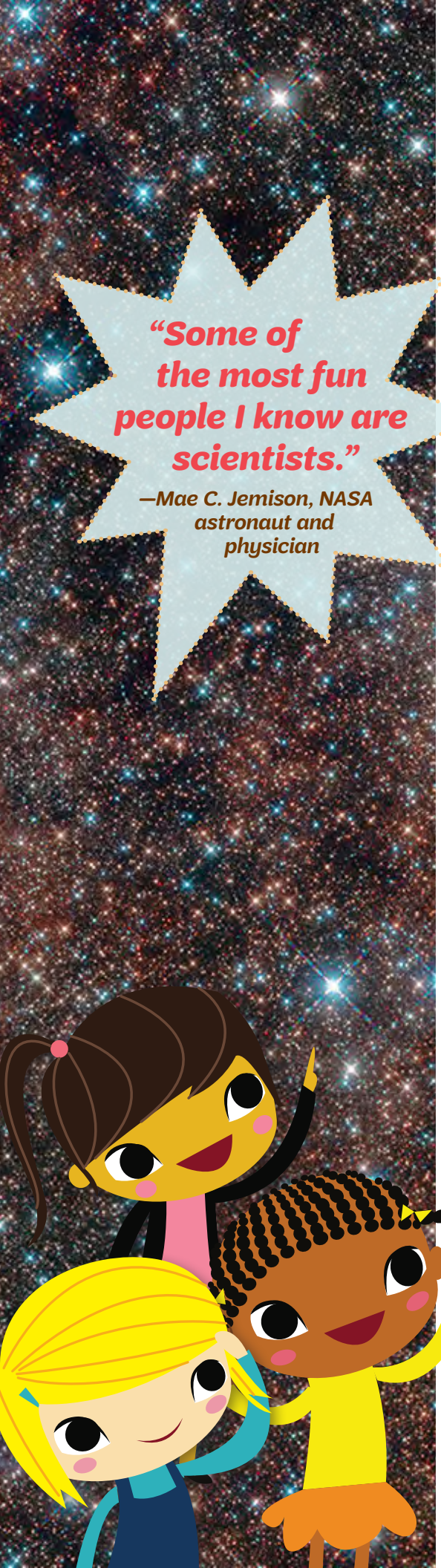
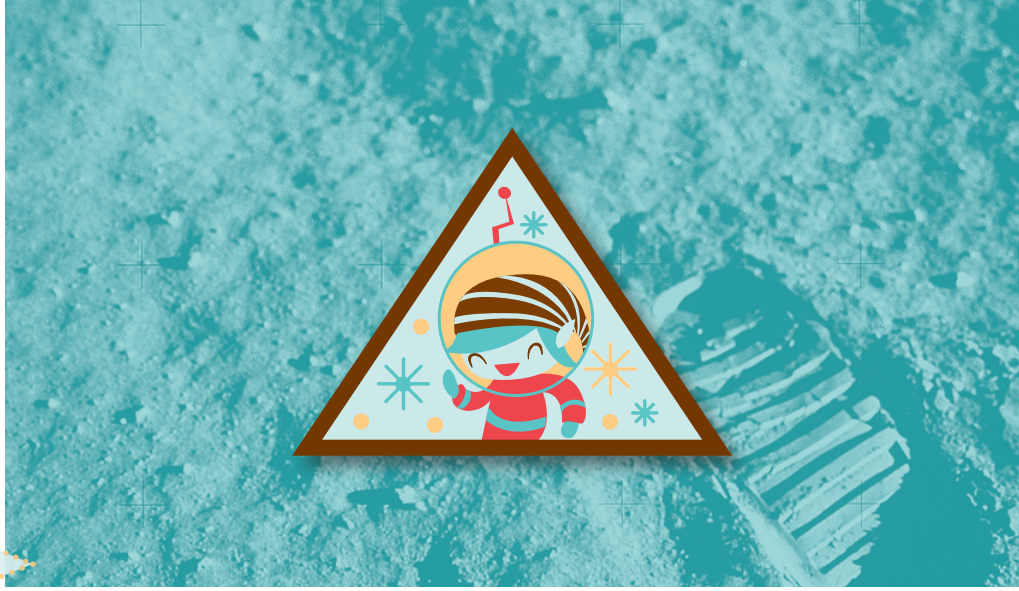


"Some of the most fun people I know are scientists."

—Mae C. Jemison, NASA astronaut and physician



Space Science Adventurer

Whether you've searched for shooting stars or found shapes in the clouds, you've probably already spent some time looking at the sky. Now's your chance to see the sky in a new way—like a space scientist does!

Steps

1. Meet the neighbors
2. See more than before
3. Investigate the Moon
4. Be a stargazer
5. Celebrate and share

Purpose

When I've earned this badge, I will know how to investigate and learn about the Sun, Moon, planets, and stars.

Our Solar System

Did you know that the Sun is a star? It looks much bigger and brighter than the other stars in the sky because it is so much closer to us. Our Solar System is made up of our star and all of the objects that travel—or orbit—around it. The Sun provides light and helps to heat our planet—without it, there would be no life on Earth.

Our Solar System is made up of:

- The Sun
- Eight planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune
- At least five dwarf planets (including Pluto!)
- More than 180 moons orbiting the planets and dwarf planets
- Comets
- Asteroids
- Rocks, ice, and dust

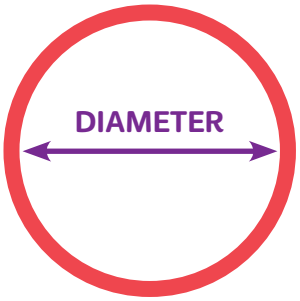
Every step has three choices. Do ONE choice to complete each step. Inspired? Do more!

STEP 1 Meet the neighbors

If you live in a city, your neighbors live close to you. If you're in the country, they're farther away. Think of your home planet—Earth—as part of a neighborhood. Earth's neighborhood is our Solar System, and the other planets are the neighbors. Some planets are close, and some are farther away. Now get to know the neighbors!

CHOICES—DO ONE:

☐ **Create a picture of our planets.** With an adult's help, go online to www.girlscouts.org/SpaceScienceSpacePlaceSolarSystem and look at the different planets in our Solar System. Next, draw eight circles on white paper using the chart with the sizes below. Have an adult help you measure the circles, then color the planets to show what they look like. Cut them out and glue them to paper, in order. You will need multiple pieces of construction paper taped together or a long strip of paper like the kind used in some cash registers. Write the planet names on the paper, and hang up your picture at home!



Planet	Circle diameter in inches	Circle diameter in centimeters
Mercury	0.4	1
Venus	0.9	2.3
Earth	1.0	2.5
Mars	0.5	1.3
Jupiter	11.2	28.4
Saturn	9.5	24.1
Uranus	4.0	10.2
Neptune	3.9	9.9

OR

☐ **Name those planets!** A *mnemonic device* is a complicated name for a fun idea. It's just a way to help you remember something, often in a very silly way. Come up with your own way to remember the names and the order of the planets in our Solar System by writing a sentence, a poem, or a song that uses the first letter of each planet in order. For example,

My **V**ery **E**xcellent **M**ap **J**ust **S**howed **U**s **N**orth.

You can see a list of planet names in the box on the opposite page. Once you've come up with your mnemonic device, teach it to a friend or family member.

OR

☐ **Make a pocket Solar System.** When you look at pictures of our Solar System, it can be hard to imagine how far apart the planets are. You can make a little model, using just a strip of paper and a pencil, that will show the distances between the orbits of the planets in our Solar System. Follow the instructions in the box on the next page to make your pocket-sized Solar System.

Find a Planet in the Sky!

There are five planets—Mercury, Venus, Mars, Jupiter, and Saturn—that you can see in the sky without a telescope. Because they orbit (move around) the Sun, sometimes you can see them in the evening and nighttime sky or early morning sky just before sunrise, and sometimes you can't see them at all. To find out where to see a planet tonight, do what astronomers do. With an adult, look up "This Week's Sky at a Glance" at **www.girlscouts.org/SpaceScienceSkyAtAGlance**. Happy planet hunting!

Make a Pocket Solar System

You'll need:

Long paper strip, like the kind found in some cash registers, with the ends cut or folded so they're straight. The paper should be about the length of your body, from head to toe.

Pencil or pen

1. Label one end of the paper "Sun" and the other end "dwarf planets."
2. Fold the paper in half and crease it, then open it up again and place a mark at the crease. This point is "Uranus." Write the name near the mark.
3. Now fold the paper back in half, then in half again. Unfold and lay it flat. Label the crease closest to the Sun as "Saturn." The crease closest to "dwarf planets" is "Neptune."
4. Fold the Sun to Saturn and crease it. Label this new crease "Jupiter."
5. Fold the Sun to Jupiter. Unfold it and label this crease "asteroid belt."*
6. Now fold the Sun to the asteroid belt. Unfold it and label the crease "Mars." See how the "neighbors" are getting closer together? There are three more planets left, so you may need to write smaller.
7. Fold the Sun to Mars. Keep it folded, and fold that section in half.
8. Unfold the paper. You should have three new creases.
9. Label the crease closest to Mars "Earth."
10. Label the middle crease "Venus."
11. Label the crease closest to the Sun "Mercury."
12. Take a step back and look at your Pocket Solar System. Does anything surprise you? Are some planets closer or farther away from each other than you thought they'd be?

***Asteroids are very small to very large rocks that orbit the Sun. There are millions of asteroids in the asteroid belt.**

"Pocket Solar System" is courtesy of the Astronomical Society of the Pacific.

STEP 2

See more than before

The objects in our Solar System—and beyond—are far away. In order to look at them in more detail, space scientists need to use tools. You can use some of these tools too—give it a try!

CHOICES—DO ONE:

- [ ] **Build a telescope.** A telescope is a tool used by space scientists to see things that are far away. One famous telescope is the Hubble Space Telescope, which was launched into space in 1990. It still orbits about 300 miles above the Earth, sending back information to space scientists. Most telescopes are not that powerful, of course. Talk to an adult about using a kit to make a small telescope of your own. Then take your telescope outside to get a closer look at the Moon and stars. What can you see through your telescope?

OR

- [ ] **Use a telescope or binoculars.** There are places called observatories where you can see a telescope in action—and look through one yourself. Telescopes allow us to see far more than our eyes alone. If you'd like to see through a telescope yourself, talk to an adult about taking a trip to an observatory or finding a local astronomy club. If you aren't able to get to a place with a telescope, ask an adult if they know anyone who has binoculars that you could look through. Ask an adult to help you take the binoculars outside and look at the Moon through them!

OR

- [ ] **See the stars with a computer.** Space scientists use tools like telescopes to view the night sky, and they use computers too! Team up with an adult and visit www.girlscouts.org/SpaceScienceEarthSky. What can you see? Are there any planets out tonight? What does the sky look like in other parts of the world?

Binoculars

Telescope

The Night Sky Network

The Night Sky Network connects you with astronomy clubs across the United States dedicated to sharing the night sky. Explore events hosted by your local astronomy club here: www.girlscouts.org/SpaceScienceNSN

STEP 3 Investigate the Moon

Have you ever noticed that the Moon looks different at different times of the month? It doesn't actually change shape, but it looks different. As the Moon orbits (or moves around) the Earth, the Sun lights different parts of it. This makes the Moon look like it is changing shape. These shapes are called the "phases of the Moon." Learn more about the Moon in this step!

CHOICES—DO ONE:

☐ **Model the Moon.** You can see how the Earth, Moon, and Sun work together to make the Moon look different at different times of the month. All you'll need is a light-colored ball (a high-density craft Styrofoam ball 3 inches or larger works best), a pencil, and a lamp with a light bulb—with the shade removed. (Don't get too close to it—*the bulb may get hot!*). Use a pencil to poke a hole into the "Moon ball" and then hold it out in front of you like a big lollipop. Make the room dark except for the Sun lamp. Take a few steps back and face the lamp with the Moon ball at arm's length, holding it just below the bulb—this is a **New Moon**, when all the Sun's light is on the other side of the Moon (your head is the Earth). With your arm out in front of you, turn left (counterclockwise) until you start to see the lighted side of the Moon. If you're not sure which way is left and right, ask an adult. As the Moon ball brightens, what shape do you see? Turn all the way around, slowly, and see if you can find all the phases of the Moon. Team up with an adult and give it a try.

"Model the Moon" activity is based on curriculum developed by The Franklin Institute supported by NSF.

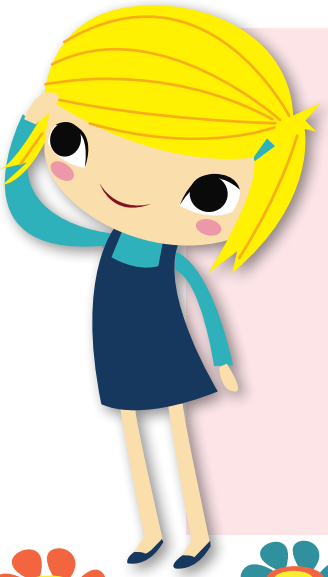
Predict the Order

OR

☐ **Make a Moon art project.** You've probably looked at the Moon at night lots of times, but have you ever seen it during the day? It doesn't look as bright against a bright blue sky, but you can often see it in the daytime! Make an art project showing the Moon during the day or at night. Use any art form you'd like—be sure to include the shadows and textures you see when you look at the Moon! Look at the pictures of the Moon phases in the box on the right-hand side of this page—which phase do you think your Moon is in?

OR

☐ **Meet the Moon phases.** The Moon goes through all of its phases in about a month. Look at the box on the right-hand side of this page—the phases are jumbled up. Predict their order in the circles, starting with the phase you think the Moon is in tonight. Then, test your prediction! Look at the Moon in the sky for up to four weeks and draw the shapes you see—be sure to include the date. You could observe once or twice a week, during the day or night—whatever works for your family. When you're finished, compare what you saw to your predictions. Were you correct? What did you learn? It will take a little while, but it will be worth it!



FOR MORE FUN: Make round chocolate cookies or ginger snaps and frost them to look like different phases of the Moon, or you could open chocolate sandwich cookies and scrape away the right amount of filling to make the different Moon phases. Yum!

STEP 4

Be a stargazer

For as long as people have been looking at the sky, they've noticed shapes and patterns in the stars. Groups of stars that form shapes are called constellations. Around the world, many people have created different constellations and stories about them. Today, astronomers have agreed to use the same 88 constellations to make maps of the sky for science.

CHOICES—DO ONE:

- [ ] **Make a constellation viewer.** Sometimes it can be difficult to find constellations in the sky, especially if you live in an area with lots of city lights. The more lights there are, the harder it is to see the stars. Team up with an adult and make a constellation viewer out of a potato chip can. Choose a constellation, then lay a print out of your star pattern on top of a black construction paper circle (3 inches across). Put your papers on layers of cardboard (to protect the table). Use a push pin to make holes where the stars are and then place the black circle inside the plastic lid so that the "up side" will face the inside of the can. Have an adult hammer a hole into the metal end of a potato chip can and then put the lid on. Hold the can up to light—what do you see?

OR

- [ ] **Tell a star story.** Before people could read or use technology to communicate, they told stories. Stories about the constellations helped share information. Sometimes it was practical information, like how to use the constellations for directions. Other stories gave examples of values—like honesty or bravery—that people thought were important. Do you know one of these stories? Can you find one? After you read it, come up with your own star story about a constellation. Then share your story with your family or friends—you could draw pictures, sing a song, write a poem, or act out your story in a skit.

OR

- [ ] **Change a constellation.** Many constellations were named for animals because long ago people thought the star patterns looked like animals. You can see two of these constellations on this page. They are Ursa Major (The Great Bear) and Taurus (The Bull). The pictures show the stars with the imaginary animal drawn around them. Now it's your turn! Create your own constellation with the same stars. It doesn't have to be an animal—you can make it anything you like! Draw or paint your constellation. Then share it with your family and friends.

"Make a constellation viewer" and "Change a constellation" activities are courtesy of Larry Lebofsky.

The International Astronomical Union, an organization of scientists from around the world, sets guidelines for naming planets, moons, and other objects.

Meet Some Space Scientists

Sally Ride was born in Los Angeles, California. Growing up, she loved science and sports—her parents encouraged her to pursue both. While Sally was in college, she replied to an ad in the school newspaper asking women to apply for NASA's astronaut program. Six women were picked—and Sally was one of them! In 1983, Sally Ride boldly went where no American woman had gone before: space. As a mission specialist on the Space Shuttle Challenger, Sally became the first woman from the United States to fly into space. On the Challenger, her job was to work the Space Shuttle's robotic arm. The arm was used to help put satellites into space. Sally thought her experience with sports helped her hand-eye coordination, which was important for working the arm. Later in her career she founded Sally Ride Science, a company that encourages children's interest in science, technology, and math. She passed away in 2012.

Victoria Garcia grew up in Miami, Florida. She is the daughter of Cuban immigrants and was born deaf. As a child, she loved solving problems and fixing things. She even made her own hoverboard one summer—out of plywood and a vacuum cleaner! Today, she works for NASA as an aerospace engineer, helping to design tools that make it safer and more comfortable for astronauts to live and work in space. "In life, there are two main things that I have learned," Victoria says. "One is to never let other people's expectations define you. People had low expectations of me with the sole basis that I cannot hear. Another lesson that I learned is that there will always be barriers in life. How you deal with the barriers make you who you are."

STEP

5 Celebrate and share

Now that you've learned about the Solar System and the stars, it's time to celebrate and share what you've learned! Whether you hold a space-themed party or share your favorite project with younger Girl Scouts, take some time to create a fun end-of-badge memory of your experiences.

CHOICES—DO ONE:

- [ ] **Hold a space party.** If you did this badge with a group of Girl Scout friends, get together with them to talk about what you learned, share any art projects you made, and have fun looking at the stars and planets together. You could make a "space snack," design a space hat covered in star and planet shapes, or—if you're feeling adventurous—have a sleepover under the stars.

OR

- [ ] **Share with Daisies.** What was your favorite part of earning this badge? What was the most interesting thing you learned? Get together with some of the littlest Girl Scouts—Daisies—to make your favorite project from this badge or share a star story. If you don't know any Daisies, that's ok! Any younger girls will do.

FOR MORE FUN: Make space-themed SWAPS (**S**pecial **W**hatchamacallits **A**ffectionately **P**inned **S**omewhere) with them.

OR

- [ ] **Attend a stargazing event.** Talk to an adult about attending an event with the Night Sky Network as an end-of-badge celebration with your family or friends. Share with the amateur astronomer the different projects you worked on in this badge, and ask them any questions you might have.

Moon Cakes

You will need:

- 1 rice cake
- Nut butter or cream cheese
- Small round cereal
- Banana slices

1. Spread cream cheese or nut butter on the rice cake.

2. Cover the top with banana slices, cereal, or anything else that sounds tasty. Does your snack look like the surface of the Moon?

Going on a Journey? Do some badge work along the way.

Brownies learn about far away stars and the patterns they make in the night sky, called constellations. Just like the stars in the sky, each Brownie's family is unique. Keep this in mind as you complete your Making a Family Star in meeting 1 of *Brownie Quest*.

Now that I've earned this badge, I can give service by:

- Showing my family how the Earth, Moon, and Sun work together
- Sharing how to use tools to view the night sky
- Teaching a Daisy what I learned about the neighbors in our Solar System

I'm inspired to:

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