PCS eDventures!™
Experts in Hands-On STEM Education

STEM in the Sun: Outdoor Science Experiments

The Sun plays one of the most significant roles in our lives. From nourishing our bodies to providing the food we eat, each and every ray not only serves an important purpose, but they also provide valuable teaching opportunities.

Enjoy these activities experimenting with the Sun's rays, discovering how they interact with different colors, what it means to be reflective or translucent, what it takes to pop a balloon without touching it and which colors melt an ice cube faster.

MATERIALS:

- **Balloons (one black, one white or translucent.)**
- **Ice Cubes**
- **Magnifying Glass**
- **Sheets of Colored Paper (at least one white and black sheet.)**

Before heading outside for this Sunshining activity, lead your learners in a group discussion to get their science gears turning. Use these discussion questions to help stimulate conversation:

- We mainly see a sky full of stars during the night, but what star can you see during the day? (The Sun.)
- Why is the Sun important? (It gives us light, it warms us, it provides Vitamin D, etc. Let students generate as many answers to this question as possible.)
- How does the Sun give us light? (Unlike a light bulb, the Sun does not use electricity, but creates energy with a reaction called nuclear fusion. In nuclear fusion, two small atoms of hydrogen are pushed together to form a bigger atom, helium. Every time this happens, energy is given off as heat and light. This heat and light travels to the Earth from the Sun as different heat and light waves, all invisible to the naked-eye! It takes about 8 minutes for light waves from the Sun to reach the Earth. - Hudson.)
- What are light waves? ("Light waves are forms of moving energy made of tiny microscopic particles called photons. Scientists usually refer to light waves as electromagnetic waves, because they make up what is known as the electromagnetic spectrum. The term 'electromagnetic' means the waves are both electric and magnetic." - Hightower.)

So, the Sun produces heat and light through nuclear fusion. These heat and light waves (sunlight) take about 8 minutes to travel to the Earth, and these waves are invisible to the naked-eye. We can see when the sun lights up a room, but we can't see all of the light waves working together to make it happen — light travels too fast! Now, even though we can't see the light waves, that doesn't mean we can't still use them in a science experiment. We're going to head outside and harness the power of the Sun to see how different colors interact with sunlight!

STEM in the Sun: Outdoor Science Experiments
Mystery Balloon

For this demonstration, you'll need:

- 1 Black and 1 Translucent Balloon
- 1 Magnifying Glass

After reading through the experiment, decide if this activity is something your learners would be able to handle on their own in small groups. The magnifying glass produces a lot of heat, enough to light fires, and it isn't a tool to be trifled with. An instructor-only demonstration is just as effective.

To begin, pose a question to your learners.

- How can you pop a balloon without touching it?

Then, dive into the demonstration.

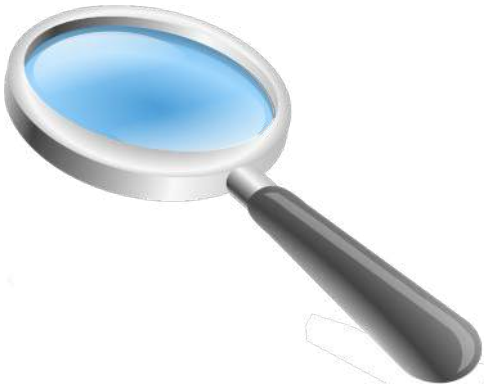
1. Carefully open the white/translucent balloon and use the end of a pen or pencil to push the deflated black balloon partially inside it.
2. Blow up both balloons so the black balloon inflates inside of the white balloon. Make sure to leave a decent amount of room between the two balloons (a few inches should be enough to showcase that there is space between the two balloons).
3. Tie off the balloons.
4. Standing directly in the sun, use the magnifying glass to focus the sunlight into the black balloon.
5. If the outer balloon is translucent enough, the focused sunlight will penetrate through the white balloon and the focal point will beam onto the black balloon.
6. As the focused dot of light heats the black balloon, it will pop.
7. You've just popped a balloon without touching it!

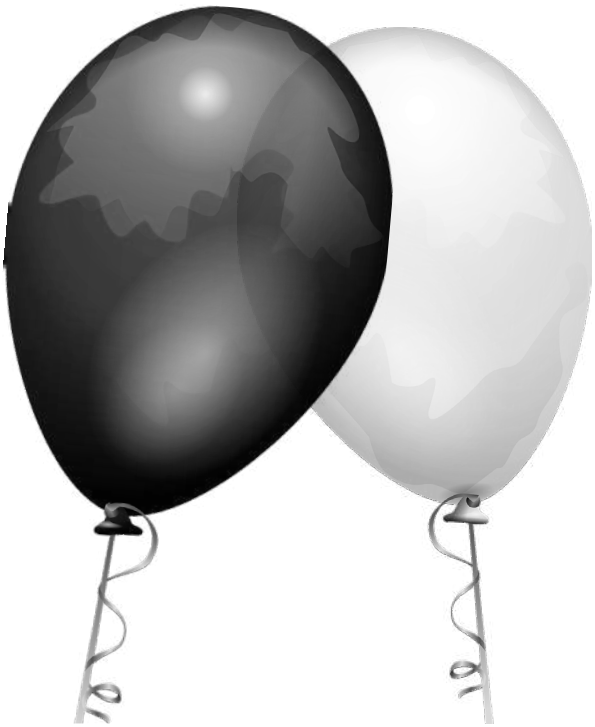
Follow up the demonstration with some discussion questions:

- What is the magnifying glass doing? (It's taking light and heat waves from the entire surface of the lens and focusing them down into one point. With so many waves being restricted into a single dot, the focal point is much much hotter. Hot enough to start a fire. When these waves are spread out across your skin, they don't burn you. But when they are focused on a single area, their powers combine into a super powerful sunbeam. It's just like breathing out of your mouth. If you open your mouth as wide as it will go, the air you exhale is spread throughout a wide area. But if you pucker your lips like you're trying to whistle and exhale again, the air is focused through a smaller area, increasing the air pressure escaping from your mouth. Hold your hand to your mouth and try breathing with an open mouth and closed lips to feel the difference.)

- Why did the black balloon pop but the translucent one didn't? (As the sunlight is being focused on the translucent balloon, the waves are traveling through the balloon instead of running into it. Just like how light moves through a window but not a wall, the focused light is moving through the translucent balloon and smacking into the black one. As the light stays focused on the black balloon, it heats up the black material and breaks microscopic bonds, eventually causing the balloon to pop!)
- What is the difference between the black and the translucent balloon? (The color black is super absorbent! While the translucent balloon allows light to pass through it like a window, the black balloon doesn't. It also isn't reflecting the light away like a mirror would, so the concentrated light has nowhere to go except to be absorbed by the black color!)

To better explain how different colors absorb or reflect light, move onto the next experiment.



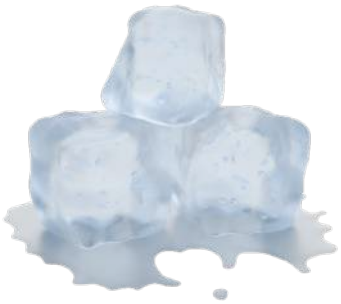


STEM in the Sun: Outdoor Science Experiments
Super Ice Melter

For this demonstration, you'll need:

- Ice Cubes
- Sheets of Colored Paper (at least one black and one white sheet.)

For the Super Ice Melter demonstration, set students up to follow the scientific method. Given what they know from the earlier balloon experiment, **pose this question and allow them to create hypotheses of what will happen.**



- If we place all these colored sheets directly in the sun and put the same sized ice cube in the center of the sheet, which ice cube will melt first?

Set up the experiment as described, with each different colored sheet of paper all in direct sun with an ice cube in the middle. Wait to see which cube melts first.

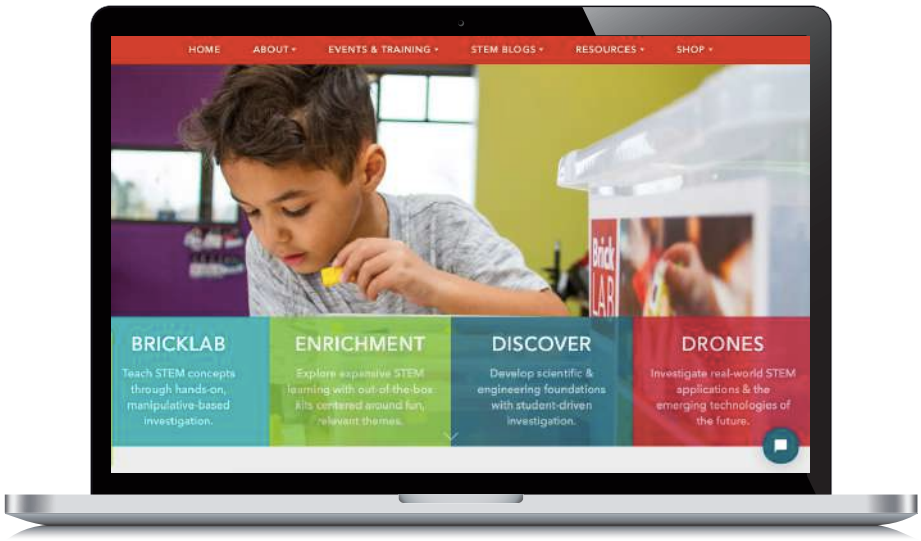
After the experiment has ended, discuss with your learners what hypotheses were supported by the results of the experiment, what happened to the ice and what it means for each color.

- Which ice melted first? (It should have been the ice on top of the black sheet of paper.)
- Why did the ice on the black sheet of paper melt first? (Just like the black balloon, the black sheet of paper absorbs more sunlight than any of the other colors, heating the ice faster than the rest.)
- What happened with the white sheet of paper? (The white paper reflects most of the sunlight, so that ice should melt the slowest!)
- If you were trying to shield yourself from the heat of the sun, what color shirt should you wear? (Light colors like white!)

References:

Hightower, T. (2018). Light Waves Facts: Lesson for Kids. Retrieved June 8, 2018, from https://study.com/academy/lesson/light-waves-facts-lesson-for-kids.html

Hudson, C. (2001). Sunlight, Sun Bright. Retrieved June 8, 2018, from http://www.morehead.unc.edu/Shows/EMS/sunlight.html



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