mystery science

Lesson: “Where do clouds come from?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

Hi, it's Doug! I have a question for you. What's the most amazing cloud you've ever seen? Look at these floating in the sky. Now clouds come in all sorts of different shapes and different sizes. Back in 2012, a man named Berndnaut Smilde got worldwide attention when he announced that he'd figured out a way to create a cloud inside, in a room like this. Here's another of Berndnaut’s cloud creations. Isn't that crazy? This cloud is totally real. There's nothing fake here. It's the same as a cloud in the sky. Now how did he do this? What do you make a cloud out of? I mean, what are clouds, really, anyway? Where do they come from? Like, are clouds the same thing as the smoke that comes from a fire? Or are clouds slightly more solid, like cotton candy material? Clouds float up there in the sky. They look so puffy. Artists and cartoonists—they make it seem like you could just lounge around on them. What do you think? If you could reach up and touch a cloud, what do you think it would feel like?

EXPLORATION VIDEO 2

Have you ever touched a cloud? Maybe you've seen a cloud come very low, like this, over a mountain. You could hike up to the top of the mountain and reach out and grab it. Or if a cloud comes even lower, do you recognize this? It's fog. Fog is just a cloud that's come down to the ground. That's really your best chance to get to touch a cloud. Now if there's ever fog that

comes by your neighborhood, go out and try to touch it. Notice what it feels like. I notice that when fog comes through my neighborhood, it leaves behind little droplets of water on everything—my windows, on the car windshield, everywhere. But another way to touch a cloud is to actually go up there and jump through one, like these skydivers are about to do. So in case you've never felt a cloud, I'll show you a video of a skydiver who is purposely going to jump through one: let's watch. Okay, the airplane is getting ready to jump, and now they're going to let go one by one. What did you notice? Let's watch it one more time. What can you learn about the cloud as the skydiver jumps through it?

EXPLORATION VIDEO 3

So as you saw in the video, clouds aren't solid, or soft, or fluffy. This skydiver goes right through one. I'm guessing the clue you noticed the most was all those little droplets of water on the camera lens. That's what you feel when you feel a cloud. Clouds aren't like cotton candy or smoke at all. Clouds are all watery; they're wet. So based on everything you've seen now, it would seem that clouds have lots of tiny droplets of water in them. That's probably not too surprising. I mean, rain comes from clouds. So there must be water that somehow gets up into the sky. Now, you know there's plenty of water here on Earth. There's lakes, and oceans, and rivers. But it's not like it ever rains upwards, where you see water going from the ground up into the sky. So how would little droplets of water get up there into the clouds? Well, take a look at this. This is a puddle of water in someone's driveway. Let's use a sped-up video and watch it for a while. What happens? You see that? The water in the puddle is disappearing. It's worth noting, this cement is solid. There's no cracks or holes for the water to drain into. So that's kind of weird. Well, have you ever seen a pot of water when you boil it? You see how something is moving up from the pot into the air? You hear this stuff called steam, or water vapor. As you

keep boiling the water, eventually all of the liquid water in the pot goes away. And the pot will be empty. The water in the pot became this steam that was rising up. The steam rising off the top of a boiling pot of water, this is what scientists call water in its gas state. You see, water comes in three different forms, or states. You already know about the other two. There's the solid state of water—that's what we call ice. Ice is still water, it's just a different form of water. It's water in its frozen, or solid state. And if you melt ice, you get ordinary water itself. That's water in its liquid state. But the steam rising off a boiling pot of water, that's a third state: the gas state. We can call it water gas. Now, the gas state is when water leaves the container. It can move and go up into the air around us. This process of going from a liquid to a gas. In science, we call this evaporation. We say that the liquid water evaporates, rising up out of the container as it becomes a gas. Now, you know the water from this puddle example was not hot like the boiling water. And we didn't really see anything coming off the top of it like we did with the boiling pot. So is this the same thing? Could the water still be evaporating, escaping into the air, even if it's not boiling? Well, here's another sped-up video you've got to see. This is an ordinary glass of water. You see the water level at the top? Now, let's watch what happens when this glass of water is left out on a counter for a few days. Notice what happened? The water level went down. So even though the water isn't boiling, when you leave it sitting out, it still seems to do the same thing as boiling water, just much more slowly. In fact, if you look really carefully, you can even see a little bit of it when it first rises up out of the glass. Then, it spreads out into the room. And it turns out that if you use warm water in the glass, the water evaporates even more quickly. Let's try an experiment. What do you think would happen if we took a cup of warm water—so in other words, a cup of water liquid that's becoming water gas rising up out of the cup—but now instead of letting any of the water gas escape, let's say that we trap it. What do you think will happen if you trap some of the water gas and don't let it escape?

ACTIVITY INTRODUCTION VIDEO

In today's activity, you're gonna put some warm water in a cup. That's water that's turning from a liquid into a gas. And you're gonna see what happens to that water gas when you trap it underneath a lid, like this. Your job, just like a scientist, is to observe what changes when you add the water and put on the lid. You'll write down and draw what you notice. Here's how to set up step by step.

ACTIVITY STEP 1

Get your supplies. You'll get the water later. When you're done with this step, click the arrow on the right.

ACTIVITY STEP 2

Use your scissors to cut on the dotted lines, cutting off the "Gas Trap Tester."

ACTIVITY STEP 3

Hold your "Gas Trap Tester" against the back of your cup and try reading it. Do question number 1 on your experiment sheet.

ACTIVITY STEP 4

Put about one inch of warm water in your cup. Your teacher might help you do this. Then, put on the lid and answer questions two and three on your experiment sheet.

ACTIVITY STEP 5

Discuss these questions as a class.

ACTIVITY STEP 6

Open the lid and feel the inside of the cup. Do question number four on your experiment sheet.

ACTIVITY STEP 7

Discuss these questions as a class.

WRAP-UP VIDEO

What did you see when you took water in its gas form and then trapped it? Well, when we did this, we noticed something foggy formed on the inside of the container. What happened? The water had moved upward. It had gone from the bottom of the container where it was a liquid and then it had traveled upward as a gas. But because we trapped it, that gas had nowhere else to go. And so there was this fogginess up on the sides and on the lid of the container. Remember earlier when we saw how clouds have water in them? Well, now you can understand how water could get all the way up there into the sky. Let me explain. Just like down here at the bottom of the cup there was water in its liquid state turning into the gas state, this is exactly what is happening off the oceans, lakes, and rivers on Earth. Some of that liquid water on Earth is always becoming water gas, invisibly rising up into the air around us. So now how does that explain clouds? Well, notice something else from your experiment. If you look really closely at that fogginess that we saw from trapping the water gas, you'll see that it's actually little tiny droplets of water, just like the drops of water you see on things when it's foggy and just like the

skydiver saw as they fell through the clouds. So it seems like clouds have something to do with water gas rising up from the ground and getting trapped up in the sky. Here's one more clue to help us understand what clouds are made of. Now normally if you were asked what color is water, what would you say? You'd probably say it's clear, right? It doesn't really have any color. But when water forms tiny, tiny droplets, when water's been broken up into smaller pieces, what color would you see? Well, let's consider sometimes when water is broken up into tiny droplets. Like here are some lawn sprinklers spraying lots of little droplets of water. What color? You see, when you get a bunch of tiny droplets of water, they appear white. Here are ocean waves breaking. Again, little droplets of water there. What color are the waves? White. Or look at a waterfall where there's a fine mist of tiny droplets. It also looks white. Now look at what you saw on the inside of your cups—little droplets of water—and look at their color. They're white. That's why clouds look white. You see, clouds don't just happen to have little droplets of water in them, clouds are made of little droplets of water. They're just very small droplets of water, droplets so small that they can stay up in the sky because of wind and air currents keeping them up there. So now you know what clouds are and how they form. Water gets up into the sky by the process of evaporation, rising and becoming a gas. And then it forms tiny water droplets up there, which appear white. Now if you want to make your own cloud in a room, that's the secret. To make a cloud in a room you need very tiny droplets of water. Using a spray bottle isn't even good enough. A spray bottle does give a white mist, but those droplets are still just a little bit too big to stay up in the air. You'll notice they all fall to the ground when you spray a spray bottle. But now this thing—it's called a humidifier, and it has a little motor inside that can break up liquid water into really tiny, tiny droplets—so let's turn it on and see. Look at that. You get tiny, tiny white droplets of water floating up to the sky. Or in other words, you get a cloud in a room, at least for

a little bit. If you have one of these at home you can try it out for yourself. Go make a cloud.

Have fun!