Lesson: “Could you build a house out of paper?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

Hi, it's Doug! Have you ever seen a building while it was still being built? If you ever have the chance, stop and look at one. There's something fascinating about it. It's like getting to see a building's skeleton. Now, buildings don't really have a skeleton, at least not like you or I do. But there's something similar. You can see what materials are holding the building together. Like, check out this skyscraper here. We don't often think about what a skyscraper is made of. But this material here is concrete, the same stuff that driveways are made of. And this material is steel, a type of metal. Or check out this house. Its skeleton is made of wood and bricks. Building materials like these—wood, bricks, steel, and concrete—they all share an important property that makes them so useful for building. They're strong. But that's not all. They're also easy materials to build with. Because you can combine many small pieces of them and make a bigger structure. Now, it's tempting to think that all buildings must be made out of these materials. And lots of buildings are for sure. But people have come up with some pretty strange and surprising ideas of other materials to build with. Check out this house. It's called Casa de Botellas, or House of Bottles. It's located in the country of Argentina. Instead of bricks, this house is made from plastic soda bottles. They're stacked up and held together by cement. If you go inside the house, you'll find that even the furniture is made from bottles. Here's another house made of something unusual. Do you recognize this material? It's a house made of LEGO

pieces. Millions of plastic LEGO bricks. Even inside, everything is made from these tiny plastic bricks. Walls, chairs, beds. The House of Bottles and the LEGO house show a couple of creative ways that small pieces can be combined to make something new. Can you think of any other materials you could use to build a house?

EXPLORATION VIDEO 2

I don't know what ideas you came up with, but there are lots of possibilities. Besides materials like concrete and steel, people have made houses out of all kinds of other materials, like this structure made of straw, or this one made of dried mud. Here's a house made of snow and ice. And here's a tent, a simple house made of fabric. But now, here's a material you probably wouldn't ever think of building a house with: paper. Paper's great for drawing, but for building? When we think about the properties of paper, it doesn't seem like a great material for building a house out of. Unlike, say, this piece of wood, paper doesn't have the property of being stiff. In fact, it's just the opposite. Paper has the property of being flexible. It's easy to bend and fold and unlike concrete, paper isn't known for being strong. You'd have a hard time making hard, solid blocks of paper. Again, just the opposite. If anything, paper's known for being easy to crumple. Now, that said, paper does have the property that it can be stacked, but it's not like bricks, which are easy to build things out of. To make a wall out of bricks, you need to lay many rows of them. To make a wall out of paper, you'd need to stack tons and tons of paper sheets. So it seems like paper doesn't have the right properties for building, but could you somehow change the properties of paper to make it better for building with? Take a look at this. It's what's known as origami. Paper that's been folded to make a certain shape. This paper bird stands up on its own rather than flopping over. Likewise, the wings of a paper airplane stay stiff and flat when you fly

it. Do these examples give you any ideas about how you might change the properties of paper to make it better to build with?

ACTIVITY INTRODUCTION VIDEO

In today's activity, you're going to build a tall tower from nothing but notecards and paperclips. Then, you'll take that tower apart and build a strong tower. Strong enough to hold up a book. You'll start with 20 cards, which may seem like a lot, but if you just stack them like bricks, you won't get much of a tower. So you're going to have to think and experiment to come up with a way to make a lot of floppy, flimsy notecards become one big tower. I'll show you how to get started, step by step.

ACTIVITY STEP 1

Go ahead and get these supplies. You'll get your worksheet later. When you're done with this step, press the arrow on the right.

ACTIVITY STEP 2

Here's something to get you thinking. If you try to stand a card on its edge, it falls down. So see if you can figure out at least three ways to make cards stand up on their own. You can bend them, you can fold them, you can cut the cards. You can use paper clips too if that's helpful. Use your imagination; there's no wrong way to do this.

ACTIVITY STEP 3

Find a partner and discuss.

ACTIVITY STEP 4

Here's a picture showing some ideas we came up with. Discuss.

ACTIVITY STEP 5

Okay, your first challenge: see if you can build a tower as tall as a ruler. Now, this might be trickier than it sounds, so don't forget, you can use paper clips and you can always get help from your partner, too. You don't need to spend too long on this. I'll set a timer for five minutes, in case that's helpful. When you're ready, you can go to the next slide.

ACTIVITY STEP 6

Sometimes, it's useful to see what ideas other people came up with. Stay where you are, but look around at other people's towers. Do you see any ideas that might make your tall tower better? Discuss with your partner and then take a minute to try out some new ideas. These pictures on-screen show some of the ideas we came up with here at Mystery Science. Okay, it's been a minute. You might need a little more time and that's okay, but if you're ready, go to the next step.

ACTIVITY STEP 7

In a few moments, I'm going to give you a new tower challenge. But first, get this worksheet and discuss these questions. Then, fill in questions one and two on your worksheet.

ACTIVITY STEP 8

All right, here's your new challenge. You built a tall tower, but now can you build a strong tower? Using the same materials, try to build a tower that's at least six inches tall and can hold up the weight of a hardcover book. You can take your tall tower apart and start over, or if you think of a way to make your first tower work where you just change it, that's okay too.

ACTIVITY STEP 9

If you haven't already tested your tower, put a hardcover book on top. Is it strong enough to hold it?

ACTIVITY STEP 10

Think about how real buildings are built. Discuss, then fill in questions number three and four on your worksheet. Afterward, don't forget to watch the final video.

WRAP-UP VIDEO

In the activity, you built a tall tower and you built a strong tower, and you did it using the same note cards—the same pieces of paper. In real life, builders do the same thing. Using a building material like these wooden boards, they can create all kinds of different buildings, buildings like cabins, windmills, wooden rollercoasters, churches. What about paper, though? Does anyone use paper to build things in real life? The answer might surprise you. As you saw, even though paper seems like it's really flimsy, you can actually change its properties. You can fold paper so that it doesn't bend, or you can roll it to make strong columns. Maybe you learned that you can cut it so that you could have a wide base to keep it from tipping over. There are some situations

where paper is actually a pretty good choice for a material to build with. Check out these houses. They include some wood, but they're mostly made of cardboard, which is a type of paper. Here's a view as one of these was being built. You see the cardboard tubes there? This house was built for someone after an earthquake destroyed their first house. They lived here for a little while until they could build a bigger house again. Paper and cardboard are pretty cheap, so this was a great solution. If you take a piece of cardboard and you look at the edge, you can see something that makes cardboard a good material to build with. Notice how it isn't just one flat layer. It's two flat pieces with this zigzagging layer in between. The zigzags make the paper much stiffer and stronger, just like the folded cards in your tower. Paper gets stiffer and stronger when it's folded. Now, cardboard itself is a really fun material for building things with. People have used cardboard to make chairs, desks—and check this out: people have used cardboard to even make a car. A cardboard car is really unusual and probably not that useful, but there are a lot of sturdy, everyday things that are made from paper, too. Boxes and packing materials—they're often made from paper. Tissue boxes—made from paper. Egg cartons are made from paper, and think about it—they keep something as fragile as an egg from breaking. Keep an eye out. I'll bet you'll find even more interesting things in your life that are made of paper. Have fun, and stay curious!