

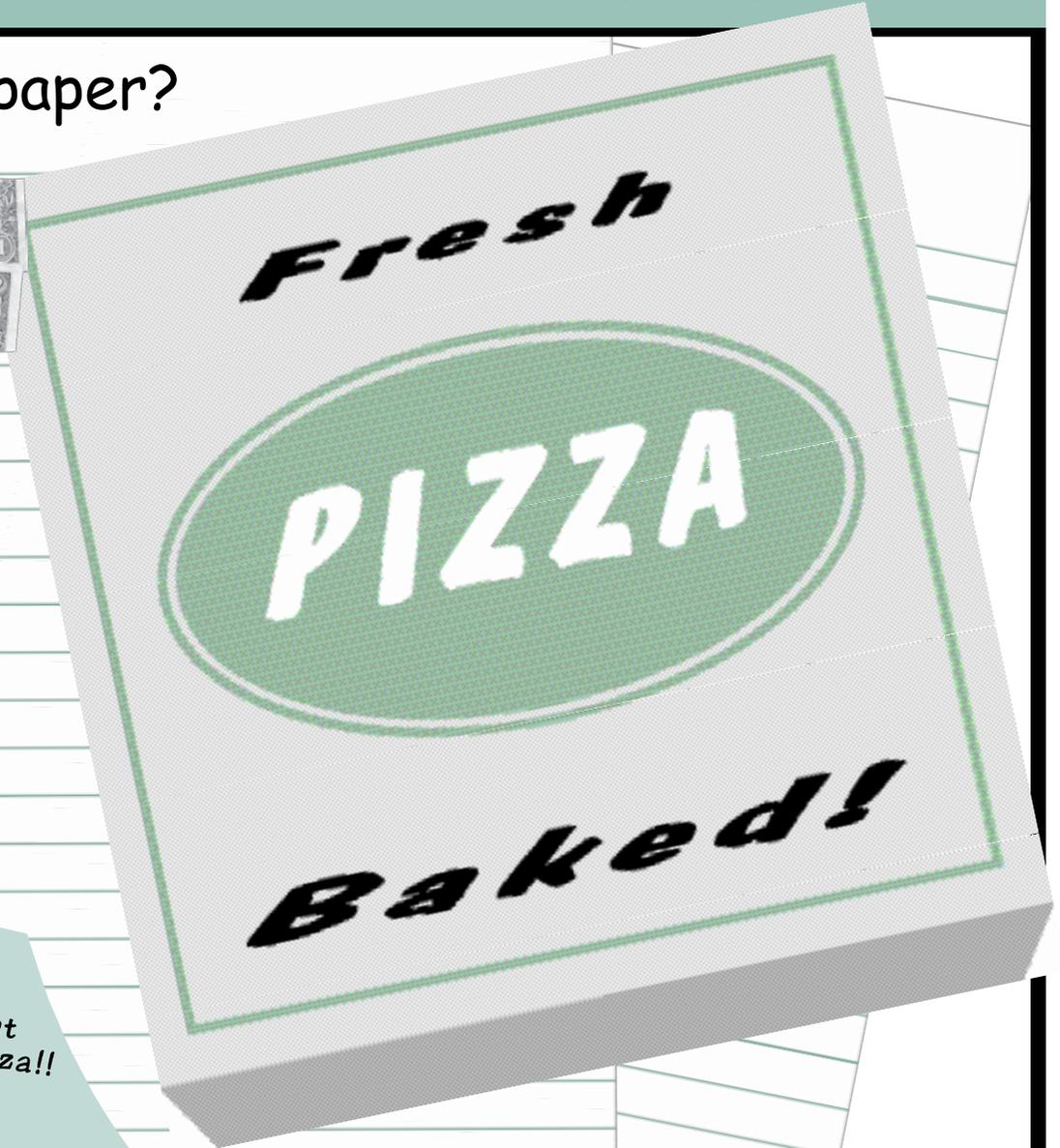
JUST FOR U.S.*

GRADES 4-5

* Understanding Science

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What is paper?



NOTE

Don't forget
to order pizza!!

Where does paper come from?

How is paper made?

What Is Paper?

Before paper was invented, people used **pre-paper**.
"Pre" means before.

Papyrus was a type of pre-paper made from the papyrus plant. Papyrus was used in ancient Egypt. It also was used throughout the Mediterranean region and in parts of Europe and Asia.



Papyrus



Papyrus sedge,
Cyperus papyrus



Parchment



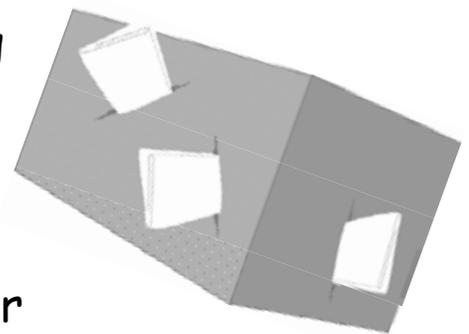
This is **parchment**. Parchment was made from the skin of a calf, sheep, or goat. The skin was stretched, scraped and dried until it became stiff. Parchment was **translucent**.

Pre-paper was not paper.

Where Does Paper Come From?

Paper is made from plants which are very strong and tough. First, water is added to make a soft **pulp**. Then people pound and dry the pulp.

Paper was invented in China in 200 BCE. People wrote prayers on small pieces of paper and put them in the bricks of their houses.



How is paper made?

Paper can be made from many different plants.



Potato plant



Cotton plant



Cactus plant



Cabbage plant

Paper can be made from rags, straw, or even from old paper. This is a kind of recycling!



rags



straw



paper

In early papermaking, there were four steps.



First, the fiber or other material was boiled in water to make it very soft.



Then the soft fiber was beaten with sticks or rocks to "break it down" and make it soft. This soft material is called **pulp**.



Next, the pulp was put on a special mold called a deckle. The deckle gave paper its flat shape.



Finally, the paper was put in the sun to dry.

On the Paper Trail

Papermaking moved to Korea about 800 years after it began in China. Korean people invented two very important items: toilet paper and envelopes!



Next, the Japanese began to make paper. They invented a way of making large amounts of paper called **mass production**. Japanese paper was very beautiful and felt like silk.



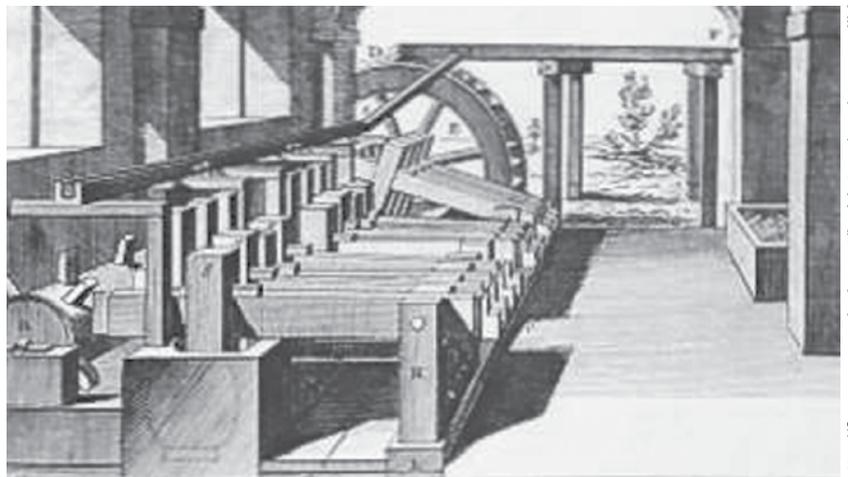
Papermaking comes to Europe

The first paper in Europe was made in Italy in 1290 CE. Italian paper was made from rags and old clothing.



But people still beat the softened rags by hand! Do you think this was hard work? In Spain, another method of beating was invented called **stamping**.

Stamping was done in a mill. A waterwheel turned large wooden hammers that pounded the pulp. Stamping made so much noise, you could hear it from a mile away!



This drawing of an early 18th century stamping machine shows a the large hammers that pounded the pulp .

Modern paper

Our society uses a lot of paper. Each person in the United States uses about 675 pounds (307 kilograms) of paper each year!

Paper is now made from the fiber of wood, cotton, or other plants. Chemicals are added to produce paper of different color, texture and brightness.

Modern paper mills use machinery to produce about 3,000 tons of paper each work day. Paper is produced at the rate of 300 feet per minute.



The most important machine in the production of paper is a Fourdrinier Machine. Here, pulp is mixed with water using big beaters to form **slurry**, which is like oatmeal.



Photograph by Tom

Rayonier Paper Plant,
Jesup, Georgia

Large amounts of slurry flow across a moving wire mesh. The wire can travel 1,800 feet per minute!



Fourdrinier Machine

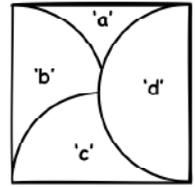
The slurry is shaken back and forth to make a thin layer. It's like sifting sand at the beach.

Then the slurry is dried, pressed flat and heated. Finally, the paper is cut into sheets.

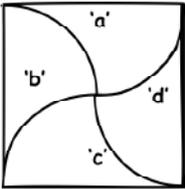


Create an Envelope

1. Trace this pattern onto a sheet of colored paper.
2. Cut out the pattern.
3. Write a message to a friend in the center.
4. Fold 'a' to the center.
5. Fold 'b' over 'a'.
6. Fold 'c' over 'b'.
7. Fold 'd' to the center.
8. Tuck the side of 'd' closest to 'a' underneath 'a' to create a pinwheel look.
9. If you want to, put a sticker in the center to hold the envelope together.



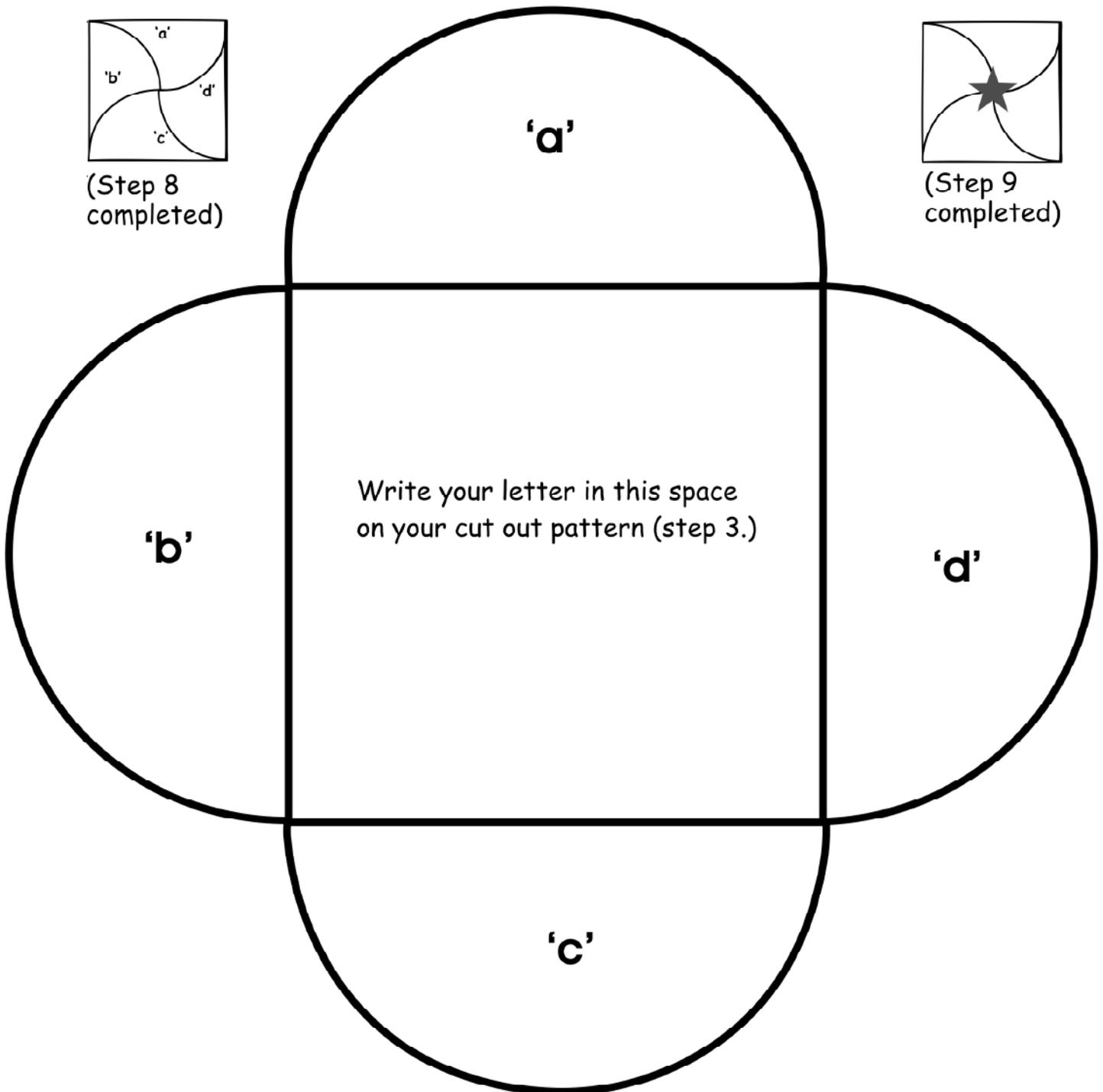
(Steps 4 - 7 completed)

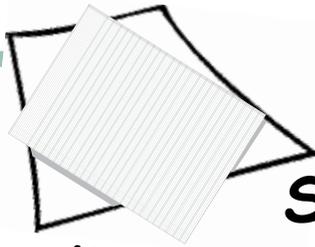


(Step 8 completed)



(Step 9 completed)





Seeing Through Paper

Opacity

An object that you cannot see through is called **opaque**. Some objects have high **opacity**, while other objects have low **opacity**. A window has high opacity, but a brown paper bag has low opacity.

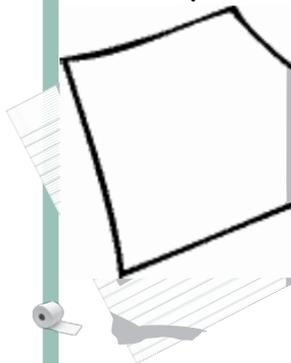
Printers say that paper with low opacity has high **show-through**. Show-through is important if you are printing on both sides of the paper.

Have students rank the opacity of different kinds of paper by following these directions. Use a ranking system of your choice. This could be a set of numbers from 1-5, different numbers of "+" marks, etc.

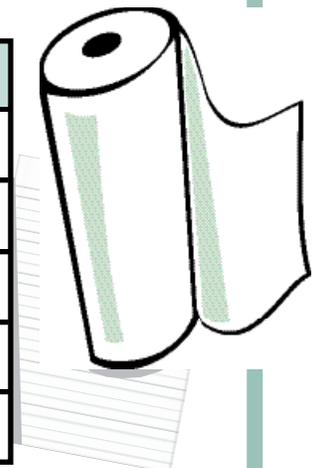
I can see this!

1. Place each paper sample over the words above.
2. Ask students "Can you see the words?" Remind them that the words will show through some kinds of paper more than through others.
3. If the student can not see the words through the paper, the paper will receive the highest rank. This is given to the most opaque paper.
4. Follow the same directions for each paper sample.

Rank the opacity of the following kinds of paper: notebook paper, newsprint, paper towel, copy paper, single sheet of toilet paper.



Type of paper	Opacity
notebook paper	
newsprint	
paper towel	
copy paper	
toilet paper	



Paper Work

Which of the following jobs are needed in the paper industry?



Machine repairperson
(a person who fixes machines)
Industrial engineer
(a person who designs machines)
Administrative Assistant
Environmental Expert

Accountant
Forest manager
Salesperson
Truck driver
Business owner
Warehouse worker
Factory worker

Farmer
Writer
Chemist
Artist

Answer: ALL these jobs are needed to make paper!

Paper Math

A modern factory can make _____ tons of paper in one hour.

How many tons of paper can the factory make in one 5-day week?

How long would it take to produce one mile of paper?

Answer: 375 tons; 15,000 tons; Between 17 and 18 minutes.

New Words

slurry
parchment
pulp
pre-paper
translucent
mass production



FERNBANK SCIENCE CENTER
DeKalb County School System

This issue addresses the following standards:

Science	Math	Lang Arts	Soc Studies
GPS	QCC	GPS	QCC
4 S4CS2	Meas 13,15	ELA4R1,3	Core 32, 56
GPS	QCC	GPS	QCC
5 S5CS2	Meas 13,15	ELA5R1,3	Core 56, 58

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Layout, illustrations and graphics are by Sheila Ward.