mystery science

Grades K-5
Mini-Lesson: “Why does the Moon turn blood red during a lunar eclipse?”

VIDEO TRANSCRIPT

VIDEO 1

Hi, it's Doug! This might not look like it, but believe it or not, this thing is a telescope. If it looks unusual, that's probably because I made it. A few years ago, a friend of mine helped me to build it. And the views through it are pretty good. I can see the moons of Jupiter, the rings of Saturn, even craters on the Moon. I've got it out and ready because I'm looking forward to a lunar eclipse that's happening soon.

Someone named Travis has a question about eclipses. Let's give him a call now.

[Video Call]
- Hi, Doug!
- Hi, Travis!
- I have a question for you. Why does the Moon turn blood red during a lunar eclipse?
- That's a great question!

On the evening of Sunday, January 20, there'll be a full moon up in the sky. Now, that's not anything unusual. A full moon happens once a month. But if you live in North or South America, on January 20th, something strange will start to happen. This. Over just a few hours, the full moon will look like it's starting to disappear. What is going on here?

When this happens, this is what's known as an eclipse of the Moon, or a lunar eclipse. And the reason this happens turns out to be pretty simple to understand. You might know that, in outer space, the Moon moves in a circle-shaped pathway around the Earth, like this. But what you might not know is that the light of the Sun causes the Earth to have a shadow that goes out this way into space.

Outer space is dark, so we normally can't see this shadow. But sometimes, when the Moon is over in this part of its pathway, it goes into the Earth's shadow, and that's when we really notice it. The shadow of the Earth blocks out the light from the Sun, and so the Moon starts to go dark. It starts to look like it's disappearing.

But I've saved the best part of all for last. And that's what happens after the Moon starts to go into the Earth's shadow. Watch and see for yourself. Right there, you see that? Notice how the Moon turns this reddish-orange color? This is why some people call a lunar eclipse the blood moon since the color reminds some people of the color of blood.

If you only go outside to look once on Sunday evening, I recommend going out and seeing the Moon when it's like this—when it's the blood moon. And you don't need a telescope or any special glasses. The lunar eclipse will be easy to find in the sky, and it's totally safe to look at.

But the exact time that all of this happens depends on where you live. If you live in the eastern part of North America, the Moon won't become a blood moon until around 11:30 p.m., so you might have to get permission to stay up late.

Now, if you're wondering, like Travis, "But why does the Moon turn blood red like this? Why does it become the blood moon?" To answer this question is really kind of tricky to understand. If you're not up for it, that's okay, you can skip straight to the end now. If you are up for it, I'll show you some visuals that will help you make sense of it.

But before I say anything more, now would be a good time to stop and discuss—why do you think the Moon turns red during a lunar eclipse?

VIDEO 2

So, why does the Moon turn reddish-orange like this during a lunar eclipse? Well, the clue to figuring this out is actually to *not* think about the Moon, but instead think about the Earth.

Picture the Earth in space. Now, when you think of the Earth, we often imagine the whole Earth as being lit up like this. But let's imagine that over here, you've got the Sun. So if we were to look at the Earth and Sun from the side, like we're doing here, then actually only half the Earth would be lit up. So I've changed that now.

Now this makes sense because, think about it. This is the side of the Earth facing the Sun, this is the part of the Earth having daytime right now. And then, over here, this is the side of the Earth facing away from the Sun, it's the part of the Earth having nighttime. So there's daytime, and there's nighttime.

But there's something important I want to add to this picture, the sky. In daytime, what color is the sky? Well, on a clear, sunny day, it's light blue. So watch, I'll add a layer of light blue, like this, to represent the daytime sky. And then, what about nighttime? The nighttime sky is maybe

black, or dark blue, so I'll represent that here, like this. What we've just added here is the Earth's atmosphere. It's the layer of air that's all around us. Now, it doesn't really look like this from space. The atmosphere is not actually this large, or noticeable. But I've drawn it to help us imagine it.

Here's a question for you, though. Is the sky always blue-colored? Like, do you ever see any other colors? Well, you might have thought about how the sky looks around sunset, it turns reddish-orange. That's also true around sunrise in the morning. So we need to add a reddish-orange color to the picture, but where should we put a reddish-orange color of the sky during sunrise and sunset?

This is a little tricky but think about it. Sunrise and sunset are the times of day that come right between daytime and nighttime. So, let's add it right down the middle here, between the daytime side of the Earth, and the nighttime side.

Now you have some of the important clues that you need to figure out why the Moon looks red during a lunar eclipse. Let's zoom out, and let's add the Moon to our picture now. Now remember, the Sun's light causes the Earth to cast a shadow outwards into space. During a lunar eclipse, the Moon travels directly behind the Earth, into the Earth's shadow.

I want you to use your imagination. Imagine if you could stand on the Moon when all of this is happening. What would you see? Now, what's especially hard about this is no one has actually been on the Moon during a lunar eclipse, so I don't have a photograph I can show you of what it would look like. But given what you know already about lunar eclipses, you could take a guess.

For one thing, you'd be in the shadow of the Earth, so you'd be looking up at the nighttime side of the Earth. We would need to color the Earth dark here to represent the nighttime, like that.

There's something important we can add here though. Think about that reddish-orange band of light, the light from all of the sunrises and sunsets happening at that moment. If you were directly behind the Earth, in the shadow of the Earth during a lunar eclipse, that band of light might look something like this.

Whoa, a ring of reddish-orange light surrounding the Earth! That light would shine on all the surface of the Moon around you. Imagine what that would look like. The Moon's surface, which normally looks white, would have reddish-orange light shining on it.

So that's why the Moon looks reddish-orange during a lunar eclipse. It's the reddish-orange light from all of the sunrises, and all of the sunsets happening on Earth at that moment.

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