mystery science

Grades K-5
Mini-Lesson: “How is a rainbow made?”

VIDEO TRANSCRIPT

VIDEO 1

Hi, it's Doug! Saint Patrick's Day. It's a time when people wear green, and some people even dress up in costume. But for me, Saint Patrick's Day always made me think of rainbows. I remember when I was young, seeing a rainbow in the springtime and getting on my bike and riding toward it, hoping that I could find a pot of gold. I never did get there.

Someone named Joseph has a question about rainbows. Let's give him a call now.

[Video Call]
- Hi, Doug!
- Hi, Joseph!
- I have a question for you. How are rainbows made?
- That's a great question.

Normally, the sky outside doesn't have that many colors, just blue or gray, like when it's dark and cloudy. But then, sometimes, a rainbow comes out. It's such a special thing when you get to see a rainbow. People even know the colors of the rainbow by heart. You've got red, orange, yellow, green, blue, and purple. Scientists call it violet. But where do rainbow colors come from? How are rainbows made? Do you have any ideas?

VIDEO 2

For a long time, no one had a very good idea about where rainbows come from and how they get all those colors. Rainbows aren't like most colorful things, like things you can reach out and touch. For example, think about a red chair or a green frog. Those things get their colors from what they're made of. A red chair has red paint on it and a frog has green skin, but a rainbow is different. It's not a thing you can reach out and touch, it doesn't contain colored stuff like a chair or a frog has. Instead, it's something that floats there like a big arc in the sky. And rainbows don't just stay there either. Not long after they appear, they start to disappear. It's really very puzzling what a rainbow's colors are made of, or where our rainbow comes from. The first big clue about how rainbows are made actually didn't come from rainbows in the sky, it had to do with rainbow colors from pieces of glass. For a long time, people had noticed that glass pieces, especially ones with flat sides on them, would sparkle with rainbow colors when placed in sunlight. Scientists noticed that one of the best ways to get a rainbow sparkle was by using a triangle-shaped piece of glass. It's called a prism. It was one scientist in particular who was very interested in this. His name was Isaac Newton. Isaac Newton wondered, “Was there a connection between the rainbow colors of a glass prism and the rainbows that we see in the sky?” To figure this out, he bought a prism and came up with a science experiment. In a room, he covered his window like this, to make the room really dark, then he made a hole in the covering to let in a single beam of sunlight. When he placed his prism in front of the beam of sunlight, it did this—it created rainbow colors on the wall. "Interesting," Newton thought. But how did it do that? Was the prism somehow creating those colors? That's what some people thought, but Newton wondered, "Could it be that sunlight itself is maybe a mixture or bundle of all the colors of the rainbow? If true, then maybe what the prism is doing," thought Newton, "is it

separating white sunlight out into each color of the rainbow?" But that seems unlikely, right? I mean, sunlight itself is white, if you had a bunch of different colors of paint and you mix those together, it doesn't make anything white. Look, you can see here, it makes a sort of brownish color. "But maybe light is different from paint," Newton thought. This is where Newton did something very clever. He took another second prism and he turned it the other way so that it would now combine all the rainbow colors of light shining onto it. When he combined all the colors of the rainbow, guess what he got, this—white light. So Newton proved the colors of the rainbow really do come from sunlight, but that still doesn't solve why a rainbow appears in the sky sometimes. I mean, it's not like there are prisms or pieces of glass floating around in the sky, right? Well, there aren't pieces of glass, but there are these: water droplets. It's rain! Water droplets can do similar things as a prism, taking white sunlight and separating it out into all the colors it's made of. When we see sunlight shining on a bunch of water droplets, we see a rainbow. And it's not just raindrops either, any drops of water in the air will do. You can find rainbows under waterfalls or even in the spray from sprinklers. Check it out next time you play with a hose.

So in summary, Isaac Newton proved that white sunlight is actually a combination of all the colors of a rainbow. A rainbow is formed when white sunlight passes through water droplets in the sky, acting like prisms.

That's all for this week's question. Thanks, Joseph, for asking it.