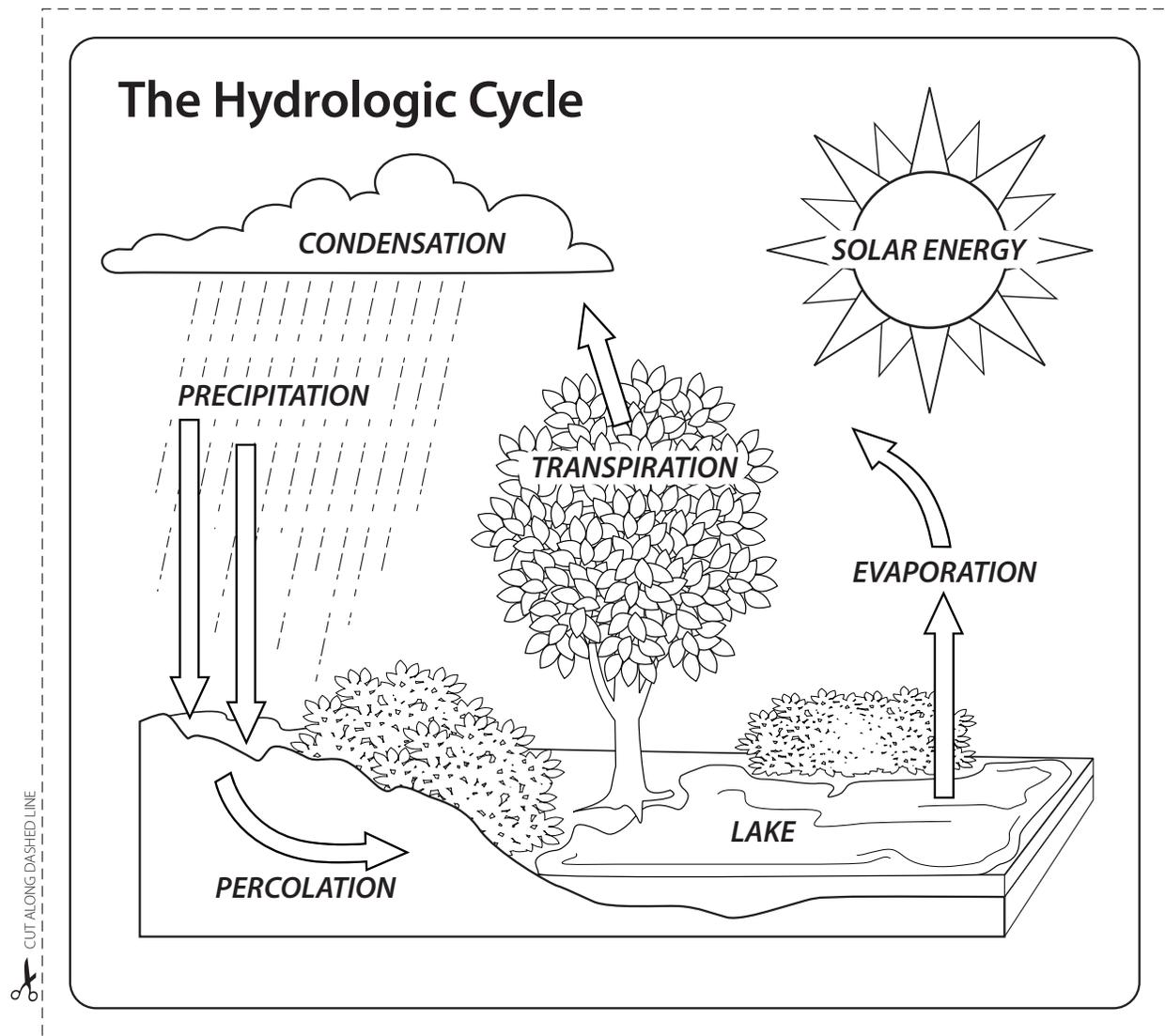


Water in Action: Capture the Water Cycle in a Bag

You have learned that water takes several paths as it moves through the environment. In this activity, you will capture the water cycle in a bag. The illustration below shows the hydrologic cycle in action and will be used in the project described on the next page.



Water in Action: *Capture the Water Cycle in a Bag* (page 2)

Parts of the Hydrologic Cycle

- evaporation** — vapor created when the sun heats water in lakes, streams, rivers, oceans, puddles, etc.
- transpiration** — vapor created when plants and trees give off moisture
- condensation** — tiny droplets of water formed when water vapor rises into the air and cools
- precipitation** — moisture released from clouds in the form of rain, snow, hail, etc.
- percolation** — the downward movement of water through the ground

MATERIALS

- illustration of hydrologic cycle
- colored markers
- tiny plants (optional)
- black permanent marker
- handful of soil
- scissors
- spray bottle of water
- plastic quart-size sealable bag
- handful of small pebbles and gravel

DIRECTIONS

1. Cut out the illustration of the hydrologic cycle and place it inside the bag.
2. Using a black permanent marker, trace the outline of the illustration onto the bag. Use colored markers to fill in the design as desired. Select a dark color to label the different parts of the cycle. When you have finished coloring, remove the picture from the bag.
3. Place a handful of small pebbles and gravel in the bottom of the bag to represent the aquifer.
4. Place a handful of soil on top of the pebbles and gravel.
5. Place a few tiny plants in the soil, if desired.
6. Gently spray water over the soil and rock mixture until it is moist.
7. Zip the bag shut and place it upright in an area that receives indirect sunlight.
8. After a few days, check to see if you have captured the water cycle!

EPA ENVIRONMENTAL EDUCATION

ROLE OF PLANTS IN WATER FILTRATION

GRADE LEVEL: 4 – 7

BACKGROUND: Experiments can be done to show how a plume of dissolved materials can move through soil and enter a groundwater aquifer. But soil and plants have something of a dual role in this process. Depending on whether materials are dissolved or suspended in the water, soils and plant roots can remove some or all of this material as the water moves down through soil.

Most suspended materials will adhere to the soil. These may then be broken down and used as food by the plants. Dissolved nutrients, such as nitrogen or phosphorus, chemically bond with some types of soil particles. They are then taken up by plants, thus removing them from the soil before they can enter an aquifer. For the plants, these elements are food, for an aquifer, they are pollution.

Not all materials are absorbed by plants and not all water pollutants are food for plants. However, sediments from eroding soil, nutrients in human and animal wastes, and some components of household wastewater (“graywater”) are excellent plant nutrients. Plants also use different nutrients at different rates, so that the amount of material they take up will depend on how much is dissolved in the water and how fast the water moves through.

This experiment is a very simplified way to show whether plants will take up certain kinds of materials from water moving relatively quickly through their root systems.

OBJECTIVE: To understand the role of plants in filtering the water moving through a watershed.

MATERIALS NEEDED:

- Six potted plants, with pots roughly six to eight inches in diameter, and holes in the bottom. These plants need to moderately dry, as if they had not been watered for a couple days. Plants with saturated soil will not absorb water, and very dry plants will absorb it all.
- Six clear containers, such as cups, which will support the plants and allow drainage to be viewed. You will need separate plants and cups for each of the materials in the water.
- Soil from outside (anywhere). The best soil is loamy, with smaller particles than sand.
- Unsweetened powdered drink mix, preferably grape or cherry for color.
- Vegetable oil.
- One or two different household cleaners (such as Comet/Ajax and Dish or Laundry soap).
One should be liquid and the other powder.

PREPARATION: Set up the potted plants, each in its own cup. Slowly pour six to eight ounces of clean water through the pot, and check the percolation rate through the pot. Loosen or tighten the soil so that water percolates at about one ounce per minute. The rate should be fast enough to prevent long waiting periods, but slow enough not to carry very much soil through the pot.

PROCEDURE:

1. Place the potted plants into the top of their cups. Pour clean water slowly through one of the pots and watch it percolate through the bottom of the pot. The water should look as clean as what was poured.
2. Add a gram or so of soil to 6-8 ounces of water and stir so that the soil is well suspended and distributed in the water. Pour slowly into another flower pot. The water percolating through should look *much* cleaner than the dirty water poured.
3. Add about one ounce of vegetable oil to 6-8 ounces of water, stir (they won't mix completely) and pour into a third pot. See if the vegetable oil percolates through or is caught up by the plant roots.
4. Add some powdered drink mix to 6-8 oz. of water and pour through a fourth pot. See if the water percolating through retains the color.
5. Add some powdered cleanser to 6-8 oz. of water and pour through a fifth pot. Is the cleanser retained in the soil?
6. Add some liquid soap to the water (an ounce or so in 6-8 oz. water). Does the soap percolate through the soil?
7. Using the "contaminated" plants, pour some clean water at the same rate through each one (simulating a rain shower). Is more of the "pollutant" rinsed away from the soil by the clean water?

FOLLOW-UP QUESTIONS:

1. In what ways can plants and soil benefit drinking water quality?
2. We saw plants and soil remove some types of impurities from water. How might the plants remove larger quantities?
3. Can plants and soil remove any type of impurity from water?
4. What other organisms in the soil-plant system might aid the uptake of water pollutants?
5. What is the role of rainwater moving through contaminated soil?



BACKGROUND:

Only a very small percentage of the earth's water is available for human use, since most is salty ocean water that cannot be used for drinking, washing, irrigation, or industry. Usable water can be created from salt water in a process called **desalination**, but the process is controversial. (Desalination is expensive and requires a lot of energy.) Desalination has been used successfully in the Middle East to supply drinking water to desert cities and in the California city of Santa Barbara.

In this desalination activity, the sun's rays cause the salt water in the bucket to evaporate and, leaving the salt behind, to condense on the underside of the plastic wrap. Because the plastic wrap is weighted in the center, the condensed fresh water will drip down to the center and collect in the jar or beaker below.

QUESTION:

Can drinkable water be made from salt water?

OBJECTIVES:

To help youth:

- Understand how the process of evaporation can be used to purify salt water for drinking.
- Practice contributing to the progress of a group engaged in a cooperative project.

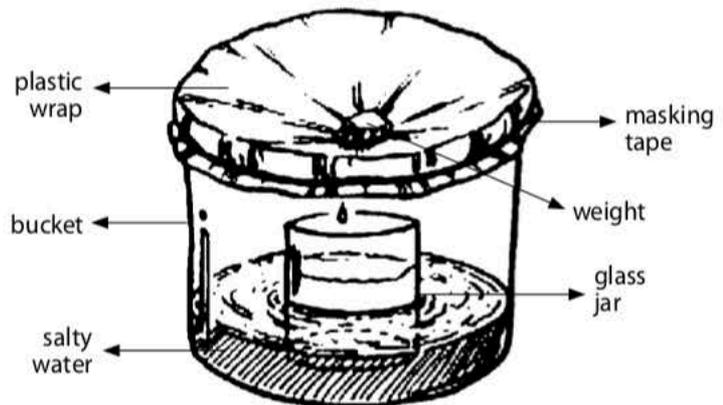
TIME: (Minimum of 3 hours)

MATERIALS:

- Clean bucket
- Beaker or glass jar
- Two small weights
- Plastic wrap
- Masking tape
- Salty water (1 T. of salt to 20 oz. of water)

Build a Solar Water Purifier

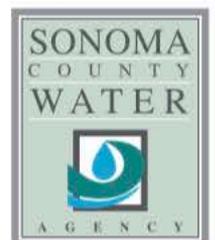
Grades 3 – 5

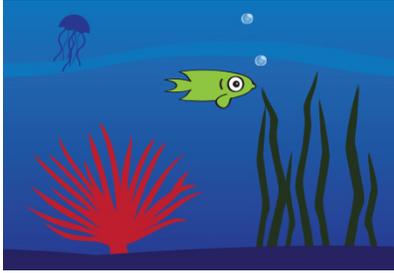


PROCEDURE:

- 1) Follow the illustration to set up your solar water purifier. The salt water level should be at least an inch below the top of the beaker or jar.
- 2) Be sure that the plastic completely covers the top of the bucket. The plastic should sag enough when the weight is placed on it so that a cone shape is formed that points down toward the beaker. Make sure that the plastic does not touch the beaker.
- 3) Place your purifier in the heat of the sun and leave it there for a few hours.
- 4) After several hours or the next day, remove the plastic covering and taste the water in the beaker.
- 5) **Optional:** Put another material besides salt in the water (food coloring, lemon juice, sugar) and see what happens.

Picture from <http://www.solarknoxville.org/for-students/science-projects/>
Adapted from the U.S. Department of Energy http://www1.eere.energy.gov/education/pdfs/solar_rainmachine.pdf





Make an Ocean Ecosystem Dessert

It's hard to imagine life on Earth without oceans. The air you breathe used to be an ocean breeze. The water you drink was once in a cloud over the ocean.

The ocean is also important to the many species of plants and animals that call the water their home. This community of organisms is called an **ecosystem**.

Human-caused climate change is warming our planet, and the oceans are feeling the heat. Plants and animals in the ocean ecosystem are sensitive to changes in the ocean's temperature. Some organisms can adapt to the change, but others can't survive the warmer temperatures. Since so much life is dependent on these waters, it's important to keep the oceans healthy!

Scientists are monitoring the temperature of the ocean with an instrument called the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Aqua satellite. The satellite measures the temperature of the top millimeter of the ocean's surface.

With this activity, learn to make a cool and tasty version of the ocean ecosystem at home!

What you'll need:

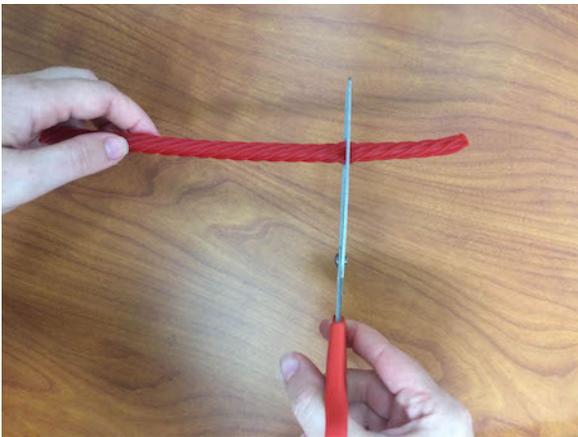
- 1 large clear bowl (deep and 10+ cup capacity)
- 2 – 6 oz boxes of blue gelatin dessert mix
- Red licorice twists
- Gummy fish
- Scissors
- Mint leaves
- Hot water
- Cold water
- Measuring cup (not pictured)
- Spoon (not pictured)



What to do:



1. **Make the ocean water.** Follow the directions on the box of blue gelatin dessert mix by pouring 4 cups of hot water into the bowl with 2 packages of blue gelatin powder. Stir for 2 minutes. Once the powder is dissolved, mix in 4 cups of cold water. Place the bowl in the refrigerator for approximately 45 minutes. (Note: This amount of time should allow the gelatin to become a thick liquid that is only slightly firm.)



2. **Make the coral.** While the gelatin is in the refrigerator, use the scissors to cut the red licorice strips into short sections that are only a few inches long. The licorice will represent the coral in your edible ecosystem.

3. **Make the seaweed.** Cut the mint into segments approximately 2 to 3 inches long. The mint leaves will represent the seaweed in your edible ocean ecosystem.

4. **Remove gelatin from refrigerator.** After 45 minutes has passed, remove your gelatin from the refrigerator. It should be thicker than liquid, but not completely firm. If the gelatin is still very runny, place it back in the refrigerator for 10 minutes and check it again.



5. **Assemble your ocean ecosystem.** Once the gelatin has become a thick liquid, begin placing your seaweed (mint), coral (licorice), and fish (gummy fish) in the ocean of blue gelatin. Push each item into the gelatin with your finger. Be sure to place some of your fish, coral, and seaweed right next to the glass so that they're easy to see. When you're done, jiggle the gelatin a bit to repair the holes.



6. **Refrigerate gelatin again.** Place gelatin in the refrigerator for another 2 to 3 hours. This will allow the gelatin to become totally firm.

7. **Enjoy your tasty ocean-themed dessert!**

guidelines outlined by EPA and the FTC in the *Environmental Marketing Claims* brochure.

4. Students can hold an open house to showcase the items they purchased. They can create a display of the “green” products and set it up either in the classroom or elsewhere in the school. Suggest placing an index card or small piece of posterboard next to each product explaining the environmental attributes it contains.
5. Students can hold an “eco” fashion show for their classmates or the whole school. They can create outfits by supplementing the items they found while shopping with used clothing from thrift shops. Suggest that they present the clothing and accessories in a live fashion show format or museum-type display (e.g., using mannequins, hangers).
6. Have students conduct research and write a report about a “green” company or a specific “green” product.
7. Have students write letters to companies. They can either write to ask a company why they do not sell/design green products, or they can thank a company for selling sustainable products.



Part of an eco-fashion show of reused clothing from thrift shops at a Pennsylvania middle school.

8. All toilet paper contains a percentage of recycled paper, but only some companies advertise this fact. Have students compare packaging for five different toilet paper brands to determine how many advertise that the paper is made from recycled content and how many do not. Write a letter to the companies that do not advertise the recycled content of their toilet paper, asking them why they choose not to promote this fact.

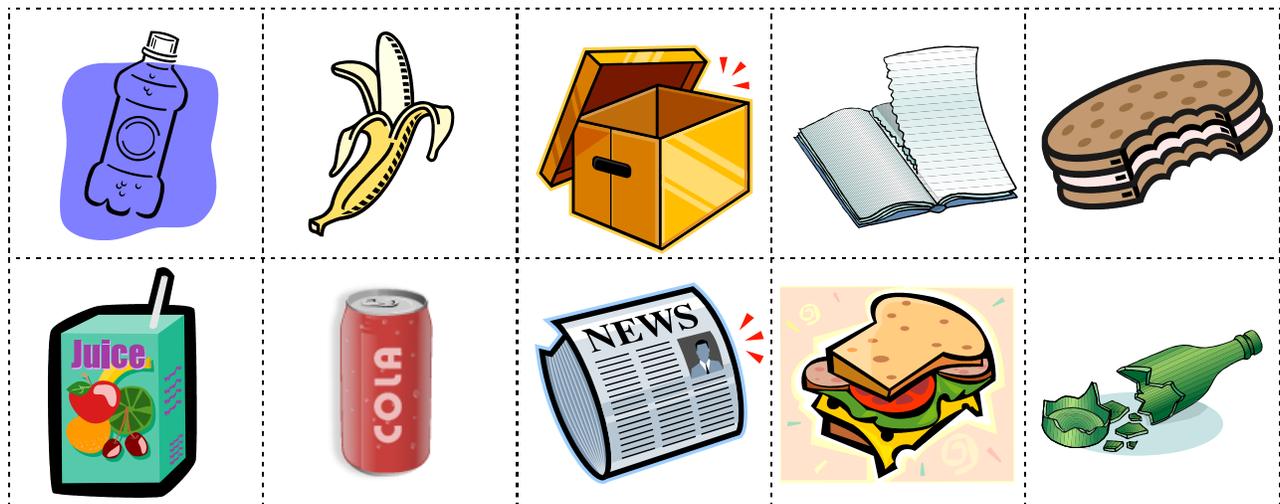
Name: _____

Sorting Trash

Cut the pictures at the bottom and paste them in the right category.

Recycle

Garbage





Nature CAT

LET'S MAKE A PINECONE BIRD FEEDER!

DIFFICULTY: MEDIUM

Birds eat many types of food – from insects to berries to seeds and nuts – and all birds have their favorites! Try adding different bird foods to your feeder to see which ones your local birds enjoy most!



MATERIALS

- 4 to 6 pinecones (with most scales open)
- Sturdy stick, about 2 feet long
- Twine or hemp cord
- Peanut butter
- Birdseed (e.g. sunflower seeds)
- Popsicle stick or butter knife (for spreading the peanut butter)
- Medium-sized bowl or shallow pan



INSTRUCTIONS

- 1** Cut a piece of twine double the length of the stick you found. Tie one end of the twine to one end of the stick. Be sure to use a double knot! Tie the other end of twine to the other end of the stick. This is how you will hang your feeder! (See Step 1 photo)



- 2** Cut different lengths of twine for each of your pinecones. Each length should be at least six inches.

STEP 1

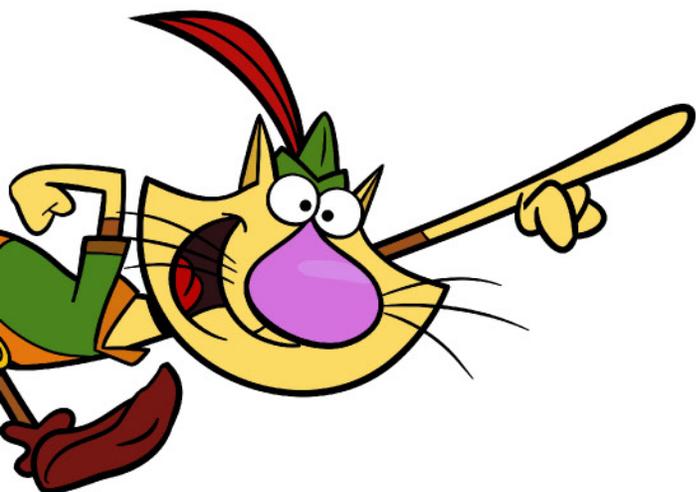


pbskids.org/naturecat



Nature CAT

- 3 Tie one piece of twine in a double knot around the top of each pinecone. (See Step 3 photo)
- 4 Fill your bowl with birdseed. 
- 5 Generously spread the peanut butter onto each pinecone. (See Step 5 photo)
- 6 Roll each pinecone in the bowl with birdseed until it is covered with the seed. (See Step 6 photo)
- 7 Tie the other end of each piece of twine to different areas of your stick.
- 8 Your bird feeder is ready for action! Find a tree branch in a shady spot and look out for birds!



PARENT NOTE:

This birdfeeder is ideal for cooler weather. For the summer, you can place the prepared pinecones in the freezer first. You can also prepare extra pinecones and store them in the freezer for when it is time to replenish your feeder!

STEP 3



STEP 5



STEP 6



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LET'S MAKE A BIRD FEEDER WITH TOILET PAPER ROLLS!

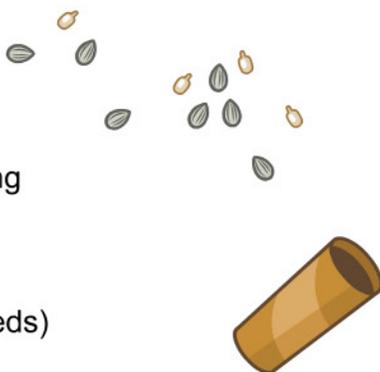
DIFFICULTY: MEDIUM

Birds eat many types of food – from insects to berries to seeds and nuts – and all birds have their favorites! Try adding different bird foods to your feeder to see which ones your local birds enjoy most!



MATERIALS

- 5 toilet paper rolls
- Sturdy stick, about 2 feet long
- Twine or hemp cord
- Peanut butter
- Birdseed (e.g. sunflower seeds)
- A hole puncher or scissors
- Medium-sized bowl or shallow pan
- Popsicle stick or butter knife (for spreading peanut butter)



INSTRUCTIONS

- 1** Punch a hole at the top of each toilet paper roll.
- 2** Cut a piece of twine double the length of the stick you found. Tie one end of the twine to one end of the stick. Be sure to use a double knot! Tie the other end of twine to the other end of the stick. This is how you will hang your feeder!
(See Step 2 photo)



STEP 2

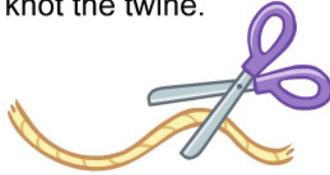


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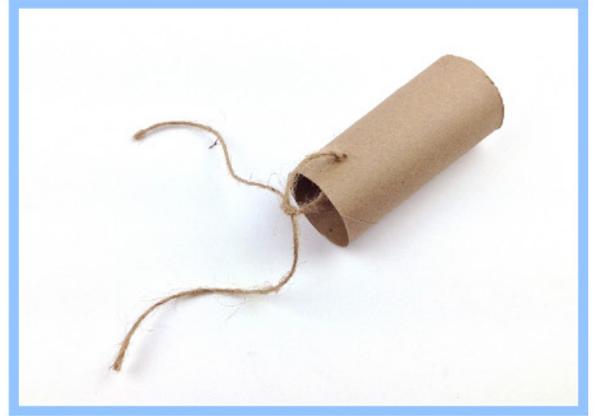


Nature CAT

- 3 Cut different lengths of twine for each of your toilet paper rolls. Each piece should be at least six inches long.
- 4 Put the twine through the hole you punched in the toilet paper roll and tightly double knot the twine. (See Step 4 photo)
- 5 Fill your bowl with birdseed.
- 6 Generously spread the peanut butter onto each toilet paper roll with your popsicle stick or butter knife.
- 7 Roll each toilet paper roll in the bowl with birdseed until it is completely covered.
- 8 Tie the other end of each piece of twine to different parts of your stick. (See Step 8 photo)
- 9 It's time to feed your neighborhood birds! Find a tree branch in a shady spot and look out for birds!



STEP 4



STEP 8



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