



**Standards and Topic Connections:**

<u>One Planet Topic</u>	Standards: <u>Next Generation Science</u>	<u>Environmental Principles and Concepts (EP&amp;Cs)</u>
<b>Consumption and Waste</b>	<b>Performance Expectations (PE):</b> Science and Engineering Practices (SEP) Disciplinary Core Ideas (DCI) and Crosscutting Concepts (CC)	<b>Principle IV</b> <b>Principle V</b>
	<p><a href="#">K-2-ETS1-1 Engineering Design</a>: <b>Ask questions, make observations, and gather information about a situation people want to change</b> to define a simple problem that can be solved through the development of a new or improved object or tool.</p> <p><a href="#">ESS3.A Natural Resources</a> How do humans depend on Earth's resources?</p> <p><a href="#">ESS3.C Human Impact on Earth Systems</a> How do humans change the planet?</p> <p><a href="#">3-5-ETS1-2 Engineering Design</a>: <b>Generate and compare multiple possible solutions to a problem</b> based on how well each is likely to meet the criteria and constraints of the problem.</p> <p><a href="#">PS3.B Conservation of Energy and Energy Transfer</a> What is meant by conservation of energy? How is energy transferred between objects or systems?</p>	<p><b>Principle IV</b> The exchange of matter between natural systems and human societies affects the long-term functioning of both.</p> <p><b>Principle V</b> Decisions affecting resources and natural systems are based on a wide range of considerations and decision-making processes.</p>

**Purpose / Learning Objectives:**

Every student will be able to...

- connect the production of paper to the extraction of trees
- describe the basic process of turning wood pulp into paper fibers
- analyze material make-up of paper products
- make predictions based on prior knowledge
- make and record observations
- make inferences on material make-up based on experiment results
- connect experiment results with real-life conservation actions and decisions

**Driving / Essential Question(s):**

- How are humans and natural resources interrelated?
- How do humans depend on natural resources?
- What happens when natural resources are limited?
- How do we ensure that humans use natural resources wisely and sustainably?
- Can we look to nature to improve our dependence on natural resources?
- What are some of the best ways to manage “everyday items” when they become “waste”?

### **Lesson Terms / Academic Vocabulary:**

- Waste
- Garbage
- Compost
- Recycle
- Rot
- Environment
- Raw materials
- Natural Resources
- Renewable resource
- Nonrenewable resource

### **Materials / Technology:**

- The Story of Paper Student Worksheet
- Access to Internet
- Pencil/Pen
- 4 glass jars
- 4 types of paper (toilet paper, paper towel, binder/copy paper, wet wipe)
- Water
- spoon/stirrer
- timer

## Agenda / Activities:

Utilize the 5E Model - Engage, Explore, Explain, Extend/Elaborate, Evaluate

The purpose of this lesson is to explain the process of papermaking from raw materials (trees/wood), examine the dissolvability of paper fibers, and connect learning about degrees of paper dissolvability with conservation and recycling practices.

10 minutes	<p><b>Engage:</b> Gauge student knowledge by asking students questions regarding the raw materials and processes used to make paper.</p> <p>Watch the linked video <a href="#">How Do They Turn Wood Into Paper?</a> as a class and discuss.</p> <p><b>Explore:</b> Procure the 4 types of paper used in this exercise (toilet paper, paper towel, copy paper and wet wipe) and ask students to describe as many different properties as they can of the 4 different types of paper and discuss why the differences are favorable to their intended use.</p>
15 minutes:	<p>Refer to student worksheet (SW) below</p> <ol style="list-style-type: none"><li>1.) Have students read the Background and Lesson. Answer any questions students may have. (SW; pg 1)</li><li>2.) Have students gather required materials and follow directions for the experiment set-up (SW; pg 1)</li><li>3.) Have students set up experiment by following Steps 1-3 (SW; pg 1)</li><li>3.) Have students follow steps 4-5. Check for procedural understanding after students record observations. (SW; pg 2)</li><li>4.) Have students follow step 6 (SW; pg 2)</li></ol> <p>Conclude experiment after the Step 6 is complete and follow-up with questions on SW; pg 3.</p>
(10 min)	<p><b>Explain and Extend:</b> The questions on SW pg 3 will help students connect the lessons learned about the properties of different types of</p>

	paper to litter prevention and conservation of resources via resource recovery and recycling.
After Completion of the Activity:	Follow up exercises can include discussions on recycling as it relates to resource recovery and conservation of natural resources and raw materials derived from such.

The Story of Paper Student Worksheet can be accessed through this [LINK](#)

The Story of Paper Student Worksheet below is embedded in this document as a teacher reference only.

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Waste	Waste is defined as any item which is discarded after its primary use, or is deemed worthless, defective or of no use.
Garbage	Garbage is defined as waste that is sent to a landfill and items that never break down or will be used again.
Compost	Compost is defined as waste that is made of organic material that can be added to soil to help plants grow. Examples: Yard trimmings and food scraps.
Recycle	Recycle is defined as waste items that can be melted down and reformed into new items of the same material. Examples: Plastic items and metal items.
Rot	Rot is defined as the process in which organic waste items (compost) are breaking down into the basic nutrients soil needs to make plants grow.
Environment	The air, water, soil, minerals, organisms, and all other factors surrounding an organism.
Raw Materials	Raw materials are defined as the basic materials that are used to produce goods, finished products, energy, or intermediate products that are needed for finished products. Examples:
Natural Resources	Materials or substances such as minerals, forests, water, and fertile land that occur in nature and can be used for economic gain. Examples of natural resources: water, air, coal, oil, natural gas, phosphorus, iron, other minerals.
Renewable Resource	A renewable resource is a natural resource which will replenish to replace the depleted portion by consumption or usage. Examples: forests of trees grow back over time but cannot always keep up with the level of consumption by the human race.
Non-renewable Resource	A non-renewable resource is a natural resource that does not replenish to replace the depleted portion after consumption or usage. The

# The Story of Paper- Experiment!

**Background:** Most people have heard the saying, “Don’t waste paper, because paper comes from trees.” It’s true! Most paper comes from wood chips, and wood chips come from trees. Watch the short video, [How Do They Turn Wood Into Paper?](#) to find out about the tree to paper process.

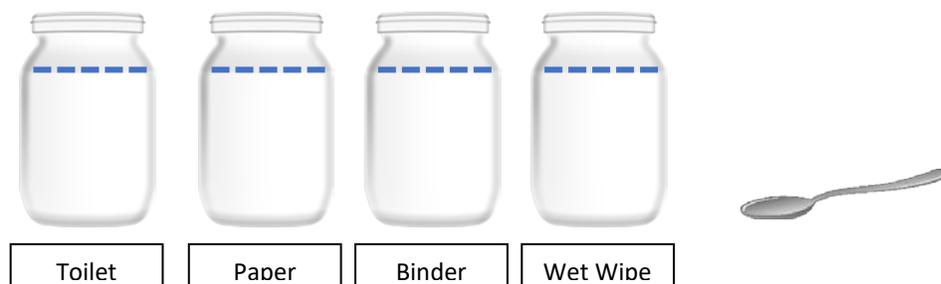
**Lesson:** By doing the experiment below, you will learn about the different properties of paper, observe the process of paper breaking down in water, and why paper products are made in different ways for different purposes.

## For the experiment you will need to gather:

- 4 glass containers about the size of a spaghetti jar but smaller than that is ok too! Lids are not necessary
- Water
- A spoon for stirring
- A clock or timer
- 3 squares of toilet paper
- 3 more different types of paper:
  - Paper Towel
  - Binder or Copy Paper
  - Wet Wipe

## Directions:

1. Measure and cut your different papers to be about the same size as your 3 squares of toilet paper.
2. Make a label for each type of paper you will be dissolving.
3. Fill you jars with equal amounts of water. Fill almost to the top but leave about an inch of room from the top of the jar so the water doesn’t spill over. Before you start, your setup should look like this:



4. Now place each paper into its jar. Stir the contents of each jar with the spoon for 10 seconds. Set a timer for 5 minutes.
5. After 5 minutes, stir the contents of each jar again and record your observations in the boxes below:

Toilet paper (5 minutes)	Paper towel (5 minutes)	Binder Paper (5 minutes)	Wet Wipe(5 minutes)

6. Set a timer for 5 more minutes. Repeat Step 5.

Toilet paper (10 minutes)	Paper towel (10 minutes)	Binder Paper (10 minutes)	Wet Wipe (10 minutes)

Answer the following questions:

1. Which paper broke down the most? Why do you think it broke down the most?

2. Which paper broke down the least? Why do you think it broke down the least?

3. Why is it important that only toilet paper go into our sewer system?

4. How much did wet wipes break down, if at all?

5. Wet wipes and cleaning wipes are often made with plastic fibers and should never be flushed down the toilet. Where should you put them instead?

6. Stormwater drains carry water from our homes, neighborhoods and streets directly to the nearest body of water. Why is it important that we pick up all litter, even if it is made from paper?

7. When you broke the paper fibers apart in the jar of water you made paper slurry, the main ingredient when making recycled paper. In this way, we make new paper out of discarded paper waste placed in recycling bins. How then do your paper and cardboard recycling actions directly help to conserve trees and forests?