



# Lesson: Popular Paper

**Grade:** 4-5

**Subject:** Math, English

**Objectives:**

Students will:

- explain the benefits of recycling paper and using fewer natural resources
- calculate answers to a variety of paper-production math problems
- understand the connection between natural resources used in manufacturing and recycling and the waste associated with each process

**Teaching Time:** Intro discussion 15 minutes, Daily weighing and data collecting 10 minutes, return to lesson after 1 week: 45 minutes

**Materials:** transparency, Don't Throw Your Trees Away; bathroom scale; worksheet, Paperwise Math;

(Optional:) video: Lifecycle of Glass and Paper (see Resources section for availability)

Lesson concept: Association of Vermont Recyclers: *Teacher's Resource Guide for Solid Waste and Recycling Education* (1999).

**REDUCE**  
**REUSE**  
**RECYCLE**

## Background:

The single largest component of solid waste is paper. Americans consume more paper per person than any other nation in the world. Each person in the United States uses approximately 600 pounds of paper annually (the equivalent of two harvestable trees). Most wood used to make paper comes from “tree farms”, but about 1/3 still comes from private and public forests. About 28% of the wood used to make paper is the wood scrap or “waste” from timber mills. This is also called “pre-consumer waste” because instead of being thrown away, it is used to make paper products. Individuals are the first links in the paper recycling process. By reusing and recycling paper we can help conserve resources (i.e. trees, water), protect the environment and reduce energy use. The paper we recycle that goes back into paper products is called “post-consumer waste.” If you see this term on a product label, you know that you have helped “close the loop” in the recycling process. (See “Close the Loop” overhead in the Lesson: We can Recycle).

In 1999, people in the U.S. recycled 45% or 47.3 million tons of paper (American Forest & Paper Association). Each ton of paper that is recycled replaces and preserves 13 to 20 five hundred pound, harvestable pulpwood trees (trees grown for paper production). Making paper from recycled fibers uses 30-55% less energy than making paper directly from trees and reduces air pollution from the manufacturing process by 95%.

## Procedures:

- Use the transparency, “Don't Throw Your Trees Away” to discuss paper recycling and as an opportunity to present some of the information in Background. Note how throwing paper in the trash breaks the cycle!
- For one week, have students collect the classroom paper they normally would throw away. (Or if your class already recycles, use the measurements to calculate your resource savings over time). Divide the collected discarded paper into two boxes: paper we can still use, paper we have used completely.
- Weigh the paper each day. Construct two graphs showing daily weights. One measurement you can use to demonstrate waste is: 500 sheets of paper in a ream or 3,000 sheets a foot. (36 reams = 6 ft.).
- Have students calculate the number of reams they saved over time (weeks, months, years) by reusing and recycling. When you get to one ton, you have saved about 17 trees.
- At the end of the week compare the two graph results. **Could we have used less paper? How can we reduce the amount of paper we use?** Students may cleverly suggest that teachers could assign less work! Generally, using both sides of the paper and making scratch pads out of discarded paper are very achievable habits.
- After the students have collected data on the amount of paper generated, have them calculate the amount of paper generated per person in the classroom. Now calculate what the school's annual paper generation rate is for an entire year based on this number.

- (Optional:) Show the video Lifecycle of Paper (it is just after the segment on glass).

### **Reflection/Response:**

- Have students write a scientific report outlining the steps they had to perform in this lesson as if it were a replicable scientific experiment for another classroom. Students should include their observations and conclusions in the final section of the report.
- Assign the Paperwise Math worksheet. Have students create their own problems/answers using the given data.

### **Extensions:**

- Working with a partner, make two lists: first, list all the paper products you use at home: and second, list substitute products to use in place of paper products.
- Make recycled paper (see Extension: Papermaking in the Resource section)
- Create a poster that encourages people to recycle paper.
- Give a speech or write an essay explaining the merits of recycling, reduction, and reuse of paper or have students write an official school proclamation for the principal to sign declaring the school's efforts to conserve paper, double-side copy, etc. Refer to Oregon Green Schools Tools as a resource for extensions, available at: [www.deq.state.or.us/wmc/solwaste/edu.html](http://www.deq.state.or.us/wmc/solwaste/edu.html).
- Assign the Activity: Environmental Fortune Teller in the Resource section.

#### **Oregon Common Curriculum Goal:**

##### **English:** Writing

- Use a variety of modes (e.g., narrative, imaginative, expository, persuasive) in appropriate context

##### **Mathematics:** Calculations and Estimations

- Demonstrate conceptual meanings for addition, subtraction, multiplication, and division

##### **Grade 5 Benchmark:**

- Write in a variety of modes (e.g., narrative, imaginative, expository, persuasive) and forms (e.g., essays, stories, reports) appropriate to audience and purpose.
- Perform calculations on whole numbers, fractions, and decimals using paper and pencil and calculators.

#### **PAPERWISE MATH ANSWERS**

$$\begin{array}{r} 1. \quad 3,688 \times 19 = 70,072 \\ \quad \quad \times 32 = 118,016 \\ \quad \quad \times 67 = 247,096 \\ \quad \quad \times 85 = 313,480 \end{array}$$

$$2. \quad \text{tens: } 70,070; 118,020; 247,100; 313,480$$

$$\text{hundreds: } 70,100; 118,000; 247,100; 313,500$$

$$\text{thousands: } 70,000; 118,000; 247,000; 313,000$$

$$\text{ten thousands: } 70,000; 120,000; 250,000; 310,000$$

$$3. \quad 17 \times 19 = 323$$

$$4. \quad \text{four} \times 32 = 544$$

$$5. \quad 24,000 \text{ divided by two} \\ \quad \quad \times 67 = 1,139$$

$$6. \quad \text{eighty-eight} \\ \quad \quad \times 85 = 1,445$$

$$7. \quad \text{three}$$

$$8. \quad 68,000,000 \text{ and sixty-eight million}$$

$$9. \quad 84 + 36 + 176 = 296 \\ \text{pounds}$$



# Overhead: Don't Throw Your Trees Away



Source: Association of Vermont Recyclers: *Teacher's Resource Guide for Solid Waste and Recycling Education* (1999)





# Worksheet: Paperwise Math

Student Name: \_\_\_\_\_

**Producing one ton of paper from virgin statistics:**

- 3,688 lb. of wood
- 216 lb. of lime
- 360 lb. of salt cake
- 76 lb. of soda ash
- 24,000 gallons of water
- 28 billion BTU's of energy

**Recycling one ton of paper yields the following fiber requires the following resources:**

- Saves about 17 trees from being harvested
- Saves 3 cubic yards of landfill space
- Uses 50% less water in the processing
- Saves 96 gallons of gasoline
- Saves 380 gallons of oil
- Prevents 2.5 tons of Carbon Dioxide from being released (a green house gas)

**The process also produces:**

- 84 pounds of air pollutants
- 36 pounds of water pollutants
- 176 pounds of solid wastes

- Creates 74% less air pollutants
- Creates 35% less water pollutants
- Uses 60% less energy in production

**Paper Facts:**

- \*There are 500 sheets of paper in a ream. It takes six reams to make one foot.
- \*Junk mail destroys about 68 million trees per year.

1. How many pounds of wood would be needed to make 19 tons of paper? 32? 67? 85?

2. Round your answers above to the nearest tens place, hundreds place, thousands place, and ten thousands place. Write your answers in the table.

TENS	HUNDREDS	THOUSANDS	TEN THOUSANDS



3. How many trees would you save by RECYCLING 19 tons of paper? 32? 67? 85?

4. How many tons of paper would you have to recycle in order to save 12 cubic yards of landfill space?

$3 \times ? = 12$  \_\_\_\_\_ tons of paper.

5. Which is the correct operation for the following question?

If producing one ton of virgin paper uses twenty-four thousand gallons of water, and recycling one ton uses fifty percent less water, how many gallons of water does recycling save?

- A. 24,000 minus 50
- B. 24,000 plus two
- C. 24,000 divided by 50%
- D. 24,000 divided by two

6. How many pounds of solid waste are in one-half a ton of paper?

7. How many reams of paper would there be in 18 feet?

$6 \times ? = 18$  \_\_\_\_\_ reams of paper.

8. Write out the number 68 million in numeric form and in word form.

9. How many total pounds of pollutants are produced by virgin manufacturing?

10. List the reasons why you believe recycling paper is or isn't important.