

Interactive Notes-“Why Is The Sky Blue?”

Materials (per group of 4 students):

1-glass beaker $\frac{3}{4}$ full of water (400 or 600 mL ideal)
1-dropper
1-flashlight
10mL-milk
1-small cup to hold milk
1-stirring rod or popsicle stick
4 Student Note sheets (see p. 7)

If you don't have a class set of flashlights (as few as 8), these are worth buying at about a dollar apiece. You'll likely use them 3-4 times a year anyway if they're around.

Additionally- PowerPoint (see p. 7)

Beforehand:

- Darken the room by closing blinds and turning off classroom lights, if possible.
- Set out all materials *the day before*. Leave yourself time to realize you're missing something, and to practice a new demonstration, research something or even make a change. In the morning, read through the slides and notes one last time. Relax and have fun along with your students. Remember- you're only as effective as your plan.
- Insert page and paragraph numbers from relevant pages in your textbook at the bottom of slides 1 and 2 if you choose to have the class read from it together. This is a good way to connect with your textbook as well as transition into the next demo. You can also delete these page inserts, or Copy and Paste them onto later slides if needed.
- As with any other demonstration, try these out ahead of time for yourself so you know how they work best and so you know what to expect.
- Print extra copies of the notes pages on paper for yourself, students that are slow writers or can't see well, and for absentees. Click “File” → “Print” → then where it says “Print what:” select “Handouts” → and then “OK”.

You've probably seen other “Blue Sky” activities that use other methods and chemicals, and some do a better job than milk in their effect. But the milk method has its advantages- 1. it's convenient, safe, and cheap, and 2. it reliably does a good enough job demonstrating the main principles, and with a well-worded explanation still bring the student to a full understanding.

At the very beginning of class review basic light and colors- “If there was no light at all in here what colors would you see? (none).

So colors come from light. What color is sunlight? (white/colorless).

And that's where all colors come from?! How do you know all colors are in white light? (rainbows, prisms, colors in this room).

Ok- if there's a flashlight near you, shine the light on your shirt. See how it's red or purple or green or yellow? The light leaving your flashlight has every color in it. When it hits your shirt, the red or purple reflects and all the others go inside.”

Interactive Notes: Why is The Sky Blue?



Do: Shined flashlight through clear water.

See: Light cuts directly through.



What's Happening: Without an atmosphere the sky would be black and we'd be exposed to unfiltered sunlight.

Read p. 1 together

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1.

Have student #1 (of the 4) get the flashlight and shine it through the beaker of clear water and see what it looks like after it's passed through.

To help students better understand this topic, begin a story that will continue and change later on-
“Students, you’ve just seen light pass through water mostly undisturbed. Imagine this classroom with no tables and chairs. Empty. Nothing but the walls. Then I ask all of you students to line up against one wall shoulder-to-shoulder and walk across the room. You’d all make it, because there are no obstructions. This is what your light is doing in this water- it enters, moves through the water, and out with almost no trouble. There is a little of what we’ll call ‘refraction’.”

2.



Do: Added 2 drops of milk to the water.

See: The light was not as intense and focused. Saw a tinge of blue.

What's Happening: The light starts to scatter as it collides with milk. Sunlight contains all colors. As it collides with nitrogen and oxygen, the blue in it (having the highest frequency) scatters out first.

Read p. 1 together

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Have student #2 add 2 drops of milk to the water, stir, and then shine the light through.

When they're watching the light pass through, it helps them focus better if you talk about and notice the "problems" the rays of light are having. At first, when the water was clear, it had no problems. As it thickens, its problems get worse. By the time we're done, the light has *big* problems.

Back to the story- students again line up against a wall like before, but this time there is 1 or 2 chairs out in the middle of the room. Most students move through without a problem, but a few collide with something they cannot go through, so they change course (scatter). Thinking of each student as a light ray, the moment they strike the object and change course, they would bend (refract), and give off a little blue. Blue scatters first because it has the highest wavelength.

3.



Do: Added 10 more drops of milk to the water

See: Light scatters more.

What's Happening: The milk thickens the water. The more it thickens the more the light scatters. After the blue scatters out, then red begins to.

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Have student #3 add the 10 drops of milk, stir, and check the water with the flashlight.

Continue the story- Now there are 5-8 chairs in the way, so more of the little “light rays” are having problems getting across. More of them are colliding, and colliding more often (some more than once). The moment they strike a chair and redirect is when they emit light. If you are really into visualizations have a few students act this out and have some “blue” and “pink” and “orange” signs to hand them every time they collide. The more this occurs, the more colors come out.

As students observe the sunset picture in the bottom center, talk them through it using common sense. “So the sky here is pink, and red, and orange. What did the people 1 or 2 time zones to the west see while looking at the same sky at the same time? (a blue sky). So the clouds aren’t really colored? It’s just an effect of where you happen to be standing, because by the time sunlight goes through all that atmosphere between over there and here, more and more colors are scattered out.”

The orange sky picture was taken just before a severe storm. Different circumstance, but same reason for the color in the sky. Several things can disrupt and scatter light- nitrogen, clouds, dust, ash, and pollution.

A bit of trivia- see if some students notice anything else in the picture besides the sunset. There’s a slice of moon in there (waning crescent). Another speck a little higher is Jupiter.

4.



Do: Poured the rest of the milk in the water.

See: The whole beaker glows. Orange is coming out of the light.

What's Happening: The water is so thick that light cannot pass directly through. The light appears to come from everywhere at once.

The gray background is a photo of an overcast sky. Is the sun behind these clouds or on the other side of the sky?

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Have student #4 pour the rest of the milk into the water.

Finish the story- now your classroom is full of tables and chairs stacked to the ceiling. The students are once again lined up and start across. “What would your path be? Where will you end up?” The little light rays are having *big* problems.

If it's cloudy outside then it's your lucky day. Take your students outside and ask where the sun is, and wait to see if they learned anything. Get them started if needed- “Where's the sun? (can't see it). How does the brightness of the sky here compare to there (*point to 2 different places in the sky*)? (all the same). And that's because... (the light hits the water droplets in the cloud and bounced all over the place, just like when we crawled across the full classroom).”

The answer to the blue question in the slide- the sun is directly behind these clouds. It had big problems that day.



Use this slide as review and summary.

For homework tonight have students complete the “Scrambled Explanation” worksheet.

Clean Up- this is what your box needs to look like in 3 minutes.

Person 1
•Empty and rinse the large beaker. Fill it $\frac{3}{4}$ full again.

Person 2
•Pour 10ml of milk into small cup

Person 3
•Count 4 new note sheets

Person 4
•Check-do your materials look just like they did at the beginning of class?

You'll need at least 5 minutes to reset everything for the next class.

Leave refills of everything in different parts of the back of your room so students don't all crowd one spot:

- milk
- note sheets

If you choose not to use this slide, you can right-click the slide and select “Hide Slide”.

To help you with clean up, have your last science class take everything out of the boxes and put them in like piles in the back of your room.

Come back and visit InteractiveScienceTeacher.com to upgrade this lesson with:

PowerPoint- lead your students through the lesson click-by-click

Do: Added 10 more drops of milk to the water

See: Light scatters more.

What's Happening: The milk thickens the water. The more it thickens the more the light scatters. After the blue scatters out, then red begins to.



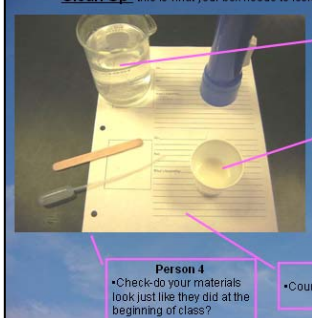
Clean Up: this is what your box needs to look like in 3 minutes.

Person 1
•Empty and rinse the large beaker. Fill it 1/2 full again.

Person 2
•Pour 10ml of milk into small cup

Person 3
•Count 4 new note sheets

Person 4
•Check do your materials look just like they did at the beginning of class?



Student Handout

Test _____ Date ____/____/____

Do: _____

See: _____

What's happening: _____

Do: _____

See: _____

What's happening: _____

Homework-Unscramble The Explanation



Instructions- The explanation of what happens to sunlight as it encounters different atmospheres has been broken into pieces. Rewrite them in the correct order.

- red, orange, and pink
- So the sky appears blue and the sun is yellow but not perfectly round.
- Things get interesting when it collides with particles.
- more colors are scattered out.
- When sunlight strikes a moon or planet without an atmosphere
- from red to blue, and green to yellow.
- the sky is black and the sun looks white and perfectly round.
- When sunlight enters an atmosphere composed of nitrogen and oxygen
- so much colliding and scattering occur that light appears to come from everywhere at once.
- When sunlight enters a very thick atmosphere
- When sunlight travels long ways through the same atmosphere
- Sunlight contains all the colors-
- the blue in it scatters out.