers do they face? What is the payoff for the dangerous journey they make?
Going Hands-On

Time: 20 minutes  
Group Size: 2

Ms. Frizzle wins the school Teacherathon, thanks to teamwork - heart, lungs, blood, and muscles all working together! Your kids make a personal heart profile of an important member of their own hardworking team.

What You Need

- Modeling clay  
- Paper match for each student  
- Clock with second hand  
- Calculator (optional)  
- Copies of YOU GOTTA HAVE HEART page

Talk About It

Ask kids to find their hearts. If they can’t, run in place for 30 seconds; try again.  
Ask: Why does your heart beat? (Pumps blood through body.) Why do you need a blood pump? (To carry oxygen, food to muscles and cells; carry away carbon dioxide.) Where else can you feel the blood pathway through your body? (At the pressure points.)

What To Do

1. Make a "Heartbeat Monitor." Imbed match in pea-sized clay, match head up. Flatten the bottom of the clay.
2. Help kids find the wrist artery. Lay hand and wrist flat on a table. Feel with fingertips along thumb-side edge of wrist for a pulse. Put the Heartbeat Monitor on the pulse.
3. No luck with the wrist artery? Feel for the neck artery, just below the chin, beside the windpipe.
4. After kids record pulse, have them do 20 jumping jacks. Remonitor pulse rate.
5. Wait two minutes, and record cool-down rate.
6. Graph results on "Chart Your Heart." Have kids fill in bars up to the numbers for their resting, working and cool-down pulse rates.
7. Help kids do the multiplication for their "Hard-Working Heart" profiles. Assume their hearts have beat at the same rate since birth.

Next Stop

Ask: Why do you breathe harder when you exercise? (Lungs are taking in more oxygen for working muscles.) Why does your heart beat faster? (It’s pumping more oxygen to muscles.)
Going Hands-On

Time: Maze setup: 30 minutes; observation time: 5 minutes every 3-4 days for 3+ weeks
Group Size: 2-4

Inside a plant, The Magic School Bus kids discover that plant food is made from air, water, and sunlight. Your kids discover that plants will go to great lengths to find light - even thread a maze.

What You Need

- Sunny window
- Water
- Copies of A-MAZE-ING PLANTS page

For Each Pair

- 2 lima bean seeds
- Soil
- Plastic cup (punch hole in bottom)
- Saucer
- Lidded box
- Cardboard for dividers
- Tape
- Scissors
- Ruler

Talk About It

Ask: Where do you get energy to grow, run, live? (food) Where do plants get energy? (also from food) Where do plants get food? (They make it from air, water, sunlight.) What would you do to get food if you were hungry? What might a plant do?

What To Do

1. To speed sprouting, soak seeds in water overnight.
2. Help kids plant seeds at a depth about twice the length of the seed. Water well. (If both seeds sprout, pinch one out.)
3. Build the maze shown on the activity page. Use cardboard for the dividers. Cut a hole at the top end of the box.
4. Discuss experiment controls. Ask: What should we do to compare how plants grow in a maze with how plants grow outside a maze? (Grow control plant outside maze.) Plant and water seeds for the control.
5. Put the mazes and control plant in a sunny window. Open the mazes only briefly every few days to observe and water.

Next Stop

Plants make food in chloroplasts, tiny green organs mostly in leaves. What happens to chloroplasts kept in the dark? Sandwich a leaf of a hardy plant like philodendron or geranium with black paper taped together. Remove paper after a week. What has happened? (The green pigment is gone.)
Going Hands-On

Time: 20-30 minutes
Group Size: Variable

Led by detective Tim and D.A., Ms. Frizzle's class discovers that all life in the rain forest is connected. Your kids create and feel the tug of the connections in your community's web of life.

What You Need

- Name tags
- Marker
- Ball of yarn
- Thin cardboard, like old manila folders
- Glue
- Scissors
- Crayons
- Tape
- 6 pencils
- Modeling clay
- Copies of THE BIG PICTURE page

Talk About It

Ask: How do animals and plants depend on each other? (for food; some animals use trees for homes, shelter; deer need hawks to eat rabbits that compete for food, and so on)

What To Do

1. Sit in a circle. Toss the ball of yarn to a kid and ask for the name of a local plant. Write it on a name tag for the child.
2. Ask: What eats or uses the plant? Keeping hold of the yarn end, the plant kid tosses the yarn to a responder, who gets a name tag.
3. Ask: What does this organism use or eat? What eats it? Continue to link community members as long as possible. Cut the yarn.
4. If everyone is not connected, start again with a new plant. Tie the yarn together as the web connects with organisms already included.
5. Something happens - perhaps a tree is bulldozed or falls from disease. The person who is the plant tugs the yarn.
6. Everyone who feels the tug raises a hand. The hand raisers tug on the yarn they hold. All who feel the new tugs raise their hands.
7. Continue until everyone has felt the tug from the removal of one thing in the web.

Next Stop

Make a bulletin board of your “Big Picture.” Kids draw their plant or animal from the web game. Have kids connect their organism to as many others as possible. Use red yarn for feeding relationships, green for home and shelter, black for other connections.
Going Hands-On

Time: 30 minutes
Group Size: 4

Arnold and the other kids enlist the power of water erosion to sculpt stone! Your kids explore how running water moves earth and creates new landforms.

What You Need

- Paper cup
- Drinking straw
- Modeling clay
- Wood plank or stiff cardboard about 2 feet long
- Bucket of soil
- Trowel or large spoon
- Stones
- Bucket of water
- Copies of GET ERODED! page

Ahead of time: Find books about local geology. Fill a bucket with local soil. Ask kids to bring in a water-eroded rock. Ask: What will you look for? (smooth, sculpted shape; ice cleavages)

Talk About It

Ask: How might water have changed your rock? What evidence do you see? How might water move rocks to faraway places?

What To Do

1. This is an outdoor activity. Have kids set up erosion boards on outdoor tables or the ground. Have buckets of soil and water ready.
2. Help kids poke holes in their cups. Seal the straw with clay.
3. Have kids draw predictions before anyone gets water.
4. After the first erosion test, ask: What might happen later to the soil and rocks washed down the slope?
5. Get kids to clean off the erosion board and add a new soil layer.
6. Repeat with the boards at a higher angle. Ask: Why would water flowing down a steeper slope wash down more soil and bigger rocks? (The water has more energy.)
7. Challenge kids to contain the erosion. Create a landscape to control water flow by packing soil around stones, sticks, leaves, roots.

Next Stop

Draw timelines of the kids’ rocks. Decide on a time scale, and let kids give their ideas for: where their rock was a very long time ago and what it looked like; where it was found; where it will be and how it will look a long time in the future.
Going Hands-On

Time: 30 minutes
Group Size: 4

Wanda's favorite doll is chopped into plastic pellets! She's crushed until she discovers the pellets can be recycled to make a new doll. Your kids explore how things can be reused or recycled again and again.

What You Need

- Books, pamphlets about recycling. Check with local waste-management service for information.
- Household trash - glass, plastic, metal, cardboard, Styrofoam, junk mail, broken appliances
- Copies of BACK TO BASICS page

Talk About It

Pass around trash samples. Ask: If we toss this stuff, where will it go? How can we re-use it? (Jars might become containers, vases; newspaper - packing material, animal bedding; paper - scratch paper, aluminum pie tin) If we recycle these things, what can they become?

What To Do

1. Analyze a piece of paper. Ask: What went into making this? (raw materials - trees, chemicals, fuel) If we toss it away, how will we get new paper? (use more raw materials) If we recycle it, what will it become at the recycling plant? (wood pulp) What can we do with that? (e.g., make newspaper, greeting cards, toilet paper, packing or building materials)
2. Ask: What gets recycled in our community? (Kids may not know that vehicles and large appliances are recycled.)
3. Brainstorm things kids would like to see made with recycled stuff. Introduce the reference resources.
4. Pass out activity pages. Let kids work in groups to analyze how the bike seat, handle bars, and tires can be reused and recycled. If kids are stumped at any step, challenge them to come up with ways to find out more about recycling.

Next Stop

With the kids, work out a plan to reduce personal waste. What can you do without? What can be reused? Ask kids to write or draw one way to reduce their waste. Compile ideas on a "Waste Away!" bulletin board.
Going Hands-On

Time: 50 minutes
Group Size: 4

Ralphie discovers that soap and water slip grease and grime away because of the special characteristics of soap molecules. Your kids investigate some characteristics of oil, water, and soap.

What You Need

- Dishpan of water
- Paper towels
- Liquid detergent
- Copies of MATCHMAKER, MATCHMAKER page

For each group:

- 2 tumblers of water
- 2 tablespoons cooking oil
- 1 tablespoon liquid detergent
- Spoon

Talk About It

Pass around samples of oil, water, and liquid soap. Ask: What are some characteristics of water? Oil? Soap? List responses. Ask: Do the teeniest-tiniest bits (molecules) of these things determine these properties? (yes)

What To Do

1. Let kids touch the substances. Ask: How do they feel? Is how they feel a characteristic? (yes)
2. Have kids dip a finger in oil and then try to rinse it off with water alone. Ask: Does the oil come off? How could we remove it?
3. During the activity, students will discover that soap and water mix, while oil floats on top of water. Challenge kids: Can you mix oil and water? Record kids' ideas. If possible, let them experiment with some of their ideas.
4. After kids add soap to the oil and water, ask: What did the soap do to the oil and water? (Soap mixes oil and water because on end of the soap molecule is water-loving, while the other clings to oil. Stirring in soap creates a cloudy suspension of tiny oil droplets surrounded by soap molecules—an emulsion.)
5. Ask: Why do soap and water clean oil and grime? (The oil-loving end of the soap molecule surrounds and lifts the oil; water rinses it away.)

Next Stop

Draw timelines of the kids' rocks. Decide on a time scale, and let kids give their ideas for: where their rock was a very long time ago and what it looked like; where it was found; where it will be and how it will look a long time in the future.
Going Hands-On

Time: 30 minutes  
Group Size: 2  
The Magic School Bus kids go inside a chicken to find out how eggs and baby chicks are made. Your kids examine the life-support system inside an egg.

What You Need

- Raw egg  
- Plate  
- Napkin  
- Glue paper  
- Copies of THE INSIDE "EGGS-POSE" page

Talk About It

Ask children:  
What is an egg? (a life-support package for a developing chick)

What To Do

2. Help students break the eggs onto plates.  
3. Compare the eggs to the drawings. Help identify the parts of the egg and purpose of each part. Look inside the eggshell for the membrane and air space.  
4. Display students' egg drawings. Ask: How do the egg parts make up a life-support package for the developing chick?

Next Stop

Incubate and hatch a fertile hen's egg. Contact local 4-H Clubs or the USDA Cooperative Extension Service for information. Follow the embryo's development by candling and weighing the egg and using picture books to show day-by-day progress.
Going Hands-On

Time: 20 minutes for tide; 45 minutes for tidal zone
Group Size: 4

Ms. Frizzles class explores the intertidal zone as mussels. Your class simulates a tide, and then populates a tidal zone.

What You Need

- 18 inches of clear plastic aquarium tubing
- Glass of water
- Food coloring
- Rectangular glass casserole dish
- Rocks, sand
- Tape
- Copies of LIFE IN THE INTERTIDAL ZONE page

For Each Group

- 1 animal model from activity sheet
- Books, magazines about intertidal critters

Ahead of time: Gather a Between-the-Tides library of pictures, shells, books, other material.

Talk About It

Ask: What are tides? (twice-a-day rise and fall of ocean waters.) Do they affect ocean shore critters? (They cover the uncover them, batter them with waves.)

What To Do

1. Create a "shoreline" in the dish. Prop it to make a sloping "beach." Arrange rocks and sand in dish for a shore.
2. Create a "tide." Color the water. Position the glass so that the glass water level is near the bottom of the beach dish - "low-tide zone."
3. Put one end of the tubing in the glass. Tape in place. Suck on the tube to fill it with water. Pinch shut while you place it in the dish. Tape in place.
4. Raise or lower the glass to siphon water to or from the dish, creating "tides." Ask: Are shore animals always covered with water? How can they survive tide changes? (experiment graphic) Raise and lower glass for tides.

Create an Intertidal Zone

1. Assign each group an activity-sheet critter.
2. Arrange furniture to create an intertidal zone - floor, low zone; chairs and tables, mid-zone; chalkboard, high and splash zone.
3. Let groups arrange their animals in the proper part of the intertidal zone. Ask: Why is this the best place for you? How do you survive when the tide is out?
Going Hands-On

Time: 30 minutes
Group Size: 2-4

Ms. Frizzle’s kids trap air in containers and discover that air is pushy stuff. Your kids explore how air pressure can hold up heavy objects.

What You Need

- Straw for each child
- Gallon zipper bag for each group
- Heavy books or other objects
- Copies of PUSHY AIR page

Talk About It

Ask: Is air real stuff? How do you know that air is real? (One way: Feel wind, breath.) What can air do?

What To Do

1. Pass out straws, zipper bags, and activity sheets.
2. Have kids trap air in their bags.
4. Use the activity to challenge kids to discover if the air bags can support heavy objects.
5. Then let kids deflate the bags for the Air Lift challenge. Ask volunteers to pick up three heavy books. Ask: Are they hard to lift? Can you lift them with your breath alone?

Next Stop

Have kids ride bikes first with underinflated tires, then fully inflated. Ask: Which required more effort to ride? Why? (Fully inflated tires have more air squeezed inside the tires. The pressure makes them stiff. Soft tires flex and bend - using up energy.)
Going Hands-On

Time: 40 minutes
Group Size: 4

Ms. Frizzles class discovers that wetlands help clean polluted water. Your students investigate how wetlands filter dirty water.

What You Need

- Pail of sand and soil
- Clock with second hand
- Copies of SETTLE DOWN page

For Each Group

- Glass of water
- Tablespoon
- Cookie sheet
- Bowl

For half the groups:

- 2 damp (not wet) sponges

Talk About It

Ask: Which carries more dirt - moving water or calm water? (Moving water; dirt settles out in calm water.)

What To Do

1. Supervise as groups make glasses of muddy water. Make an extra to serve as a control.
2. Let kids investigate how dirt settles out in Dirt Drop.
3. For the Muddy Water Race, give each group a cookie sheet and bowl. Give half the groups damp sponges to represent wetland plants.
4. Hold races between sponge and nonsponge teams. Each team needs a Pourer, Timekeeper, Water Catcher (to collect water running off the cookie sheet), and Recorder.
5. Compare the amount and muddiness of the collected water. Use the control to ask: Is the water as muddy as the dirty water we made? How are the sponges like wetland plants? How are they different?

Next Stop

What kinds of wetlands are near you? Create an Our Wetlands bulletin board of plants and animals that live in local wetlands.
**Going Hands-On**

**Time:** 20 minutes, then observe periodically for next 40 minutes  
**Group Size:** 2-4

Arnold’s classmates discover that his body cells are alive. Your kids investigate whether yeast cells are alive.

**What You Need**  
**For the Class**
- 3 1-pint plastic zipper bags  
- 3 packets dried yeast

**For Each Group**
- 1-pint plastic zipper bag  
- Packet of dried yeast  
- Pen or marker

**For the class and each group:**
- 1 teaspoon sugar  
- 1/4 cup warm (not hot) water  
- Copies of **MAKE A YEAST FEAST** page

**Talk About It**

Ask: What do you need to grow? (food, for one)

**What To Do**

1. With the groups, pour a yeast packet into a bag. Ask: Is yeast a living thing? How can we find out? Record ideas. (Yeast is a one-cell fungus. It grows by dividing or pinching off new cells.)
2. Ask: If yeast is alive, will this yeast grow all alone? Leave your bagged yeast to observe.
3. Ask: What might you give yeast to make it grow? When kids say food, let groups add sugar to their bags.
5. Ask: Is water food? (No, but it’s necessary for cells to function.) What will happen if we just add water to yeast? Make a class yeast-and-water bag.
6. Ask: Do you need water to survive? If yeast is alive, does it need water? Let kids add water to their yeast-sugar mix.
7. Have kids observe and draw yeast action. (Water activates yeast. Growing cells give off carbon dioxide gas, which inflates bags.)
8. Continue to observe. Ask: Is yeast alive? What is your evidence?

**Next Stop**

Have a pizza party. Make pizza dough. Ask: What makes dough rise? (carbon dioxide gas from the feeding yeast cells)
Going Hands-On

Time: 30 minutes
Group Size: 4

Dorothy Ann has a nifty new telescope, but she still enjoys looking at the stars with eye power alone. You kids report star counts and explore why we can't see stars during the day.

What You Need
For the Class
- Star Count take-home activity sheet
- Copies of SHINE ON page

For Each Group
- Pencil or pen
- Bright flashlight

Ahead of time: Encourage students to do the Star Count activity with their families. Set a date for Star Count reports.

Talk About It

Let students report results of their Star Counts. Ask: Who saw the most stars? The least? Why did some see less stars than others did? (Light from surroundings or a bright moon fades out some stars.)

What To Do

1. Ask: Do stars shine during the day? (Yes, but atmospheric gases, dust, and water vapor scatter sunlight passing through. This veils stars until the sun sets.) Record students' ideas.
2. Alter kids punch out the Astro-Liz “constellation,” have them cut out the foldover. Fold the white flap over the dark Astro-Liz flap. Ask: What do the holes represent? (stars) The flashlight? (sun) The cover flap? (atmosphere)
3. Tell kids to pretend it's nighttime. Hold up Astro-Liz to a bright window, white flap facing them. Do they see “stars” through the “atmosphere” (cover flap)?
4. Ask: When the sun comes up, do you see stars? Let kids shine the flashlight on the cover flap “atmosphere.”
5. Ask: Why don’t we see stars during the day?

Next Stop
Make a sky map of favorite constellations students see at night.
Going Hands-On

Time: 20 minutes  
Group Size: 4

Phoebe and her classmates find out that gravity pulls everything down. Your kids test whether gravity makes heavier things fall faster than lighter ones.

What You Need

For Each Class

- Pencil tied to a string  
- Scissors  
- Copies of WHAT A DOWNER page

For Each Group

- 1 empty film canister filled with sand, pennies, or clay  
- 2 pairs safety glasses for “Eyes” and “Ears”  
- Stepladder (optional)

Talk About It

Hold up the string with the pencil suspended. Ask a volunteer to cut the string. Ask: What happened? Why did the pencil fall?

What To Do

1. Set up a dropping station for each group - stepladder, table edge, chair on table - the higher the better. Check that stations are sturdy.  
2. Ask: Do heavy objects fall faster than lighter ones? How can we tell if one object falls faster than another? How will we know if the objects hit the ground at the same time? What senses can we use? (vision, hearing)  
3. Give groups light and heavy film canisters to test. Ask: Does gravity pull equally on heavy and light objects?

Next Stop

If one kid throws a ball straight out, horizontal to the ground, and another drops a ball at the same time from the same height, will the balls hit the ground at the same time? (Yes. One may travel farther, but gravity pulls down on each equally, and they both fall at the same speed.) Ask: Is this difficult to judge with our senses? What could we use to improve our judgment?
Going Hands-On

Time: 20 minutes
Group Size: 4-6

Ms. Frizzles class explores Janets nose to learn how we smell. Your kids investigate how well their own odor detectors can identify smells.

What You Need

- 4 plastic film canisters, plus 1 for each group
- 4 objects with strong odors
- Hole punch
- Copies of ODOR DETECTIVES page

Talk About It

Ask: What smells can you identify?

What To Do

1. Number the canisters. Punch a hole in each lid.
2. Put a strong-smelling object in each canister. Some ideas: cotton balls soaked with perfume, ammonia, spices, citrus peel, soap, toothpaste, coffee, tea, pencil shavings, flavored breakfast cereals, pizza.
3. Tell students to sniff gently. Caution them not to touch lids with their noses.
4. Rotate the canisters among groups for identification and response to the odor. Ask: Do odors send a message to you? What are some signals these odors send to you?
5. Let each group create an odor challenge for the others. Ask: How did you choose your odor?

Next Stop

Ask: Do smells need time to travel from the source to your nose? Group kids at the back of the room. Uncap a mystery bottle of perfume or aftershave. Time how long it takes kids to detect the odor.
Going Hands-On

Time: 30 minutes
Group Size: 2-4

The Magic School Bus kids charge through an electrical circuit to discover how it works. Your kids make a simple circuit and switch.

What You Need

For Each Group

- D dry-cell battery
- Flashlight bulb (PR2, PR4, PR6)
- 12-inch aluminum foil strip or copper wire
- Paste
- Index card
- 2 1-inch-wide foil strips
- 2 12-inch foil strips or copper wire
- Rubber band
- Tape
- Clothespin (spring type)
- Copies of MAKE THE FLOW GO page

Talk About It

If we have a battery and a lightbulb, how can we light the bulb?

What To Do

1. Before passing out activity sheets, give each group a battery, bulb, and 12-inch foil strip or wire. Fold foil strips lengthwise to make them sturdier. Challenge kids to make the light glow. ("A circuit between ..." graphic)
2. Compare groups' electrical circuits. Ask: What do successful setups have in common? (They make a circular pathway with the foil between battery and bulb.) Let kids draw and label circuits on the activity sheet.
3. Ask: How can we turn the bulb off? (Break the circuit.) Use activity-sheet instructions to make pressure switches. Ask: What do switches do? (They turn electrical circuits and connected appliances off and on.)
4. Ask: Why does the bulb light when you press the foil strips together? (It completes the circuit, or pathway.)

Next Stop
Create a code using the pressure switch to turn the bulbs off and on. Send a message.
Going Hands-On

Time: 40 minutes
Group Size: 4

One tiny mistake in Mikey’s computer program has the school’s system in an uproar. Your kids learn that computer tasks must be broken into small parts.

What You Need

For Each Student

- Copy of I COMPUTE page
- Pencil

Talk About It

Ask: What do computers do? How are computers like other machines? How are they different?

What To Do

1. Ask: What tells a computer what to do? (a program in a computer language) What is a program? (a set of step-by-step instructions to accomplish a task) Can you follow a program?
2. Space groups in separate squares, with four pencils in the center of the square.
3. Have kids act out the Pencil Pass Program instructions. Are more instructions needed for Bit #1 and Bit #2? Are there “bugs” - mistakes? If so, challenge kids to fix them.
4. Have groups compete the program to pass out pencils. Let them present the programs they write. Ask: How many ways did we find to accomplish the same task?

Next Stop

Examine a computer. Unplug it from the wall. Where do the cables go? Unscrew and remove the cover. Find - don’t touch - the floppy drive, hard drive, motherboard, CPU, other components. CAUTION! Never open a monitor. It stores shocking voltage.
Going Hands-On

Time: 50 minutes
Group Size: 4-6

Ms. Frizzle’s kids discover that they share their city with wild critters. Your kids take a wildlife field trip of your neighborhood to discover what lives there.

What You Need

For each student:
- Copies of WALK ON THE WILD SIDE page
- Map of community
- Adult or student leader for each group

Ahead of time: Help students draw a large-scale map of your neighborhood. Enlarge a commercial map, or create your own.

Talk About It

Ask: Do wild animals live in our community? Which ones? Why might they want to live here?

What To Do

1. Brainstorm ways to tell if wild animals are around. (sightings, tracks, droppings, garbage or garden raids, homes)
2. Pass out copies of WALK ON THE WILD SIDE page. Assign groups to specific areas. Decide if you will include common animals like pigeons or squirrels.
3. Explore areas for 20-30 minutes. Warn kids not to touch or disturb any animals. Look for shelters - sheds, culverts, burrows, rock piles, nest sites; food sources - gardens, open garbage cans, feeders, pet dishes; vegetation cover; water sources - pet dishes, pools, leaky faucets. Record all sightings or signs of wildlife.
4. Transfer information to the map. Ask: Does wildlife cluster in some spots? Why? Did we find all the wild critters that live here? (No, many are hidden or come out at other times.)

Next Stop
Encourage families to record wildlife sightings. Add them to your map, and display it for a family night.
Going Hands-On

Time: 20 minutes  
Group Size: 2

Wanda thinks she can reach the treasure alone, but she soon learns that survival on the coral reef often depends on cooperation. Your kids find out how partners can help run a race.

What You Need
For Each Student

- 4- or 5-foot scarf or cloth strip for each pair
- Clock with second hand
- Copies of TIED TOGETHER page

Ask: Why do we cooperate with each other? Does cooperation benefit you?

Talk About It

Ask: Do wild animals live in our community? Which ones? Why might they want to live here?

Ask: If I walked into your room, what could I discover about you from all your things? Would I know as much from just one thing?

What To Do

1. Ask: Are humans the only ones who cooperate? Why might coral reef animals become partners? (Cooperation benefits one or both.)
2. Mark “Start” and “Finish” lines on a racecourse. The finish line is the safety of the reef. Place the clock for all to see.
3. Set the scene: Imagine you are a coral reef critter, with only one leg. A big, HUNGRY fish is chasing you. You must get to the reef to hide. Can you make it in time?
4. Round 1: Kids hop on one leg down the racecourse. Yell the time for Start, and have them time themselves to the finish.
5. Ask: Could you run faster with more legs? For Round 2, pair kids of similar heights and abilities. Help them tie ankles together - left ankle of one to right ankle of other. They cannot communicate, but they must not drag the other. Let pairs time themselves down the course.
7. Ask: Could cooperation help partners survive?

Next Stop
Make a bulletin board of coral reef partnerships. Have pairs of kids research and draw the partners.
Be a Planet

Show the order of the planets in the Solar System.

1. Write the name and draw a picture of the planet or the Sun on your label.
2. Form a line showing the order of the planets from the Sun.
3. Then orbit around the Sun.

Approximate diameters in kilometers:

- Mercury: 4,900 km
- Venus: 12,100 km
- Earth: 12,600 km
- Mars: 6,800 km
- Jupiter: 143,000 km
- Saturn: 121,000 km
- Uranus: 51,100 km
- Neptune: 49,500 km
- Pluto: 2,300 km

As I always say, class...you’re out of this world!

Make a Model

1. Look at the balls and marbles. These objects stand for the planets.
2. Place them in the order of the planets to make a model of the Solar System.
Food Crushers

Observe
Look at your front and back teeth in the mirror.

1. Bite the apple. Did you use your front teeth or back teeth to take the bite?

2. Chew the bite of apple. (It's OK to swallow it, too.) Did you use your front or back teeth to chew?

3. Eat a piece of banana and a piece of celery. Which teeth do the most work when you bite...
   - the banana?
   - the celery?

4. What work does your tongue do when you eat the banana?

Think about it
Can you think of other foods you eat with your
   - front teeth?
   - back teeth?
   - tongue?

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Skin to Germs: KEEP OUT!

Observe the apples each day. Draw what you notice.

Day 1

A

B

Day 2

A

B

Day 3

A

B

Day 4

A

B

Day 5

A

B

What changes did you see in the apples?

Skin is tough!
Draw a picture of a food chain. Show where the food energy comes from. Show what eats what.

GET READY FOR THE POPCORN CHAIN
Color and cut out the symbol that matches your role in the food chain.
Tape it to a piece of yarn and wear it around your neck.

It's your job as scientists to look for connections!
Earth-Wormery

Set up the earthworms' indoor home.

WHAT TO DO
1. Fill the jar about three-quarters full with the soil.
2. Mix the dry food and grass or dead leaves into the soil.
3. Put 4-5 earthworms in the jar.
4. Sprinkle water each day to make the soil damp, but not wet.
5. Cover the jar with the black paper. Keep it closed with rubber band or tape.
6. After observing the earthworms, return them to their natural habitat.

OBSERVATIONS
Write about what you see the earthworms doing each day.

Day 1

Day 2

Day 3

Draw a picture of your earthworm observations.
The Leaf-Decay Contraption

What To Do

1. Cut and label the soda bottles like this:

2. Put the stocking piece over the spout of B. Secure it with a rubber band.

3. Set B, small end down, inside A.

4. Mix the leaves with the soil. Put the mixture inside B and gently pack it down. With the crayon, mark on B where the top of the mixture reaches.

5. Loosen the cap on C. Set C, spout down, inside B.

6. Pour the rain water into C. The water will drip through the loosened cap, the leaves and soil, and down into A.

7. Keep the Leaf-Decay Contraption in a warm place, but not in the Sun. Each day, pour the water from A into C.

8. At the end of a week, stir the mixture and pack it down. Mark the top of the mixture again. Do this for a month or longer, if possible.

What do you think will happen to the leaf and soil mixture?

Make a chart on the back of this sheet. Record what you observe each week.
Write the name of the food in each bag on the labels.

Find out if different foods you eat contain water.
1. Put one piece of food in each plastic bag and seal.
2. Place the bags under the lamp.

PREDICTIONS
Which food do you think will have the most water? __________________________
Why? __________________________

Which food do you think will have the least water? __________________________
Why? __________________________

OBSERVATIONS After waiting half an hour, look at the bags.
Which food has the most water in it? __________________________
How can you tell? __________________________

Which food has the least? __________________________
How can you tell? __________________________

Do all the food pieces have some water? __________________________
How can you tell? __________________________
Can you locate a “moth” even if you can’t see it? Try this test and you’ll “see”!

What to Do

If You’re the Bat:
Walk around. Clap to tell if you are facing an object or moth. Objects you are facing will clap back. The moth will clink its spoons. Try to tag the moth without bumping into any objects.

If You’re An Object:
Stand quietly. If the bat claps when it is facing you, clap back.

If You’re a Moth:
Stand quietly. If the bat claps when it is facing you, clink your spoons.

Observations
1. On the back of this paper, describe what it was like to be the bat.
2. Did you or anyone else catch the moth? Describe how on the back of this paper.

To LOCATE an object, bats use echolocation!

Keep Bat-score!
How many bats tagged moths?____
How many bats bumped into objects?____
MEGA PRETZELS
This recipe will make 8-10 large pretzels.

WHAT YOU NEED

UTENSILS
- mixing bowl
- greased bowl
- cutting board
- clean dish towel
- wooden spoon
- greased cookie sheet

INGREDIENTS
- 1/4 ounce package or 1/2 tablespoon active dry yeast
- 1/2 cup warm water
- 1 tablespoon honey
- 1 teaspoon salt
- 1 1/2 cups flour
- 1/4 cup flour (to sprinkle on cutting board)
- 3 tablespoons melted butter
- extra salt

WHAT TO DO

1. Stir yeast into the warm water. Add honey and salt. Let sit about 5 minutes.
2. Stir in 1 1/2 cups flour to make a thick mixture.
3. Sprinkle 1/4 cup flour (as needed) on a cutting board. Knead dough on the board for 5-7 minutes.
4. Put dough in greased bowl and cover with the dish towel. Let dough sit at room temperature about 20 minutes.
5. Roll out long thin pieces of dough and make shapes or letters. Place these on a greased cookie sheet.
6. Pre-heat oven to 475° for 5 minutes.
7. Pour melted butter over pretzels. Sprinkle salt.
8. Bake pretzels for 10-12 minutes.
9. Enjoy!

An Adult Needs to Help with These Steps

Take chances! Make mistakes! And especially... Get messy!
Friction Action

Find out what happens when you pull the box.

Fill box with stones. Put box on table.

<table>
<thead>
<tr>
<th>PREDICTIONS</th>
<th>OBSERVATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Think about what will happen when you pull the box by the rubber band. Write how long you think the rubber band will stretch before the box moves.</td>
<td>Pull the box. Measure how long the rubber band stretches before the box begins to move. Write the distance here.</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>inches</td>
<td>inches</td>
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</tbody>
</table>

Place rollers under box. Then record your predictions and observations.

<p>| | |</p>
<table>
<thead>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>inches</td>
<td>inches</td>
</tr>
</tbody>
</table>

Use this handy ruler to measure the distance.
How do you think each seed could travel? By wind, water, or as a hitchhiker? Make a guess and test it. Then record what happens.

### Identify Your Seed
Draw a picture and write the name of the seed.

<table>
<thead>
<tr>
<th>Name</th>
<th>Name</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>maple</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Prediction
Circle your guess about the way your seed travels.

<table>
<thead>
<tr>
<th>Wind</th>
<th>Wind</th>
<th>Wind</th>
</tr>
</thead>
<tbody>
<tr>
<td>water</td>
<td>water</td>
<td>water</td>
</tr>
<tr>
<td>hitchhiker</td>
<td>hitchhiker</td>
<td>hitchhiker</td>
</tr>
</tbody>
</table>

### Observation
Circle the way your seed actually travels.

<table>
<thead>
<tr>
<th>Wind</th>
<th>Wind</th>
<th>Wind</th>
</tr>
</thead>
<tbody>
<tr>
<td>water</td>
<td>water</td>
<td>water</td>
</tr>
<tr>
<td>hitchhiker</td>
<td>hitchhiker</td>
<td>hitchhiker</td>
</tr>
</tbody>
</table>

Draw a picture on the back of this sheet showing the way one of your seeds travels.
Wind Spiral

1. Decorate your spiral. Cut it out along the dotted line.

2. Pull needle and thread through the X on the spiral. Tie a knot at the end of the thread so it will hold up the spiral.

3. To see how warm air rises, hold your spiral over the light bulb.

What happens?

__________________________
ERUPTION!

Make a model of an ocean volcano. Then make it erupt!

What to Do

1. How can you make a volcano that reaches from the ocean floor to up above the top of the water? Draw your ideas on the back of this paper.

2. Use clay to build your volcano.

3. Make a crater in the top of the volcano. It should be almost as long as your pinkie finger and wide enough to slip two fingers into the hole.

4. Put a teaspoon of baking soda and four drops of food coloring into your crater.

5. With your teacher's help, pour in two teaspoons of vinegar. What happens?

Observations

Describe the eruption.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

What do you think made the bubbles?

__________________________________________________________________________
GIVE ME A HAND

How is your arm and hand like a chicken wing? How is it different? Find out!

What to Do

<table>
<thead>
<tr>
<th>Your Body:</th>
<th>How Many?</th>
<th>The Chicken Wing:</th>
<th>How Many?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting at your shoulder, count all the bones you can feel in your arm and hand.</td>
<td></td>
<td>Count all the bones you see in the chicken wing.</td>
<td></td>
</tr>
<tr>
<td>Count all the different places where your arm and hand bends and twists.</td>
<td></td>
<td>Count all the places where the chicken wing bends and twists.</td>
<td></td>
</tr>
</tbody>
</table>

Observations

Here's how the chicken wing is the same as my hand and arm:

Here's how the chicken wing is different from my hand and arm:

Take chances, get messy, ask questions!
SEEING WITH SOUND

Can you locate a “moth” even if you can’t see it? Try this test and you’ll “see”!

What to Do

If You’re the Bat:
Walk around. Clap to tell if you are facing an object or moth. Objects you are facing will clap back. The moth will clink its spoons. Try to tag the moth without bumping into any objects.

If You’re An Object:
Stand quietly. If the bat claps when it is facing you, clap back.

If You’re a Moth:
Stand quietly. If the bat claps when it is facing you, clink your spoons.

Observations

1. On the back of this paper, describe what it was like to be the bat.
2. Did you or anyone else catch the moth? Describe how on the back of this paper.

To LOCATE an object, bats use echolocation!

Keep Bat Score!

How many bats tagged moths?____
How many bats bumped into objects?____
TRICKY BUTTERFLIES

Make a butterfly with shapes, designs, and colors that help protect it from predators.

What to Do

1. Think about how a butterfly can protect itself. Write your ideas on the back of this paper.
2. Decide whether you’ll make a Hider or Tricker.
3. Think about where your butterfly lives. What are the colors, shapes, and other animals there?

Observations

How does your butterfly’s looks protect it from predators?

Think About It

Name some other animals whose looks protect them. Looks CAN be deceiving!
GETTING MOLDY

What does cold do to mold? Grow bread mold and find out!

Observations
Look at the slices of bread every day for eight days. Starting on Day 4, draw what you see every other day.

Predictions
Which slice of bread do you think will mold faster? Why?

Think About It
How might you keep food from growing mold?
Some buses move with gasoline power. Can you move your own mini-Magic School Bus with balloon power?

What to Do

MAKING YOUR BUS

1. Cut the top off your milk carton.
2. Cut out four round cardboard wheels as big as the circle shown.
3. Use a pencil to punch holes in the middle of your wheels.
4. Push the straws through the holes in the milk carton. They should stick out on each side.
5. Tape the wheels onto the ends of the straws.
6. Slide the straw with the balloon into the hole in the back of the milk carton.

MAKING IT MOVE

1. Blow up your balloon partway.
2. Pinch the end of the straw to keep the air in.
3. Put the bus down and let go of the straw.

THE GREAT BALLOON RACE RESULTS:

1st Round: ______ inches
2nd Round: ______ inches
3rd Round: ______ inches
FALLING, FLOATING, GLIDING

MAKE A GLIDER
1. Take a sheet of paper. Fold the top two corners toward the middle.
2. Fold each triangle that you made in step 1 in half along the dotted lines.
3. Fold each triangle that you made in step 2 in half along the dotted lines.
4. Fold the glider in half—away from the middle.
5. Open up the flaps and you're ready to take the FALLING, FLOATING, GLIDING test.

What to Do

The Test
Compare your glider to a flat sheet of paper and a crumpled paper ball.

Predictions
Write down where will the paper shapes land: straight down, ahead of you, or in back of you.

FLAT PAPER

GLIDER

CRUMPLED PAPER

Observations
How did your objects fall? Write it down.

FLAT PAPER

GLIDER

CRUMPLED PAPER
PINWHEEL POWER

Make a pinwheel. Then, make it do some work for you—lift paper clips!

What to Do

MAKE A PINWHEEL

1. Draw a six-inch circle on the folder. Cut it out.
2. Draw a big X on the circle.
3. Trace a quarter in the center of the big circle to make a small circle.
4. Cut along the X lines. Stop at the small circle.
5. Fold each part of the big circle in the same direction.
6. Your teacher will help you attach the paper clip. Blow on your pinwheel. What happens?

Energy is such a moving experience.

LIFT PAPER CLIPS

1. Slide the long end of the straight paper clip through the holes in the milk carton.
2. Tie a small paper clip to one end of your string. Your teacher will help you tape the string to the straight paper clip.
3. Blow on your pinwheel. Can you make it lift the paper clip?
CRATERS

Do balls of different weights and sizes leave different size craters? Find out!

Prediction
Which ball will leave the biggest crater?
Why?

Objects in Space by Tim

ASTEROIDS are made of stone or stone and metal. Some are hundreds of miles wide.

COMETS are made of rock, dust, and ice. The ice turns to gas when comets get near the sun, and the gas and dust can form a bright "tail."

METEORS are bits of rock and metal. If they come near Earth, most burn up in our planet's atmosphere. Meteors that do hit the ground are called meteorites.

Observations
Draw the size of your craters below.

From Crouching
From Standing

Ping-Pong Ball Aluminum-Foil Ball
Small Marble Large Marble
LIZARD LIFE

How would a lizard meet its needs outside YOUR school? Make some observations that will help you find out.

What to Do

1. On the back of this paper, write your ideas about what a lizard needs.
2. On the back of this paper, write where a lizard might warm up and cool down outside your school.
3. Draw a picture in each of the boxes below. Show a lizard outside your school at three times of day.

Observations

Which seasons would be easy for a lizard to meet its needs outside your school? Which seasons would be hard?

<table>
<thead>
<tr>
<th>Season</th>
<th>Easy</th>
<th>Hard</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPRING</td>
<td>Easy</td>
<td>Hard</td>
</tr>
<tr>
<td>SUMMER</td>
<td>Easy</td>
<td>Hard</td>
</tr>
<tr>
<td>FALL</td>
<td>Easy</td>
<td>Hard</td>
</tr>
<tr>
<td>WINTER</td>
<td>Easy</td>
<td>Hard</td>
</tr>
</tbody>
</table>

Think About It

Why could or couldn’t a lizard meet its needs outside your school? Write it down on the back of this sheet.
THE HONEY-BEE-BOP

Dance the Honey-Bee-Bop to tell your hive-mates where the flowers are!

1. START HERE! Flap your arms and wiggle down the straight run.

2. Turn right.

3. Wiggle down the straight run again.

4. Turn left.

5. Back to START. You've done one Honey Bee-Bop!

Dance the Honey-Bee-Bop to Communicate:

- **Direction to the flowers:**
  The "straight run" points to flowers.

- **Distance to flowers:**
  The NUMBER and SPEED of the Honey-Bee-Bops in your dance tell how far away the flowers are.

**Distance Key**

<table>
<thead>
<tr>
<th>Distance of Flowers</th>
<th>Dance of Honey-Bee-Bops</th>
</tr>
</thead>
<tbody>
<tr>
<td>VERY FAR AWAY - 25 feet (7.6 meters) or more</td>
<td>1 Honey-Bee-Bop VERY SLOWLY</td>
</tr>
<tr>
<td>FAR AWAY - 15-25 feet (4.6-7.6 meters)</td>
<td>2 Honey-Bee-Bops SLOWLY</td>
</tr>
<tr>
<td>CLOSE - 10-15 feet (3-4.6 meters)</td>
<td>3 Honey-Bee-Bops FAST</td>
</tr>
<tr>
<td>VERY CLOSE - less than 10 feet (3 meters)</td>
<td>4 Honey-Bee-Bops VERY FAST</td>
</tr>
</tbody>
</table>

**WHAT TO DO**

IF YOU'RE THE SCOUT BEE:
Hide your hive's flowers.
Then follow directions to dance the Honey-Bee-Bop.
The dance will tell the worker bees where and how far away the flowers are.

IF YOU'RE A WORKER BEE:
Watch the Scout Bee's dance.
Work with your hive-mates to understand the directions.
Then go for the flowers!
THE INSPIRATION OF INSULATION

TEST A "POLAR BEAR BLANKET"

WHAT YOU NEED
- bag of ice water
- 2 zipper bags
- 12-15 cotton balls

1. To make a Polar Bear Blanket, zip cotton balls in one bag. Zip the empty bag shut.
2. Work with a partner. Hold out your hands, palms up. Ask your partner to put the blanket on your palms. Then put the ice bag on top. Does your hand feel cold?
3. Remove the bags. Put the empty bag on your palms. Put the ice bag on top of it. Does your hand feel cold?

PREDICT: Put a check mark by the one you think will keep your hand warmer.

RESULT: Circle the one that kept your hand warmer. On the back, write how you think the Polar Bear Blanket worked.

TEST A "WALRUS MITT"

WHAT YOU NEED
- bag with 1 cup shortening inside
- 2 empty bags (empty the cotton-ball bag for one)
- bowl of ice water

1. Turn an empty bag inside out. The "zipper" strips now face out.
2. Put the inside-out bag inside the shortening bag. The zipper strips face each other. Zip the two bags together to make a Walrus Mitt.
3. Spread the shortening evenly around inside the mitt.
4. Put one hand in the Walrus Mitt, the other in the empty bag. Take the plunge! Put both hands in ice water. Which is colder?
TAP INTO A TRAPPER

Spider Field Log

Name

Date

To make your Field Log, cut out the pages, stack in order, and staple together.

---

MS. FRIZZLE’S SPIDER RULES

Rule #1 Learn to recognize black widow and brown recluse spiders. These spiders are poisonous. But they will not hurt you if you do not disturb them. Consult a good field guide for identifying marks.

Rule #2 Never touch or pick up any spider.

Rule #3 Don’t touch webs with your hands.

Rule #4 After observing, release spiders exactly where you found them.

---

OBSERVE A SPIDER IN THE FIELD:

Where is it?

How many body parts does it have?

How many legs?

How does your spider trap its prey?

Observe the spider in its trap and draw what you see on the back of this page.

---

OBSERVE A SPIDER IN YOUR SPIDER HOTEL:

With adult help, catch a spider. Get it to walk onto a twig. Transfer it gently to the hotel.

Checking In:

- Observe your spider each day. What’s new?
- Where does the spider hang out?
- What happens when you put in prey?
- Write or draw your observations. Use the back and date each one.
- After a few days, release your spider.

Observation:

Date: 

4
Gumdrop Bridge

Draw your first gumdrop bridge.

Strength Test #1
Hook the cup to the middle of your bridge. Predict how many pennies you can put in the cup before your bridge falls. Add one penny one at a time.

Prediction Result

Draw your new, improved gumdrop bridge.

Make It Stronger
Think: Can you make your bridge stronger? What would you change? Work with your team to make strong bridge parts. Draw your new bridge design. Then build it!

Strength Test #2
Predict the penny strength of your new bridge. Test it.

Prediction Result
What to Do

1. Predict: Write the letter of the picture that shows what you think will happen.
2. Do the experiment.
3. What was the result? Write the letter of that picture.

What do you know about light? Can you move it around? Find out when you try these experiments!

EXPERIMENT #1:
Point the flashlight at the wall and turn it on. Where will you see light?

A. In the air and on the wall  B. Only on the wall  C. Only in the air

Prediction: _____  Result: _____

EXPERIMENT #2:
Hold a card between the flashlight beam and the wall. You’ll see the card shadow on the wall, of course. Will you see the shadow in the air?

A. Shadow in the air  B. No shadow in the air

Prediction: _____  Result: _____

EXPERIMENT #3:
Ask a partner to hold the mirror and white card at an angle to each other. If you shine light on the mirror, where will you see the light beam?

A. Only on the mirror  B. On the mirror and the card

Prediction: _____  Result: _____
What to Do

1. For each bunch of clues passed to your team, record the group name and all the clues.
2. Then, work together to guess the activity from the clues.

Group Name:

Clues:

Activity:

List or draw 10 things in your bedroom or desk that tell about you—who you are, what you like, what your special interests are.

My Personal Archaeology

Circle the fifth thing on your list. If you found this object lying on the street, what would you know about the person who owned it? Write what you think on the back of this page.
What to Do

1. Paste the wheel on cardboard, then cut it out. Get help to punch the center hole.
2. Color the wheel:
   Team Member #1—A single color
   Team Member #2—Blue, Yellow, Red
   Team Member #3—Red, Green, Blue
   Team Members #4, 5—Your choice
3. Poke a pencil through the hole so the wheel fits snugly. Predict what color(s) you will see when you spin the wheel. Record them below.
4. Spin the wheel as fast as you can. Record the color(s) you see in the space for results. What happens as it slows?
5. Trade wheels to spin and observe all of them.

<table>
<thead>
<tr>
<th>Wheel Color(s)</th>
<th>Prediction</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#2</td>
<td></td>
<td></td>
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<tr>
<td>#3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For faster spins, wrap a piece of clay or loop a rubber band tightly around the pencil at the top of the wheel.
What to Do

1. Color the drawings.
2. Paste the wheels onto cardboard, and cut out. Ask an adult to cut out the window on Wheel A and poke holes in both wheels.
3. Put Wheel A on top of Wheel B. Attach with a paper fastener.
4. Follow the salmon’s migration. Turn the wheel clockwise.
HEART WORKOUT WORKSHEET

Find Your Resting Pulse Rate

1. Put Heartbeat Monitor on your wrist artery. (Or feel your neck artery.)
2. Ask a partner to click 15 seconds. Count the tick tocks of the Heartbeat Monitor (or pulses in neck artery).

____ Heartbeats in 15 seconds x 4 = _____ Resting Heartbeats per Minute

Find Your Working Pulse Rate

3. Do 20 jumping jacks. Now find your working pulse rate.

____ Heartbeats per 15 seconds x 4 = _____ Working Heartbeats per Minute

Find Your Cool-Down Pulse Rate

4. Wait 2 minutes. Find your cool-down pulse rate.

____ Heartbeats per 15 seconds x 4 = _____ Cool-Down Heartbeats per Minute

MY HARD-WORKING HEART

Heart Profile of:

_________________________ Age:_____

My heart beats (Resting Pulse Rate):

________________ times per minute,
(x 60)_________ times per hour,
(x 24)_________ times per day, and
(x 365)_________ times per year.

In my lifetime, (x your age______),
my heart has beat more than
________________________ times.

CHART YOUR HEART!

PULSE RATE—Heartbeats per minute

<table>
<thead>
<tr>
<th></th>
<th>130</th>
<th>120</th>
<th>110</th>
<th>100</th>
<th>90</th>
<th>80</th>
<th>70</th>
</tr>
</thead>
<tbody>
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<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

Resting  Working  Cool-Down
**A-MAZE-ING PLANTS**

**What to Do**

1. Build the maze. Cut pieces of cardboard as wide as the box to make dividers. Tape in place.

2. Ask an adult to cut a hole at the top of the box. Set your plant inside at bottom. Tape the lid on. Place box in a sunny spot.

3. Check your plant every few days. Each time, draw what you see on the maze here. Water plant if the top of the soil is dry.

**How It Grows:**

- Measure your plant when it grows out of the box: ______ inches (centimeters)
- Measure the control plant: ______ inches (centimeters)

**Each time you observe the plant, use a different color to draw how it is growing. Record the color and date here.**

**On the back, write why one plant might be longer.**
Liz’s Desert Cousin

Liz’s cousin Chuckwalla is a lizard that lives in the Southwestern desert. One morning Chuck comes out of his rock shelter and warms in the sun. He keeps away from a rattlesnake on the rocks. It might eat him. Chuck sets off for his local diner—a creosote bush. He climbs the bush and munches on flowers and seeds.

A big bird, a roadrunner, cools off in the bush shade. The bird spots the snake and dashes toward it. Yum, yum, rattlesnake breakfast! Chuck is glad he’s not on the roadrunner’s menu. He walks back to his warm rock to soak up the sun.

What to Do

1. In the story about Liz’s cousin Chuckwalla, look for clues to his desert environment.
2. Color the pictures on the circles. Glue to thin cardboard, and cut out.
3. To make a stand for each, use a pencil stuck in a blob of clay for a base. Tape the cut out circles to the pencils. Arrange them to create a picture of Chuck’s home.
4. Use yarn to connect the plant, animals, and habitat in as many ways as you can. Tape the yarn to the pencils.
5. On each strand of yarn, tape a label to describe the connection: “Food,” “Shelter,” or “Habitat Need.” A habitat need might be warmth, shade, or just a place to hang out.
GET ERODED!

Explore the force of water erosion and create your own landforms!

GENTLE SLOPE TEST

1. Poke a hole in the cup near the base. Put the straw in the hole. Seal with modeling clay.
2. Prop up the board about 3 inches.
3. Cover the board with soil. Put cup at the top as shown.
4. Draw your prediction of what will happen when water runs down the slope.
5. Hold a finger over the straw end and fill the cup with water. Remove your finger. Watch water power in action. Draw the result.
6. Raise the board to 6 inches and repeat the test.

STEEP SLOPE TEST

Setup:

Challenge:
Can you control steep-slope erosion with rocks, leaves, roots, or sticks? Try it!

Prediction

Result

Prediction

Result

3 inches high

6 inches high
Make something new from something old. Reuse or recycle parts of this bicycle!

Reuse as:

- **SEAT**
  - Recycle into (basic material)
  - Make into new:

- **TIRES**
  - Recycle into (basic material)
  - Make into new:

- **HANDLE BARS**
  - Recycle into (basic material)
  - Make into new:
MATCHMAKER, MATCHMAKER

Name: ___________________________ Date: ___________________________

What to Do

1.
Put a few drops of SOAPS
in a glass of WATER.
Stir well. What happens?
______________________________
Can you see the soap?
______________________________
Do the oil and water mix?
______________________________

2.
Put 2 tablespoons of OIL
in a glass of WATER.
Stir well. What happens?
______________________________

3.
Add 1 tablespoon of SOAP
to the WATER and OIL.
Stir well. What happens?
______________________________

Think About It

What did the soap do to the oil and water?
______________________________

Take-Home Challenge:

Remove oil and grime the matchmaker way. Rub baby oil onto greasy, grimy hands. Then wash under running water with soap. Baby oil lifts the grime; soap and water wash it away.
THE INSIDE "EGGS-POSÉ"

Name: ___________________________ Date: ___________________________

What to Do:

1. If you crack an egg onto a plate, what will you find? Draw a picture of how you think the egg will look.

2. Now crack an egg. Draw a picture of all the parts of the egg on the top half of the back of this page. (P.S. Don't forget to look inside the shell.)

3. Cut out the egg-part labels below. Paste them on your drawing and draw an arrow to the part. Did you see all these parts?

What I think the inside of an egg will look like:

Get cracking!

Use these labels for your egg drawing:

- **Eggshell**: Protects egg
- **Yolk**: Food for embryo
- **Shell Membrane**: Holds in egg stuff and lets in air
- **Germ Spot**: White dot on the yolk. It holds the hen's ovum. (You may not see it.) On a fertile egg, the germ spot develops into the chick embryo.
- **Thick White**: Shock absorber and food for embryo
- **Chalazae (Kuh-lay-zah)**: Twisted white cord holds yolk in place
- **Air Space**: Extra air for the embryo

Take-Home Challenge:

How can you tell a raw egg from a hard-boiled egg without cracking the egg?

**Answer**: Spin the egg on its side. Hard-boiled eggs spin fast; they are solid. Raw eggs wobble and hardly spin; the liquid inside makes them wobble.
LIFE IN THE INTERTIDAL ZONE

Where would YOU live between the tides?

What to Do:
1. Learn as much as you can about one of the animals. Draw it to size and color more copies of it.
2. Arrange the drawings of your animal in the class intertidal zone. Tell other groups how it lives.
3. From your research, choose one more animal. Draw and color it. Find out where and how it lives. Place it in the intertidal zone.

CALIFORNIA MUSSHEL
- 2 inches
- HOME: Middle-Tide Zone
- SURVIVAL TIPS:
  - Strong byssal threads anchor me to rocks and other mussels.
  - If an intruder tries to steal my place, I grow right over it.
- ENEMY: Sea Star
- FOOD: Plankton

SEA STAR
- 4 inches
- HOME: Lower- and Middle-Tide Zone
- SURVIVAL TIPS:
  - I stay moist.
  - I engulf my food.
- ENEMIES: I am the enemy.
- FOOD: Shellfish

ACORN BARNACLE
- 1/2 inch
- HOME: High Tide to Middle-Tide Zone
- SURVIVAL TIPS:
  - I seal tight in my shell when the tide is out.
  - To stand up to waves, I cement myself to a rock.
  - When the tide washes in, I stick out “legs” to sweep in food.
- ENEMIES: Seagulls, other birds
- FOOD: Plankton

FRILLED DOGWINKLE SNAIL
- 1 1/2 inches
- HOME: Middle- and Lower-Tide Zone
- SURVIVAL TIPS:
  - The sharp teeth on my tongue-like radula drill holes in other shelled creatures. Then I eat them. Yum!
  - When the tide goes out, I close my operculum safety door, and hunker down.
- ENEMY: Sea Star
- FOOD: Owl limpets, barnacles, mussels

ERODED PERIWINKLE SNAIL
- 1/2 inch
- HOME: High Tide Zone
- SURVIVAL TIPS:
  - My gills take oxygen out of sea water. But I can also breathe in oxygen from the air.
  - For protection and to keep from drying out, I shut the door-like operculum to my shell.
- ENEMY: Seagull
- FOOD: Algae and plankton scraped from rocks
PUSHY AIR

Get Started!

Air is pushy stuff!
But can it push up heavy books?

1. Sweep an open zipper bag through the air. Zip it closed. What is in the bag?

   ______________________

2. Press on the bag. Can you press the bag all the way down? What happens?

   ______________________

CHALLENGE #1
PUSHBACK
Can you beat air's push?

Predict: Can your air bag hold up heavy books?  ____ Yes ____ No

Guess: How many heavy books? ______

Try it! Pile books on your bag. How many does your air bag hold up? ______

What is holding up the books?

____________________

CHALLENGE #2
AIR LIFT
Can you lift three heavy books with your breath alone?

1. Insert a straw halfway into an empty zipper bag. Seal the bag around the straw.

2. Blow through the straw into the bag. Keep blowing as you slip the straw out. Seal the bag FAST as you remove the straw.

3. Did the books lift off the table? If not, try again.

   ______________________

Wrap-Up:

What pushed the books up? ______

____________________

The books are pressing down on the air bag. Is the air pressing up on the books? Write what you think on the back.

Take-Home Challenge:

Blow as you remove straw, then seal bag

Will a zipper bag of air hold YOU up? Trap air in a new gallon zipper bag, then seal it shut. Sit on the air bag. What happens? Challenge an adult to sit on the bag!
SETTLE DOWN

Can a wetland soak up a flood of muddy water?

**DIURT DROP**

1. Make muddy water. Stir 1 tablespoon of dirt into a glass of water. **Predict:** If you stop stirring, what will happen to the dirt?
2. Stop stirring. Wait 10 minutes. **Observe:** What happens to the dirt and water?
3. Stir the water to get it moving. **Observe:** What happens to the dirt and water?

**Wrap-Up:** How might wetlands help clean dirty flood waters? Write your ideas on the back.

**MUDDY WATER RACE OFFICIAL RULES:**

1. Sponge teams race against no-sponge teams.
2. Prop up cookie sheets three inches at one end.
3. Each team needs a
   - **WATER CATCHER:** Hold bowl at the bottom of the cookie sheet to catch the water. Act quickly!
   - **POURER:** Stir up dirt in the muddy water. Pour it at the top of your cookie sheet.
   - **TIMEKEEPER:** Say “Go!” to the Pourer. Time how long the water takes to fill the bowl.
   - **RECORDKEEPER:** Say “Finished” when all water has run into the bowl. Record official race results.
4. When the Timekeeper says, “Go!” Pourer pours muddy water. Water Catcher has bowl ready to catch water. RecordKeeper says “Finished” when water has run down. Timekeeper calls out, “time.”

**RACE RESULTS**

**NO-SPONGE TEAM**

Time: ____ seconds

**SPONGE TEAM**

Time: ____ seconds

How does your water look? Compare with the other team.

Write your observations on the back.

**Take-Home Challenge:**

Visit a marsh, swamp, bog, streamside, or other wetland with your family. List the plants and animals you see.
MAKE A YEAST FEAST

How can YOU discover if yeast is a living thing?

Think About It:

1. What do you think? Is yeast a living thing?  Yes ___  No ___
2. How could you find out?

What to Do:

1. Pour the yeast into the zipper bag.
2. What will you add to find out if yeast is alive?
3. Seal the bag. Mark the level of the yeast at the start.
4. Observe, mark the level, and draw what happens at each observation.

START  AFTER 20 MINUTES  AFTER 40 MINUTES  AFTER 60 MINUTES

Take-Home Challenge:
Go on a yeast hunt in your kitchen. What things contain yeast? What food recipes use yeast as an ingredient?

Wrap-Up

Did the yeast grow?  ___Yes  ___No
Is yeast a living thing?  ___Yes  ___No
Write the reasons for your answer on the back.
SHINE ON

Why can’t you see stars during the day? Shine on and see!

See Astro-Liz, the newest constellation in the sky!

1. To see this stellar event, use a pencil to punch out the holes in the black panel.

2. Fold the white flap over Astro-Liz. Hold up Astro-Liz to a bright window, with the white flap facing you (Picture A). Do you see Astro-Liz shining in the “night” sky? Yes No

3. What will happen when the sun rises? Hold up Astro-Liz to the window as before. Shine a flashlight “sun” on the white flap (Picture B). Do you see Astro-Liz shining in the “daytime” sky? Yes No

Think About It

Do real stars shine during the day? Yes No Why or why not?

How is the flashlight like the sun?

How is it different?

Take-Home Challenge:

After the sun sets, when can you see the first star? the second? When can you see 10 stars?
WHAT A DOWNER

Do heavy objects fall faster than lighter ones? You be the judge...

What Do You Think?

If you drop a heavy canister and an empty canister at the same time, will the heavy one fall faster? __Yes__ No

Now, Find Out

1. Assign jobs.
   
   **DROPPER** places a heavy and light canister on the edge of a surface. When Starter says, “GO!” the Dropper knocks both off at exactly the same time.
   
   **STARTER** says, “GO!” and makes sure canisters fall at the same time.
   
   **EYES** and **EARS** wear safety glasses. They lie on the floor to see when objects hit. They listen as objects hit. Are the hits together or apart?

2. Test your canisters.

3. Run four trials. Rotate jobs so everyone fills all jobs.

YOU BE THE JUDGE:

Which canister hit the ground first—The heavier (H), the lighter (L), or both at the same time (S)? Record H, L, or S on this chart.

<table>
<thead>
<tr>
<th></th>
<th>Trial #1</th>
<th>Trial #2</th>
<th>Trial #3</th>
<th>Trial #4</th>
</tr>
</thead>
<tbody>
<tr>
<td>DROPPER</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>STARTER</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>EYES &amp; EARS #1</td>
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<td></td>
</tr>
<tr>
<td>EYES &amp; EARS #2</td>
<td></td>
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</tr>
</tbody>
</table>

Wrap-Up

Do heavy objects fall faster than lighter ones? __________

Were the trials easy to judge? ________________________

Explain why or why not on the back.

Take-Home Challenge:

Can you push with as much force as gravity pulls?

1. Weigh yourself on a bathroom scale. Your weight is the pull of gravity on you.

2. Now, ask a family member to hold the scale against a wall. Push on it with both hands. Push HARD! Can you push your own weight?
ODOR DETECTIVES

How good is your odor detector?
Identify objects from their smell alone!

Mystery Smells

What to Do:
1. Take a whiff of each mystery smell. What is it? Write its identity.
2. What signal does the odor send you? Draw a line from the odor to its signal. Write in signals not shown.

Odor Detective

1. Select a strong-smelling object for other groups to identify. Put a small sample in the film canister.
2. Guess other groups' mystery smells. Write your answer on the back. Are you a good Odor Detective?

Take-Home Challenge:
Who has the best and fastest nose in your family? Gather your family in one room while a meal is cooking.
Time how long it takes each of you to smell and identify the foods. Can you stump everyone with a mystery food?
Can you create an electric flow and make the bulb glow?

THE GLOW-FLOW CHALLENGE

1. Use a battery, bulb, and foil strip to make an electric circuit. If the bulb glows, you've got a circuit! Draw a picture here of your setup.
2. Connect the labels below with arrows to the parts of your electrical circuit.

LIGHTBULB
What it does: Uses electric current to make light and heat
Job: Lights up

BATTERY
What it does: Moves electric charges in a current
Job: Energy source

FOIL STRIP
What it does: Lets electric charges move easily
Job: Conducts electricity

SWITCH IT ON!

Make a switch to turn your lightbulb on and off.
1. Fold index card in half. Tape pieces of foil completely around both halves.
2. Make a pressure switch, as shown in the illustration.
3. Finish making the switch. Does the bulb light? What can you do to make it light?

Wrap foil around bulb base. Hold with clothespin.
Press together to switch on
Get with the program! A computer program is a list of step-by-step instructions. It tells a computer how to do a task. Can you follow a program?

What to Do

1. Number group members: Bit #1, Bit #2, Bit #3, Bit #4.
2. Stand in a square, three steps apart.
3. Each Bit must do exactly what the program commands—no more, no less.

PART ONE:
Follow the “Pencil Pass” Program

Bit #1
1. Turn to face the center of the square.
2. Walk forward in baby steps.
3. Stop when you reach the pencils.
4. Pick up four pencils.
5. Turn around halfway.
6. Return to your original position.

Bit #2
7. Turn one quarter turn to face Bit #1.
8. Walk forward three steps.
9. Stop when you reach Bit #1.
10. Say, “Please give me three pencils.”

PART TWO:
Write Your Own Program

• First write instructions to give pencils to Bit #3 and Bit #4, then to collect and return all pencils to the center of the square. Use the back for your program.
• Act out your program. Does it work? Are there “bugs”—mistakes? Write new instructions to fix them. Then test again.

Take-Home Challenge:

With your family, write a step-by-step program for putting away dishes. Then practice it to find and fix any bugs.
WALK ON THE WILD SIDE

What wild critters share your community?
Record all sightings or signs of wild animals. Be on the lookout for tracks, droppings, garbage or garden raids, homes, etc.

What to Do:

Wild Animal:

Time: __________  Exact location: __________

Did you see it?  ___Yes  ___No

Wild-critter signs:

Why do you think it lives here?

Take-Home Challenge:
Walk or ride through your neighborhood with a family member at dawn or dusk. Record all wildlife sightings for your class wildlife map.

Use the back for more critter sightings.
What to Do:

**ROUND 1**

Hop down the racecourse on one leg. Time yourself.

**ROUND 2**

Will another leg get you to safety faster? Tie ankles with your partner. Do not communicate in any way. Race for the reef!

**ROUND 3**

That's not fast enough. Plan with your partner how to get to the reef faster—with your legs still tied together! Then test your plan and race to safety.

**Take-Home Challenge:**

Do you have a pet? Ask your family: What are three ways your pet benefits you? How do you benefit your pet?