WestFest

SCIENCE & SUSTAINABILITY

#OSUWestFest

The Ohio State University West Campus Science & Sustainability Festival

2023 Activity Booklet

THE OHIO STATE UNIVERSITY

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STEM Impact collaborative

The 2023 WestFest Activity booklet was made possible through the contributions of the following individuals:

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Solar Safety and Eclipses

Materials:

Solar eclipse glasses	Push pin (in pencil topper)
White card stock	Paper plate
Black construction paper	Penny

Activities:

1. Safe Solar Observing
    a. Eclipse Glasses
    b. Pinhole Imaging
2. Big Sun, Small Moon?

Safe Solar Observing

Instructions for the Safe Use of Eclipse Glasses/Solar Filters/Viewers

- Always inspect your solar filter before use; if scratched, punctured, torn, or otherwise damaged, discard it. Read and follow any instructions printed on or packaged with the filter.
- Always supervise children using solar filters and eclipse glasses.
- If you normally wear eyeglasses, keep them on. Put your eclipse glasses on over them or hold your handheld viewer in front of them.
- Stand still and cover your eyes with your eclipse glasses or solar viewer before looking up at the bright Sun. After looking at the Sun, turn away and remove your filter — do not remove it while looking at the Sun.
- Do not look at the uneclipsed, partially eclipsed, or annularly eclipsed Sun through an unfiltered camera, telescope, binoculars, other optical device, or your eyes.
- Similarly, do not look at the Sun through an unfiltered camera, telescope, binoculars, or any other optical device while using your eclipse glasses or handheld solar viewer in front of your eyes — the concentrated solar rays could damage the filter and enter your eyes, causing serious injury.
- Seek expert advice from an astronomer before using a solar filter with a camera, telescope, binoculars, or any other optical device; note that solar filters must be attached to the front of any telescope, binoculars, camera lens, or other optics.
- Sunglasses are NOT safe to use to view the Sun.

What should I see?

Once your eclipse glasses are over your eyes and you turn toward the Sun, you should see an orange orb in the sky. The Sun is the only thing bright enough in the sky for you

to see with your eclipse glasses on. The Sun is always active but sometimes more than others, at times of high activity there may be numerous dark spots on the Sun called sunspots. When there are large numbers of sunspots, or they are very large themselves, they are easy to see with your unaided eye. If you cannot see anything other than a glowing Sun, you should go to the NASA Solar Dynamics Observatory website (https://sdo.gsfc.nasa.gov/data/) for a current image of the Sun. There is a lot of data there from colors of light our eyes cannot detect but if you search for the HMI Intensitygram, you will see an image of the Sun that is looking at the same layer of the Sun as our eyes. There you can see what sunspots are on the surface of the Sun and give yourself an idea of how easy they might be able to see. You can also learn more about solar astronomy by clicking on “Outreach” and “Outreach Home.”

Pinhole Imaging

Safe Pinhole Imaging

- All of the above safety rules apply to ANY viewing of the Sun. NEVER look at the Sun with your unprotected eye or with any equipment including your pinhole viewer.
- Pinhole imagers allow for safe viewing of the Sun by looking away from the Sun and are ideal for larger groups.

Equipment

- White cardstock (screen)
- Black construction paper (camera)
- Pushpin (pinhole maker)

Instructions (Inspired by NASA JPL - https://www.jpl.nasa.gov/edu/learn/project/how-to-make-a-pinhole-camera/)

1. Find your Solar Viewing equipment and flatten out the sheets of paper. The thick white paper will be your screen that you can set on a table outside or on the ground. We will use the black construction paper to make our pinholes and “image” the Sun on the white paper. You can also use the ground (concrete or something flat and light colored, as your screen.
2. Use the pushpin to make a single hole in the middle of one of the pieces of construction paper, you have two if you want to experiment later with designs, size of hole, or where you want to poke the hole. Push the pin back into the pencil topper so you don’t lose it.
3. Place your white card stock on the ground. Now hold your black construction paper with the hole in it flat. Make sure you can see through the hole. Stand with the Sun behind you and view the projected image on the card stock below! The farther away you hold your camera, the bigger your projected image will be. You may start a few inches away and explore how high you can get the paper and still see the image of the Sun.

4. To make your projection a bit more defined, try putting the bottom piece of card stock in a shadowed area while you hold the other piece in the sunlight.
5. You can experiment with how large or small to make your pinhole. You should be able to see sunspots if there are any on your image. You can also experiment with multiple holes making multiple images of the Sun and creating your own designs.
6. During the 2024 eclipse you will see trees making images of the Sun with the pinholes between their leaves making the ground look like this:

User:Ellywa, CC BY-SA 3.0, via Wikimedia Commons

Big Sun, Small Moon? - https://www.nisenet.org/diy-sun-science-app

The Sun and the Moon are very different sizes, but they appear to be the same size in the sky. This activity will investigate “angular size” or how big things appear based on their distance from us and their physical size. It is using this concept that you have seen people hold mountains, the Sun, or buildings in pictures. This is also the reason we have Solar Eclipses where the Moon blocks some or all of the Sun. 2. Reminder: NEVER look directly at the Sun!

Equipment

- Penny
- Paper plate

Instructions

When you see a Total Solar Eclipse, like the one in Ohio on April 8, 2024, you will notice that the Moon is able to cover the entire Sun. We are using a penny and a plate to investigate why the Sun and Moon look like they're the same size.

1. Grab a penny and the paper plate from the Activity Kit box. Instead of a plate and penny, you can create your own Sun and Moon out of construction paper or use other objects from around your house that are different sizes. You will need a partner to help you with this activity or you may need to tape your plate against a wall during the activity.

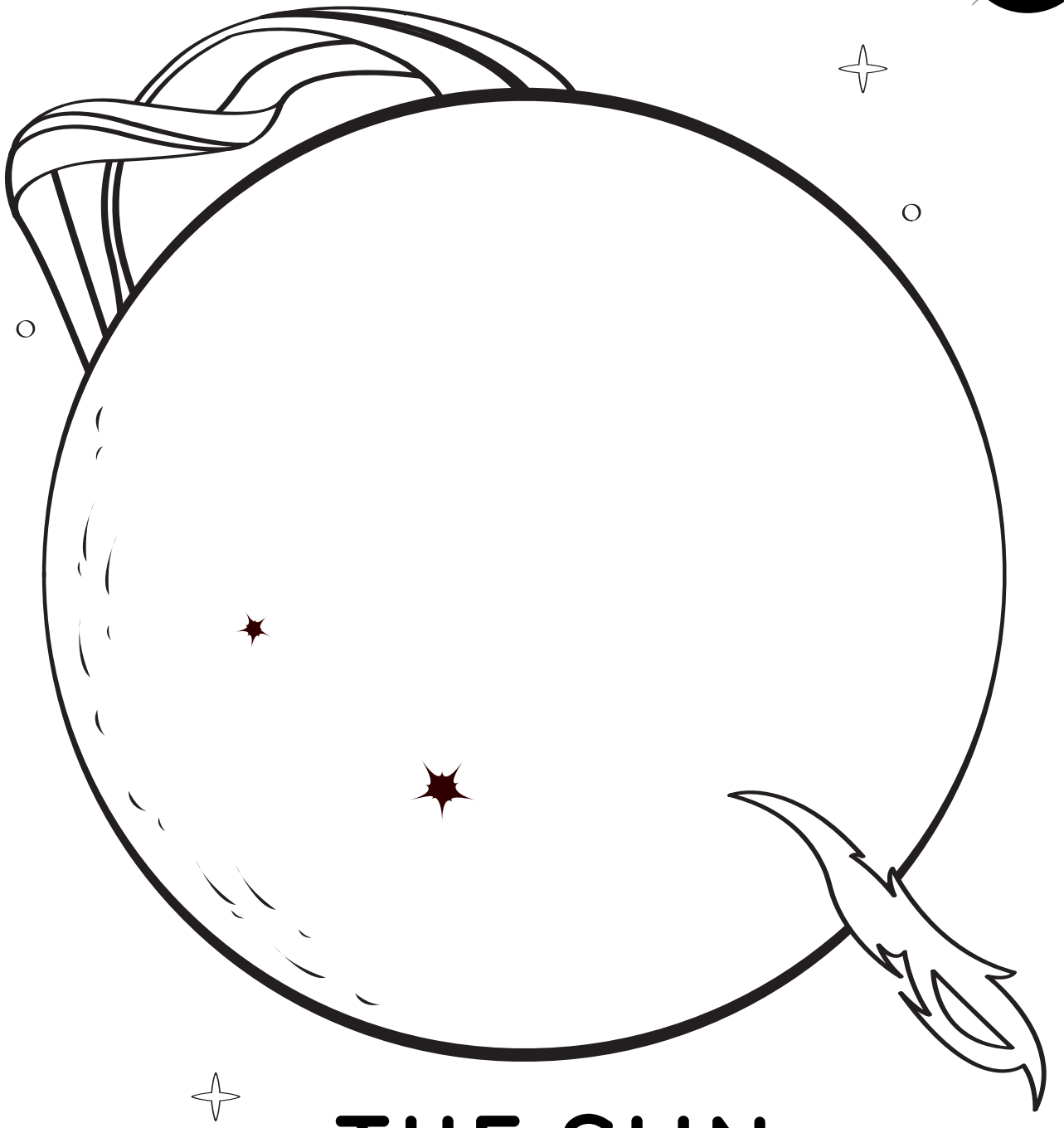
2. Hold both the penny and the plate at arm's length. The plate will look much larger than the penny when they are at the same distance.
3. While you hold the penny at arm's length, have your friend hold the plate and walk backwards away from you four steps. When your friend stops, close one of your eyes and look at both the penny and the plate as though they are next to each other. Does the plate look smaller than before, compared to the coin?
4. Predict how far away your partner will have to walk away from you until the penny and plate appear the same size to you. Then have your partner step backward slowly and safely until the coin and plate look the same size to you. How far away did your partner have to walk? Was your prediction correct?
5. If you have ever seen a picture of a Solar eclipse, you may have noticed that the Moon is able to cover the entire Sun. The Sun is actually 400 times larger than the Moon! So how can these objects appear to be the same size? Objects that are farther away always look smaller, but a small object and a big object can look the same size if they are the right distances away from you. In fact, the Sun is about 400 times further away from Earth than the Moon!
6. Another experiment to do is to close one eye and look at an object far away, like your experiment partner if they step farther away or a distant tree. Use your fingertips to mark the top and bottom of the object like you are pinching it.
7. Now look at an object that looks bigger and again move your fingertips to the top and bottom of the object. Your fingertips should be farther apart. Astronomers do something very similar to this to measure the size of stars and planets as they appear to us. Astronomers call this idea the "angular size" of an object, for the angle that is formed by the size an object appears to us when observing it from Earth.
8. The Sun and Moon have roughly the same angular diameter which is why we have Total Solar Eclipses!!!

This work was supported by NASA under award numbers NNX10AE05G and 80NSSC21M0082. Any opinions, findings, conclusions, or recommendations expressed in these programs are those of the author and do not reflect the views of NASA.

Resources and Sources

- Total Solar Eclipse Safety - https://solarsystem.nasa.gov/eclipses/2024/apr-8-total/safety/
- DIY Sun Science App - https://www.nisenet.org/diy-sun-science-app
- DIY Sun Science - https://lawrencehallofscience.org/science-apps/diy-sun-science/
- How to Make a Pinhole Camera - https://www.jpl.nasa.gov/edu/learn/project/how-to-make-a-pinhole-camera/
- Ohio Eclipse Total Solar Eclipse 2024 - https://eclipse.ohio.gov
- American Astronomical Society Eclipse Page - https://eclipse.aas.org/
- How to View a Solar Eclipse Safely - https://eclipse.aas.org/eye-safety

National Aeronautics and Space Administration

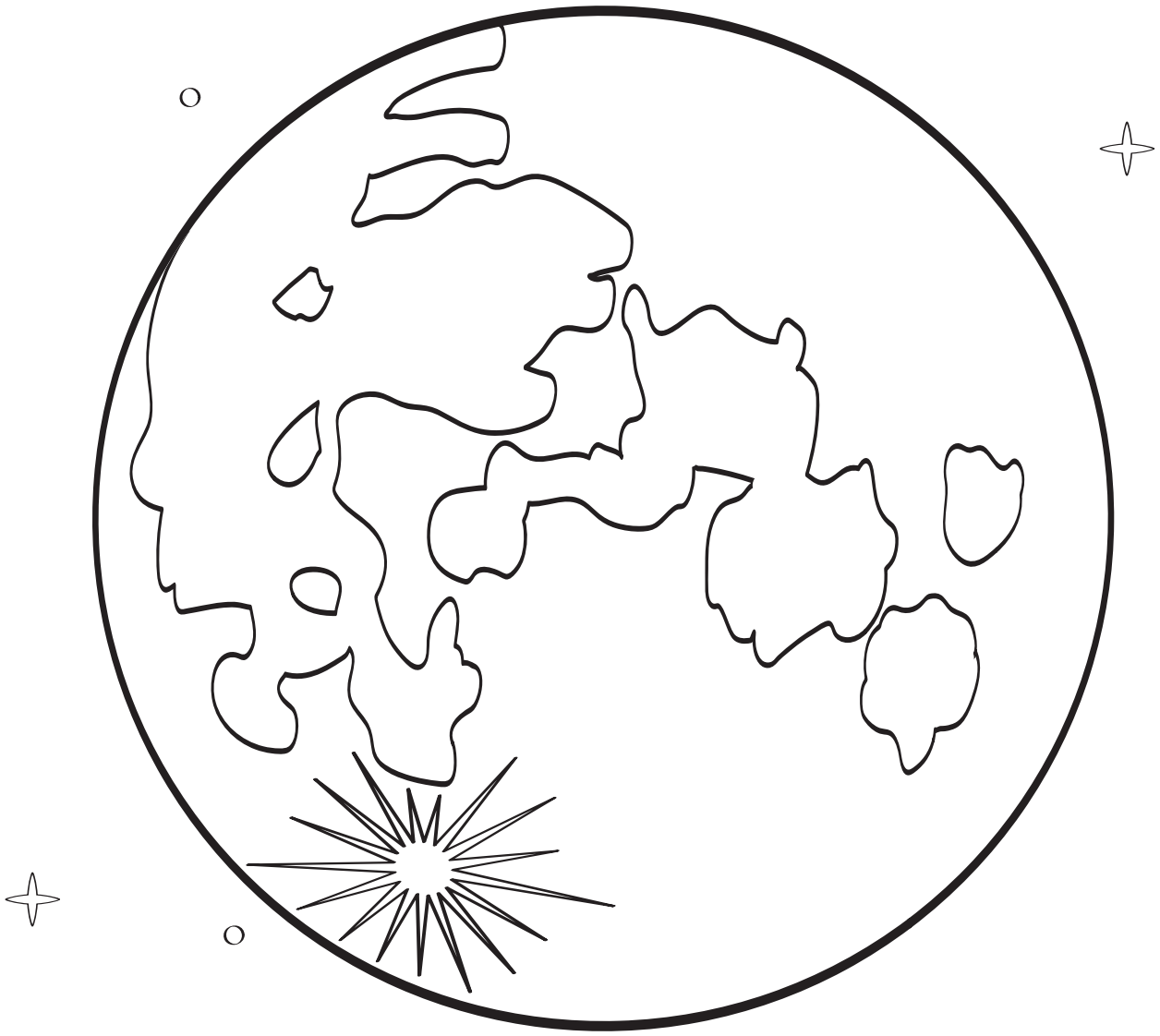


THE SUN

- **It is a 4.5-billion-year-old star at the center of our solar system.**
- **It makes life on Earth possible.**
- **It is a hot glowing ball of hydrogen and helium.**
- **Color: The Sun is all of the colors of the rainbow at once, so it looks white.**

For more information about the Sun visit: spaceplace.nasa.gov

National Aeronautics and Space Administration



THE MOON

- **It is Earth's only natural satellite.**
- **It has a solid, rocky surface cratered from impacts by asteroids, meteorites, and comets.**
- **It is the only place beyond Earth where humans have set foot.**
- **Color: Dark and light gray.**

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For more information about the Moon, visit: spaceplace.nasa.gov

Making Earth-Friendly Paint

Materials:

Water	Paint brush	Orange peel powder
Honey	Watercolor paper	Spinach powder
Baking soda	Stirring stick	Red cabbage powder
Lemon juice	Mixing dish	

Directions:

1. Choose one powder to start with (orange peel, spinach or red cabbage).
2. Put a pinch of powder in your mixing dish.
3. Place a drop of honey on top of the powder.
4. Add 3-5 drops of water.
5. Use the wooden stir stick to mix the ingredients together.
6. Repeat steps 2-5 until you get a thin paste.
7. Take your brush and test a little bit of your paint. Is it the way that you want it?
8. For thicker paint, add another 1-2 drops of honey or a pinch more powder and mix well. For thinner paint, add 1-2 drops of water and mix well.
9. Repeat steps 1-6 for the other two types of powder.
10. Change the pH of your paint mixture to see if it changes color! To do this, add a small pinch of baking soda or a drop of lemon juice and mix well.
11. Experiment! Try changing the recipe and see what happens. Can you make a really dark color, or a lighter one? What happens if you make a painting and then sprinkle baking soda or lemon juice over it?
12. Let your painting dry on a flat surface for 1-2 days or until it is dry to the touch.
13. Compost any leftover ingredients! If you don't want to keep your painting, you can compost that too.

What is pH, and how does it change?

The abbreviation “pH” stands for the “power of hydrogen.” It measures the concentration of hydrogen ions, which are tiny molecules that attach to other molecules in ways that change their shape. They are too small to see, but we can still observe what they do. Changing a molecule’s shape changes its chemical properties and can affect the color we see. If something is really crowded with hydrogen ions, it is acidic and has a low pH number. If something has fewer hydrogen ions, it is alkaline (or basic) and has a high pH number. Lemon juice is acidic, and baking soda is alkaline. Adding either one to your paint will change the ratio of hydrogen ions, turning the pH lower or higher.

Some common acidic things are lemons, tomatoes, vinegar, and sour candy. Some common alkaline (or basic) things are sea water, almonds, avocado, and soap. Red cabbage is a pH indicator, which means we see a color change when the pH gets higher or lower. Many scientists use pH-sensitive materials to measure the pH of a solution, by comparing the color to a pH color indicator chart. For painters, pH is important in helping to create the colors they need.

What is compostable paint?

Composting is the earth’s way of recycling. It is one of the important ways kids can help take care of the environment. Food scraps, dead plants, cardboard, paper, and even some fabrics can be composted at home. Small invertebrates, fungi, and bacteria turn these materials back into nutritious soil that feeds the growth of new plants and animals. Waste that doesn’t get composted or recycled goes to the landfill, where it can’t turn back into healthy soil.

Did you know that most paints are made with a type of plastic? This kind of paint (and anything painted with it) can’t be composted or recycled. Instead, it has to go in the landfill. However, before these paints were invented, people made paint out of compostable ingredients, including plants, clay, oil, and eggs. Most of the famous old paintings you see in museums are actually compostable! Making compostable paint is fun, affordable, and good for the earth.

When you think about the things in your house, consider what will happen to them when they’re no longer needed. Can they be composted or recycled, or will they end up in the landfill? No material can last forever, so it’s important to think about where your things will go after you use them. That way, we can reduce the amount of trash in the world. Using compostable paint is a great way to help take care of the earth!

Want to learn more?

Check out the supplemental document *Biodegradable Paint Recipes* (go.osu.edu/WestFestKits2023) for more recipes and instructions for making your own pigments for oil paints, watercolors, and dyes.

Sources

Expii. (2010). *What is pH? Definition & Overview*. Retrieved from https://www.expii.com/t/what-is-ph-definition-overview-10348

Natural Earth Paint. (2022). *Recipes*. Retrieved from https://naturalearthpaint.com/blog/tag/recipes

USEPA. (2023). *Composting at Home*. Retrieved from https://www.epa.gov/recycle/composting-home

Landslide Game

A landslide is sliding rock or soil from a mountain or a cliff that is caused by a disturbance - such as heavy rainfall, erosion, an earthquake, or a volcanic eruption. The amount of material in the slide could be as small as debris flow (with enough rock to fill a competition swimming pool) or as large as an entire mountainside (the largest recorded landslide happened during the eruption of Mount St. Helens). Landslides behave differently based on the types of rock and soil. This activity simulates landslides using different materials.

Materials

Sand	Clear plastic bowl	Plate (from your kitchen)
Water	Playing card	Pennies
Flour (optional)		

Directions

Mix enough water with the sand so that it holds its shape when packed. To do this, add a tablespoon of water, mix with your hands, and test that the material holds its shape. If needed, add one tablespoon at a time until it packs.

1. Scoop and pack the material into the bowl. Level it off at the top, just like you are going to build a sandcastle.
2. Using the plate, cover the bowl and flip it over so that the bowl is now upside down on top of the plate.
3. Gently lift the bowl so that a mound of sand is left on the plate. Once again, this process is similar to building a sandcastle. The mound represents a hill.
4. Carefully place two pennies on top of the mound in the very center. These pennies represent a house.
5. Take turns cutting the material vertically with the playing card. Make each cut half the distance between the penny and the edge of the mound. Each cut should be 90 degrees from the previous cut.
6. After four cuts, you will have cut completely around the mount. Repeat with process by cutting half the distance between the penny and the new edge of the mound.
7. Once a landslide occurs below the penny, the game ends. Record the number of cuts that you made in the observations table below.
8. Repeat steps 2 to 8 a second time for the sand and record your results.
9. (Optional) Repeat steps 2 to 9 with flour. Use any type of flour in your kitchen - wheat, corn, almond, etc. – but make sure to skip step 1. DO NOT ADD WATER.

Observations

Sand – Trial 1 # of cuts: notes:	**Sand – Trial 2** # of cuts: notes:	**Flour – Trial 1** # of cuts: notes:	**Flour – Trial 2** # of cuts: notes:

Questions

1. Which material is the most likely to “landslide”? What is your evidence?
2. Describe the strategies that worked best when cutting the material to avoid a landslide. Did it ever happen accidentally when you were taking the bowl off the mound or when you bumped the plate?
3. Did the landslide aways happen immediately when the cut was made or was there sometimes a delay or something else that happened first?
4. If you were building a house and you had a choose to build on one of the materials you tested, which would you choose? Why?
5. Do you think that really dry sand or sand that is soaked with water would landslide more or less easily? Try it!

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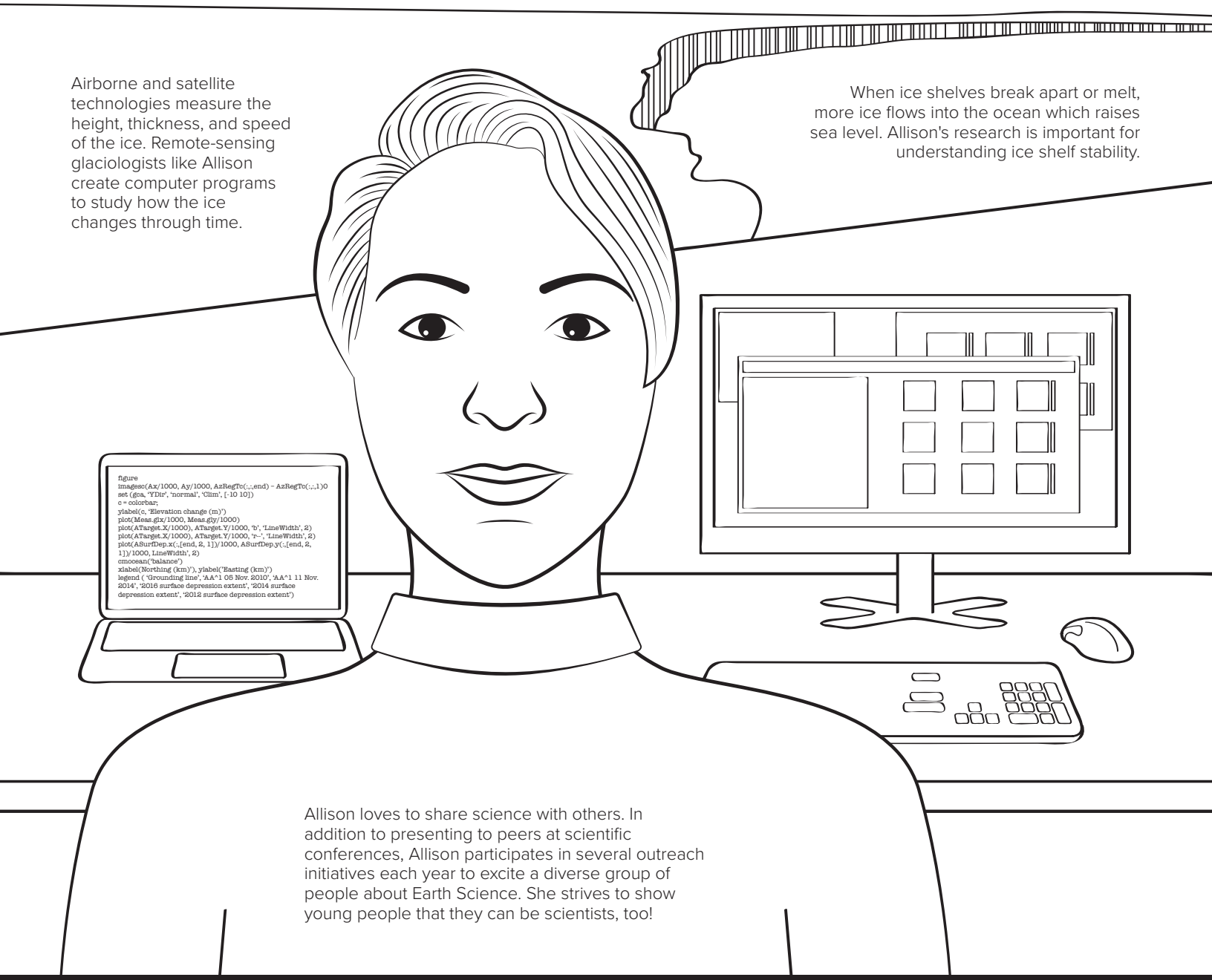
byrd.osu.edu

Allison studies Antarctic ice shelves, the floating ice at the edges of the Antarctic ice sheet. She uses remote sensing data collected from airplanes and satellites and analyzes the data with her computer at the Byrd Center.

Airborne and satellite technologies measure the height, thickness, and speed of the ice. Remote-sensing glaciologists like Allison create computer programs to study how the ice changes through time.

When ice shelves break apart or melt, more ice flows into the ocean which raises sea level. Allison's research is important for understanding ice shelf stability.



Allison loves to share science with others. In addition to presenting to peers at scientific conferences, Allison participates in several outreach initiatives each year to excite a diverse group of people about Earth Science. She strives to show young people that they can be scientists, too!

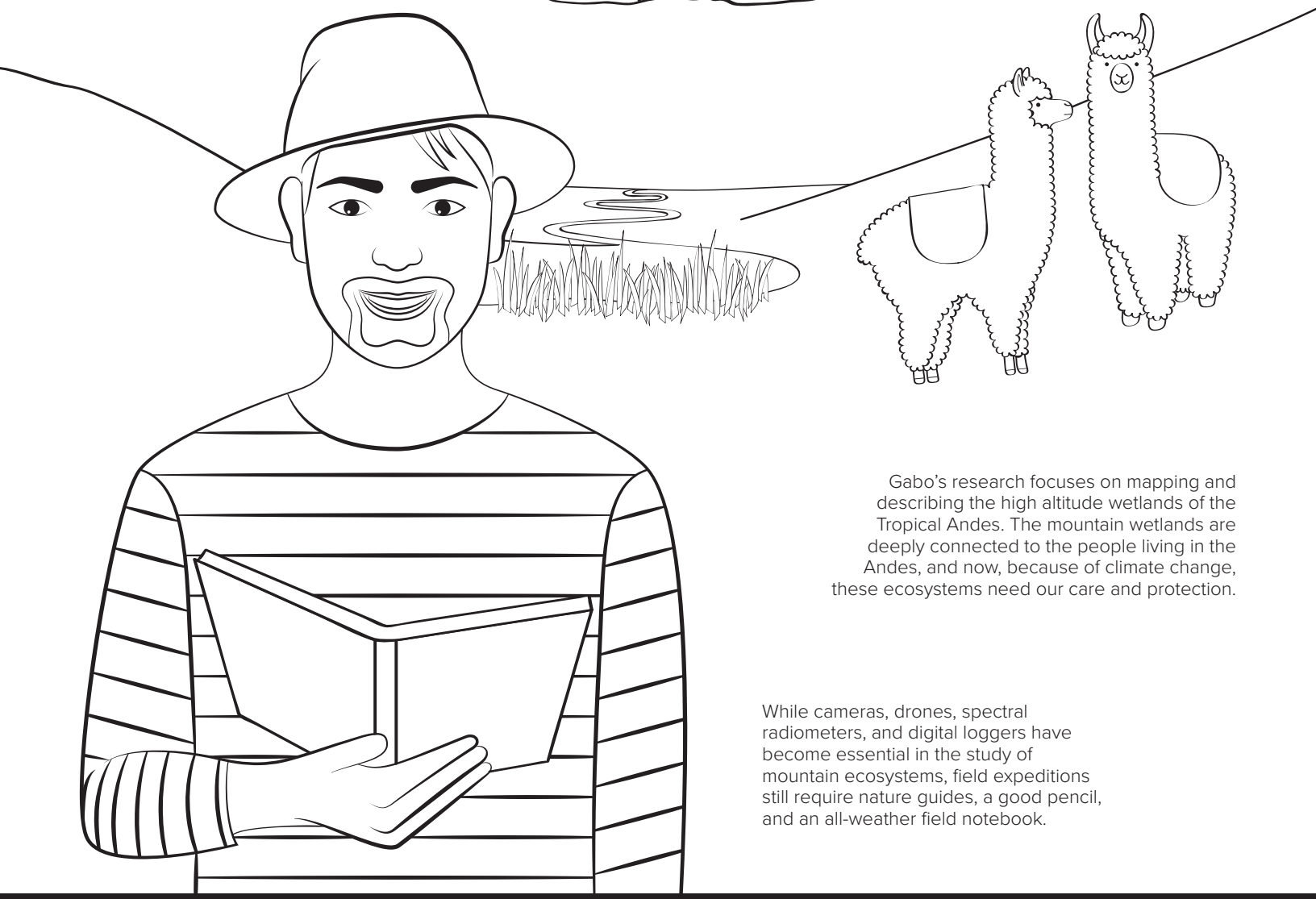
Allison Chartrand

Allison Chartrand is a Ph.D. candidate in the Glacier Dynamics Research Group at Byrd. She grew up in the glacially-formed hills of upstate New York, where she developed a love for frozen and liquid water sports — she once skied on snow and water in the same afternoon! Allison switched from a career in music to a career in science because of her fascination with glaciers, but she still plays French horn when she's not looking at ice.

A comforting solitude surrounds the mountain landscape. Gabo enjoys hearing the quiet murmur of groundwater streams, the chirps of curious birds, and the scents of aromatic plants, all set against the backdrop of majestic, snow-covered mountains.

Geography

Gabo belongs in the mountains, so working at the Byrd Polar and Climate Research Center, only a few meters away from the most important tropical glacier ice core collection in the world, makes him feel at home.



Gabo's research focuses on mapping and describing the high altitude wetlands of the Tropical Andes. The mountain wetlands are deeply connected to the people living in the Andes, and now, because of climate change, these ecosystems need our care and protection.

While cameras, drones, spectral radiometers, and digital loggers have become essential in the study of mountain ecosystems, field expeditions still require nature guides, a good pencil, and an all-weather field notebook.

Gabo Zeballos

Born and raised in Bolivia, Gabo has a deep passion for the natural and cultural history of the Andes and the Amazon. Gabo is interested in social justice and climate change resilience. He likes old maps, the smell of new books, and he would never say no to a basketball game or a chess challenge.

Light Science and Kaleidoscopes

A kaleidoscope is a device that creates beautiful patterns. It's like having a tiny world of shapes and colors inside a tube! It works by using mirrors and reflection. When you look through one end and turn or shake the tube, the mirrors inside reflect the light and repeats its reflection of whatever you're looking at. It's like a never-ending play of colors and shapes, making it a fascinating toy for exploring the wonders of light and reflection!

Materials:

Container of 30 beads	1 ornament ball (2 halves)	tape (not included)
1 sheet mirror board	1 sheet origami paper	
1 cardboard tube	1 glue stick	

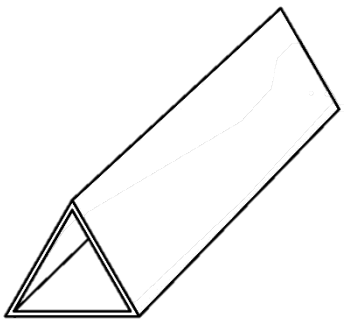
Building the Kaleidoscope

Assembling the Object Chamber (what we want to see)

1. Remove the beads from the container and place in half of an ornament ball
2. Close the ornament ball with the other half
    a. (optional) secure the ornament ball with a piece of tape
3. Push the ornament ball into one side of the cardboard tube opening so it fits snuggly

Assembling the Reflection Tube

4. Fold the mirror board (lengthwise) into thirds with the mirror (reflective side) facing in
    a. Mirror boards are 5 inches by 4 inches; once folded, each section should be roughly 5 inches by 1.3 inches
5. Make a triangular tube (mirror board should face inside the tube) by bringing the long edges together
    a. (optional) secure the tube with a piece of tape on the outside of tube
6. Slide the triangular tube into the cardboard tube on the opposite end of the ornament ball



Decorating the Kaleidoscope

1. Glue down the sheet of origami paper around the cardboard tube
2. OR decorate the cardboard tube as desired

Viewing through the Kaleidoscope

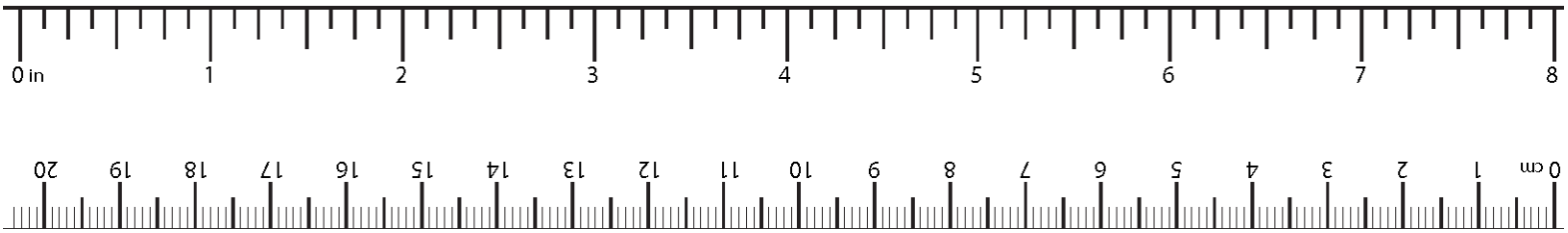
1. Look through the cardboard tube where the mirror board is flush with the opening (opposite end of the ornament ball)
2. Notice the reflections being made on the mirror boards by the beads
3. Rotate or shake the carboard tube so that the beads shifts and moves

Additional Challenges

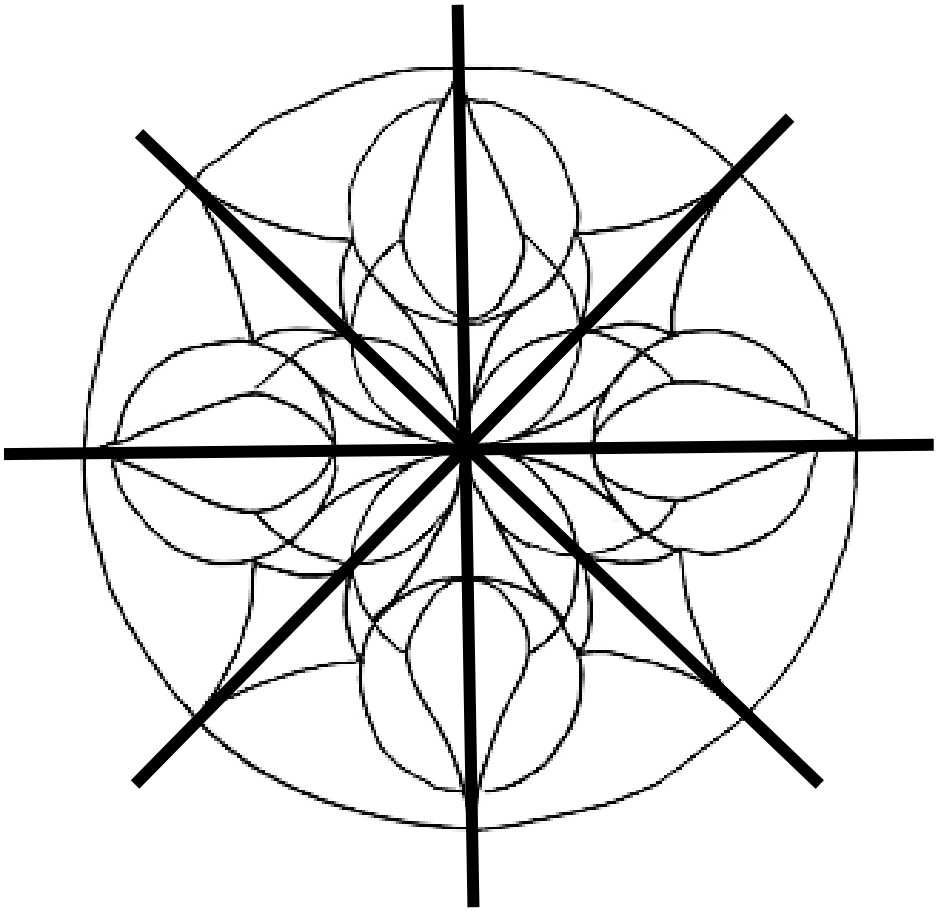
1. Replace the beads with other colorful items found around your house (yarn, buttons, etc.)
2. Change the light source by looking into a window, a lamp, a dark room
3. Fold one of the sections of the mirror back so that only two of the three mirror sections are visible when viewing the beads

Questions for Curious Minds

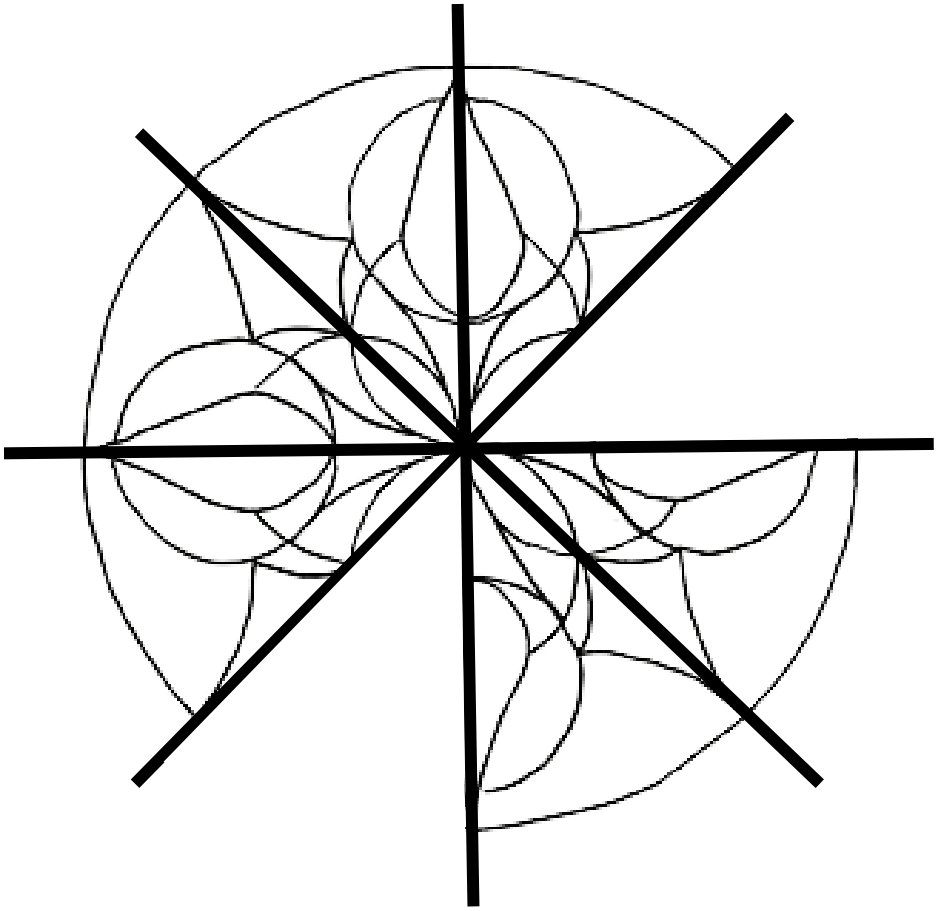
1. What would happen if there's no mirror inside the carboard tube?
2. Is light important in creating the images/pattern inside the kaleidoscope? Why?
3. Why do patterns inside a kaleidoscope look symmetrical (repeat itself)?
4. How does turning/shaking the kaleidoscope tube change the patterns and colors you see?
5. Can you think of any other objects or situations where mirrors and reflection are important?



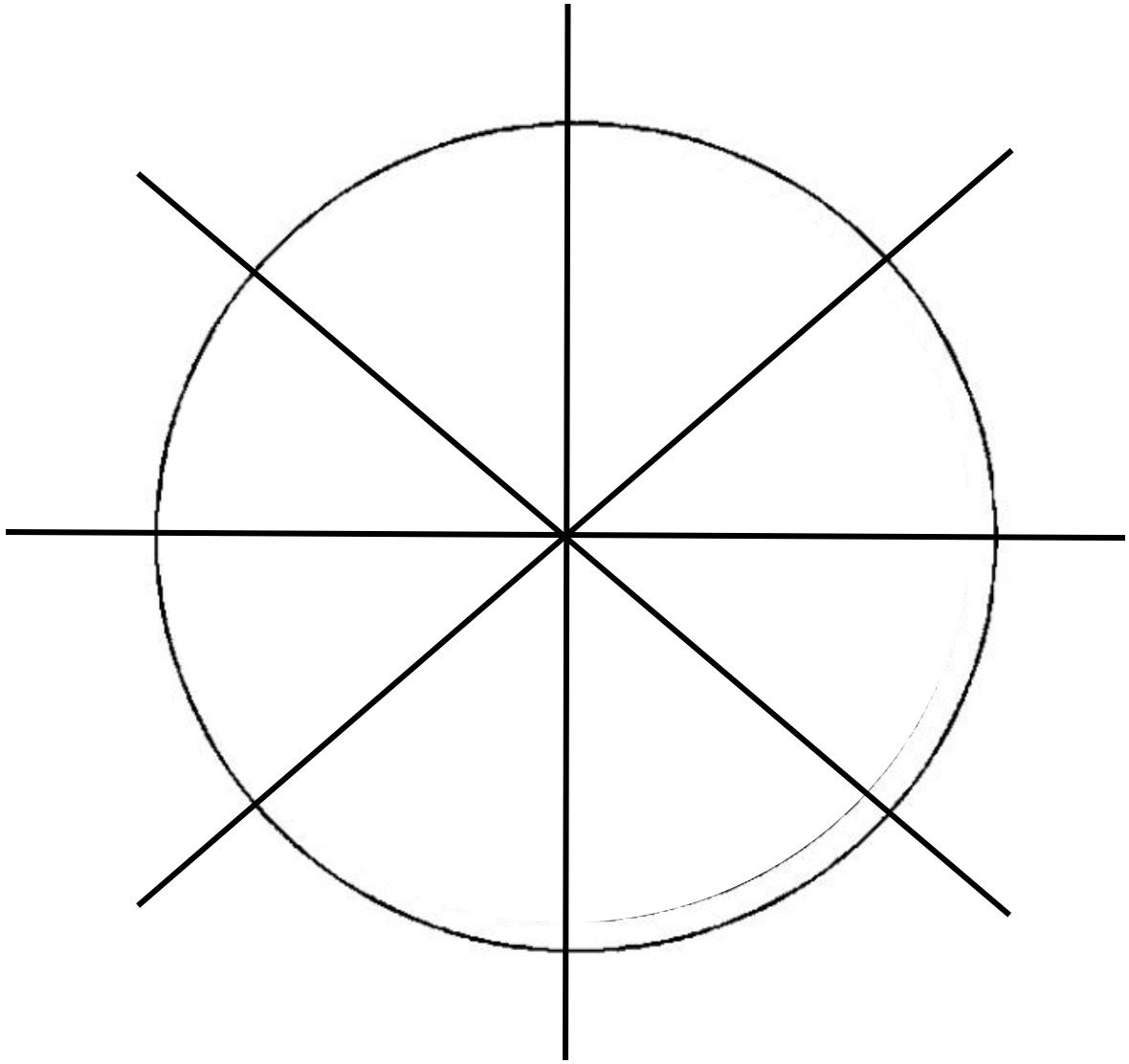
Let’s Make Mandalas!



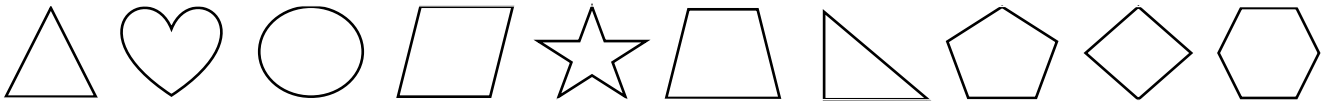
Mandalas have symmetry around their center point. This mandala has been divided into eight equal triangles. Use what you have learned about reflections to color the mandala. *Hint:* A shape should be the same color in every triangle.



Now that you know how to color a mandala, let’s see if you can draw the missing patterns! Use the mandala to reflect the pattern into the two missing triangles! *Hint:* The triangles you draw should match the mandala you colored.



Now it’s time to create and color your own mandala! Use the shapes below to create a pattern that will be reflected in each triangle of the mandala above. Remember, each of your sections should be reflected around the center point.



WestFest

The Ohio State University
Science & Sustainability Festival

A free event featuring family-friendly activities!

Saturday, September 30th, 11:00-3:00 p.m.
West Campus Quad (near Lane Avenue & Kenny Road)

Event Highlights

STEM activity booths

Behind the scenes tours

WestFest prizes

Food trucks

& more!

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