Investigating the Strength of Paper

Summary

Paper is made from plant fibers that are piled together. If more plant fibers are piled together, the paper will appear to be stronger and thicker. You have probably observed the difference in strength between tissue paper and brown paper. Tissue paper has very few paper fibers piled together, so it tears very easily. Brown paper, on the other hand, has many fibers piled on top of each other so it is more difficult to tear.

Have you ever tried to see how many times you could tear a piece of paper in half? If you have done this, you probably noticed that when the paper got small enough you could no longer tear it. When the piece of paper becomes small enough your fingers can no longer grip the paper well enough to tear the fibers.

Another example that shows the strength of these fibers is when you try to fold a piece of paper many times. If you fold a piece of paper over and over again, eventually you will be unable to fold it anymore. This is because so many fibers are piled on top of each other that you are not strong enough to fold them.

In this activity you will observe fibers from different types of paper. You will also test your strength against a piece of computer paper. Good luck!

In this activity we will:

1. Observe different fibers from different types of paper.
2. Test the strength of computer paper.

Materials

- Several sheets of different types of paper (newspaper, printer paper, notebook paper, tissue paper, paper towels, etc)
- Magnifying glass

Preparation

1. Gather all materials listed above before beginning

Pre-Activity

1. Take a sheet of newspaper. Examine the paper with your naked eye and then with the magnifying glass. What do you see? Can you see anything special about what makes up the paper?

2. Now tear the page into two pieces. Examine the torn edge. What do you see now? Look at the edges with a magnifying glass. You should be able to see the fibers that make up the paper. Where do these fibers come from?

3. Different types of paper are made up of different types of fibers. Examine your other types of paper in the same way that you examined the newspaper. What can you say about the differences in the fibers in the different pieces of paper?

Activity

1. Now take out a standard piece of printer or notebook paper. Tear this piece of paper in half.
2. Take one of the torn halves from step 1 and tear this piece of paper in half.
3. Take one of these pieces and again tear it in half.
4. Continue to tear the torn pieces in half. What happens after you tear the halves of paper about 10 times? You should no longer be able to tear the pieces of paper after this because you can no longer grip the paper well enough to tear the fibers that are piled together in the paper.
5. Take out another standard piece of notebook or printer paper and fold it in half.
6. Fold the paper in half again. Keep folding the paper in half until you can no longer fold the piece of paper any more. How many times were you able to fold your piece of paper?
7. Why do you think that you were unable to fold the paper after so many times? Is it because of the same reason that you could not tear it after you tore the paper in half several times?

Extension Activity

1. Try soaking your piece of paper in water for a minute and then repeating steps 1-4 above. Did you get the same results? Why or why not?
2. Repeat the steps of the activity using different types of paper to see if you get the same results.

Wrap-up

After this activity you should have a good idea of how fibers can affect the make-up of different types of paper. Manufacturers keep this in mind when they choose paper for different products. For example, you wouldn't choose tissue paper to make grocery bags; you would want something strong like brown paper. On the other hand, you wouldn't want to blow your nose in brown paper! You would want to use something light like tissue paper. The strength of paper is important because we use paper for so many different things!

Resources

Milgrom, Harry. *Paper Science*. Walker Publishing Company, New York, 1978.