



Why Is the Sky Blue?

Video: 3:38 · Episode 005**Grades:** 4–8 · Physics**Time:** 30–45 min (video + worksheet + quiz)**Key term:** scattering (light sent off in new directions when it hits tiny particles)**Connects to NGSS:** MS-PS4-2 (waves are reflected, absorbed, or transmitted through materials) · 4-PS4-2 (light entering the eye lets us see)

The big idea

Sunlight is every color mixed together, and each color travels as a wave (red: long; blue: short). The tiny nitrogen and oxygen molecules in air are much better at **scattering** short waves than long ones, so blue light reaches your eyes from every part of the sky. It isn't violet because sunlight has less violet than blue and our eyes are much better at seeing blue.

One-line recap students should be able to say: "The sky is blue because air scatters blue sunlight all across the sky."

Learning goals

- Explain that white light is a mix of colors, and that colors differ in wavelength.
- Describe scattering: air molecules send short (blue) waves off in all directions far more than long (red) ones.
- Use scattering to explain the blue daytime sky and red-orange sunsets.
- Predict what the sky looks like where there is no air (the Moon).

How to use it

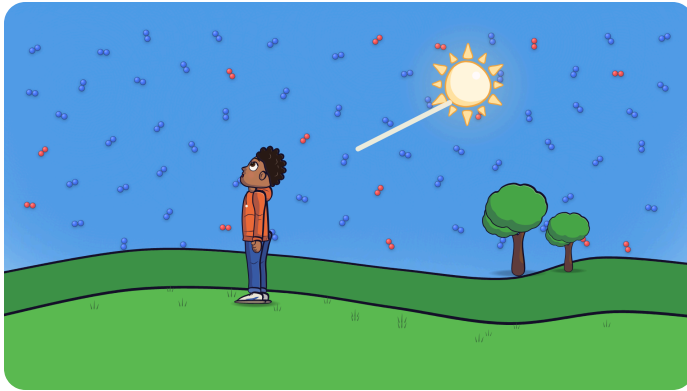
1. **Before watching (3 min):** students answer the prediction on the worksheet. Don't correct them yet.
2. **Watch (4 min):** play it straight through. Optional check-in pause at 2:11 ("That's the blue sky").
3. **Worksheet (10 min):** fill in the blanks, then draw the sunset path.
4. **Discuss (10 min):** pick two or three discussion questions.
5. **Quiz (5 min):** six quick questions; answer key on the last page.

What the video simplifies: this is *Rayleigh scattering* (strength $\propto 1/\text{wavelength}^4$): molecules re-send light in all directions, not bounce it like a ball. Violet scatters even more than blue; the sky looks blue because sunlight has less violet and eyes are less sensitive to it. Red scatters too, just much less. The Moon has an extremely thin exosphere, not literally zero gas. The sky isn't reflecting the ocean: it's just as blue over deserts.



A Sunset in a Jar

A flashlight beam through slightly milky water scatters blue light out the sides, just like air does. Look from the side and the water glows bluish. Look through the long way, toward the light, and the beam looks yellow-orange, like a sunset.



From the video: scattered blue comes from every part of the sky



A long path through air: the blue is scattered out

You need

- A clear, straight-sided glass or plastic container (a tall one works best), filled with water
- Milk (a few drops at a time) and a spoon for stirring
- A bright white flashlight (a phone light works) and a dim room
- A sheet of white paper

Steps

1. Shine the flashlight through the side of the clear water. Notice the beam is hard to see.
2. Stir in a few drops of milk. Shine it again. Look at the water from the **side**: what color is the glow?
3. Hold the paper on the far side of the container, so the light has to go all the way through. What color is the spot on the paper?
4. Add a few more drops and repeat. Does the spot get more orange?

The milk's tiny particles stand in for air molecules. They are bigger than air molecules, so the effect is weaker and whiter than the real sky, but the side glow and the orange spot show the same idea: blue is scattered out of the beam, and what makes it all the way through is shifted toward orange.

Safety: never point the flashlight into anyone's eyes, and never look at the real sun. Wipe up spills so no one slips.

Talk about it

- Which part of the jar was like the daytime sky? Which part was like a sunset?
- Why did adding more milk make the spot more orange? What is "more milk" like in the real sky?



Why Is the Sky Blue?

Name: _____

Date: _____

Before you watch

Why do you think the sky is blue? Write your best guess.

While you watch: fill in the blanks

1. White sunlight is really all the _____ mixed together.
2. Red light has _____ waves. Blue light has _____ waves.
3. Air is mostly made of two gases: _____ and _____.
4. Air molecules send _____ light off in every direction much more than red light.
5. This is called _____.
6. Two reasons the sky isn't violet: the sun sends out less _____, and our eyes are better at seeing _____.

Draw it

Draw the Earth, the air around it, and you. Draw sunlight's path at noon (sun high) and at sunset (sun low). Which path goes through more air?

NOON

SUNSET

Explain it

Astronauts on the Moon saw a black sky in the middle of the day. Explain why, using the word *scattering*.



Talk It Over, Then Check Yourself

Discussion questions

1. Some people think the sky is blue because it reflects the ocean. How does the video show that idea is wrong?
2. A glass of air looks clear, but the sky looks blue. What is different?
3. Violet waves are even shorter than blue ones. Why isn't the sky purple?
4. Why is the sun itself still bright and whitish-yellow at noon, while the rest of the sky is blue?
5. Mars has a very thin atmosphere full of fine dust. Would you expect its sky to look like ours? What would you need to find out?

Quiz

Name: _____

1. What is white sunlight made of? (Circle one.)
A. Only yellow light
B. Only blue light
C. All the colors mixed together
D. No colors at all
2. Which color of light has the shortest waves of these?
A. Red
B. Orange
C. Green
D. Blue
3. What does air do to blue sunlight?
A. Scatters it in every direction
B. Turns it into red light
C. Lets it all go straight through
D. Stores it like a battery
4. True or false: the sky is blue because it reflects the ocean. _____
5. Why are sunsets orange and red?
A. The sun cools down in the evening
B. Sunlight crosses much more air, so most of the blue is scattered out
C. The ocean turns orange
D. Clouds paint the sky
6. What color is the daytime sky on the Moon, and why?



Answer Key

Worksheet: fill in the blanks

1. colors · 2. long; short · 3. nitrogen; oxygen · 4. blue · 5. scattering · 6. violet; blue

Draw it: at noon the sunlight comes nearly straight down through a thin layer of air. At sunset it comes in low and sideways, crossing a much longer stretch of air. The sunset path goes through more air.

Explain it: The Moon has (almost) no air, so there is nothing to scatter sunlight across the sky. Light only comes straight from the sun, and the rest of the sky looks black.

Quiz

1. **C.** All the colors mixed together (a prism spreads them out).
2. **D.** Blue.
3. **A.** Air molecules scatter blue light in every direction, much more than red.
4. **False.** The sky is just as blue over deserts and land.
5. **B.** The long path through air scatters most of the blue out; yellow, orange and red are left.
6. Black. There is no air to scatter the sunlight, so no light comes from the rest of the sky.

Discussion: points to listen for

1. The sky is blue over deserts too; and the ocean is partly blue *because* it reflects the sky.
2. A glass holds very little air, too little scattering to see. The sky is miles and miles of air.
3. Sunlight has less violet than blue, and our eyes are much less sensitive to violet. (A little violet is also absorbed high in the atmosphere.)
4. Light coming straight from the sun still has most of its colors; only a small share of the blue is scattered out of a short path. Never look at the sun to check.
5. Mars's daytime sky is a dusty butterscotch color, and its sunsets look bluish, because dust scatters light differently from tiny gas molecules. Good answers ask what the air is made of and how thick it is.