Lesson: “Why do the stars come out at night?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

Hi, it's Doug! How many stars can you see where you live? From the time I was a little kid, I've always been fascinated by the things I could see in the night sky, things like the Moon and the stars. So when I got older and applied to college, the first thing I thought to do was to join the astronomy club. That's a club for people who like to look at things in the night sky. In the astronomy club, they had telescopes that you could borrow. I was so excited. Some of the older students in the astronomy club gave me advice. They said, Doug, when you borrow a telescope, don't just use it near where you live by all the bright street lights. Instead, if you take the telescope and drive out into the country where there are no street lights, just wait until you see the night sky there. You'll be surprised. Hmm, I thought. What do they mean? I decided to take the telescope out to the country to find out. I took my friend Andrea with me. Now I had grown up in a small town. And I could see some stars at night, but it wasn't exactly out in the country, so I didn't know how many stars I'd see that night. But my friend Andrea, she grew up in the middle of a big city, Chicago. She told me, Doug, I don't think I've ever seen more than 10 or 11 stars my whole life. That's just all I could see from the city that when I was growing up. I said, Andrea, would you like to come with me tonight? Everyone from the astronomy club says that if we drive out into the country, it will be a big surprise. Well, when we got out there, I'll never forget the view. Are you ready for this? It looked like this. Whoa! With no bright city lights

around, we could see hundreds of stars, maybe even thousands. I was amazed. And Andrea, I'll never forget. Her reaction was great. She almost fell over. She was that surprised. I'm not kidding. I remember what Andrea said. She said, Doug, this is like being in outer space. This is great. Now whether you live in the city or in the suburbs outside the city or out in the country, every night, you can see at least some stars come out. Why is that? Why do you think stars come out at night? And why do you think you can see more of them when you're out in the country?

EXPLORATION VIDEO 2

So why do stars come out at night but can't be seen during the daytime? This is a hard mystery to solve. It's not like you can ask the stars, they don't talk. They're not even alive. It also turns out the stars are really far away. Even the astronauts don't get close enough to the stars. So we can't find out by going to space. Let's see if we can figure out why stars come out at night in another way. Now one thing scientists do when they want to figure something out is they watch it very carefully. They call that observing. We should observe the stars carefully. We should go out and look at them. Now we can't do that right now. But we can look at pictures of stars. Like here, look at all these stars. Now hold on a second. Right away, we noticed there are so many stars and they all just look like little dots of light. There are so many of them that it's hard to even keep track of them. Well, you might have heard that people like to connect the dots with stars. People connect them into shapes to help us keep track of them. We call these shapes constellations. Now these stars right here, people thought these stars looked a bit like a person with a bow and arrow. Can you see the similarity there? So they connected those dots in that way. This constellation is called Orion. It's a real constellation. Here's another group of stars that's pretty easy to find during many nights of the year. People call it the Big Dipper because it

looks a little like a spoon. Can you see that? Here's another picture of the Big Dipper when you can see a lot more stars out. Do you see it? Spend a few moments practicing by spotting the Big Dipper among all these stars. And then we'll return to the question of why stars go away during the daytime.

ACTIVITY INTRODUCTION VIDEO

In today's activity, you're going to create a Starmaker that lets you make a copy of the Big Dipper shine onto a dark wall. Then, you'll use a flashlight to create sunrise. And you'll see what happens to the stars in your Big Dipper. Now, of course, your Starmaker won't make real stars. You're making spots of light that look like the stars you see in the night sky. You're making what we call a model—a pretend copy of the real thing. It's similar to what you see in a type of museum called a planetarium. That's a place where a giant Starmaker projects light to make pretend stars shine all over the ceiling so that people can learn about the night sky. You'll make your Starmaker by poking holes in the bottom of a paper cup. Then you'll shine a flashlight through the holes to make the Big Dipper. Now, you'll have to experiment to get good at this. It will take a little practice. Once you're good at making stars, you and a partner will make the Big Dipper shine in a pretend night sky. Then you'll use the bright light of a flashlight to turn that night sky into a daytime sky, and so find out what happens to your Big Dipper. All right, I'll show you how to get started, step by step.

ACTIVITY STEP 1

Get your supplies. When you're done with this step, click the arrow on the right.

ACTIVITY STEP 2

Cut out your Big Dipper picture by cutting on the dotted lines. Here's a tip: to make this easier, you can turn the paper, instead of turning the scissors.

ACTIVITY STEP 3

Use a sticker to stick your Big Dipper picture on the bottom of the cup, like this.

ACTIVITY STEP 4

Carefully use a pushpin to poke a hole in each star of the Big Dipper. It should look like this when you're done. You've created a star cup.

ACTIVITY STEP 5

Get a flashlight. It may not look like the flashlights you're used to, but it works just like a normal flashlight.

ACTIVITY STEP 6

It's time to turn off the lights and cover the windows.

ACTIVITY STEP 7

Now it's time to test out your star cup. Shine the flashlight through your cup onto your desk like this. Move the light to find a spot that gives you the Big Dipper. Do you see it?

ACTIVITY STEP 8

Discuss.

ACTIVITY STEP 9

Get a partner. Decide who will be Starmaker and who will be Sunshine first. Don't worry, you'll switch jobs later.

ACTIVITY STEP 10

Go to an activity station. Look for a sky picture. It looks like this. There are some houses at the bottom and above them is the sky and look here, there's an outline of the Big Dipper in the sky.

ACTIVITY STEP 11

Starmaker: Use your star cup to shine the Big Dipper onto the sky. Make it about the same size as the Big Dipper printed on the page. Keep shining for the rest of the activity.

ACTIVITY STEP 12

Now it's time for sunrise. Starmaker: keep shining the stars on the paper. Sunshine: shine your flashlight. Move it up on the paper like the rising sun. What do you notice when it shines on the Big Dipper?

ACTIVITY STEP 13

Now it's time for the sun to set. Starmaker: keep shining the stars on the paper. Sunshine: start with your flashlight high in the sky, and lowering it down now, like the setting sun. What do you notice?

ACTIVITY STEP 14

Switch roles so that everyone can have a turn. Watch sunrise and sunset again. What happens to the Big Dipper?

ACTIVITY STEP 15

Watch what happened when I did this. Then discuss. When you're done discussing, be sure to advance the slide to watch the final video.

WRAP-UP VIDEO

Here's what we figured out when we projected an image that looked like stars and then used a flashlight to act like the Sun. When you turn the flashlight on, now you can't see the stars. The Sun—or the flashlight—it outshines the stars. This is what's going on in the real world. See, it's nighttime, and you see the stars out. But as the Sun comes up in the morning, it gets so bright that it starts to outshine the stars, making them impossible to see. See that? Now when you move the flashlight down, notice how you can see the stars again. Well, watch this in real life. Only once the Sun goes down in the evening does its light go away. And now, the stars are not being outshone, and so we can see them. It's not just the Sun that can outshine stars. This is true of any bright light. The Moon isn't as bright as the Sun. So you can still see stars when the

Moon is out at night. But look at this. Here's the sky when the Moon is out. And here's the sky when the Moon is not out. Wow. You see the difference? You can't see as many stars when the bright Moon is out. It does outshines some of the stars. This is also true for city lights, like street lights. That's why my friend Andrea was so amazed. You see, she grew up where there were lots of street lights and lights from tall buildings. And those lights were always outshining the stars. So living in the city, she didn't see very many stars. But in the countryside, there aren't as many streetlights to outshine the stars, so you can see lots of stars there. Now here's something interesting to think about. If all the city lights could be turned off, what would you see? Well, sometimes things like this even happen, like when a city has a power outage. Here's what the sky would have looked like above New York City if they had a power outage and all the city lights went out. This can happen in neighborhoods, too, if the street lamps go out. You'll be able to see more stars when the street lights go out. So think about it. Does this mean that if you could somehow turn off the Sun, you'd see the stars even in the middle of the day? Hmm. There's no way to turn off the Sun. Or is there? Well, actually, there is, kind of. During a special rare event called a solar eclipse, the Sun is out, it's a normal day, and then the Moon goes in front of the Sun, as seen from here on the ground. What that does is it blocks out all the sun's light, like you see here. When that happens, the sky gets dark, even though it's the middle of the day. So you can see stars in the middle of the day. See? Stars really are there the whole time, even in the daytime. You just can't see them when the sun is shining brightly. See you next Mystery. Have fun and stay curious!