

## Junior Space Science Investigator- STEM

**Goal:** I will learn about how far away the Sun, Moon, and planets are from Earth, why we have seasons, how old I am on other planets, drive a Mars rover and explore the stars.

### Notes:

*To complete the entire badge, gather these supplies ahead of time:*

- Paper or notebook
- Pen or pencil
- Flour
- Salt
- Water
- Large mixing bowl
- Sharpie marker
- Paint
- Paintbrush
- A ball
- String
- Envelope
- Cardboard
- Toilet Paper Tubes, Cereal Boxes, Shoe Box or other cardboard shapes
- Tin Foil
- Scissors

*Vocabulary Words to Look Up:*

*Orbit*

*Light Year*

*Solar System*

*NASA*

*Planet*

*Star*

*Constellation*

*Scientist*

Before we dive in, take a look at this video by Girl Scout Alum Christina Koch. She talks a little bit about what it's like to live in space and some of the things she's learned while studying science in space:

<https://www.youtube.com/watch?v=9KGKlp3J-N4>

## **Step 1: Model the Solar System**

*What I'll do:*

Find out the size of each of the planets in our Solar System.

*What I'll need:*

- Flour
- Salt
- Water
- Large mixing bowl
- Sharpie marker
- Paint
- Paintbrush
- 8 labels made of paper, index cards, etc.

*How I'll do it:*

Do you know the size of each of the planets in our solar system? Which ones are the biggest and which ones are the smallest? Write the planets down in order from biggest to smallest before you begin this activity. (Here they are in alphabetical order: Earth, Jupiter, Mars, Mercury, Neptune, Saturn, Uranus, and Venus.) When you are done, you will be able to see if your guess was correct. Feel free to ask family members to make guesses too.

Next, follow this simple recipe to make salt dough.

### *Salt Dough Recipe*

2 cups of flour

½ cup of salt

¾ cup of lukewarm water

Mix all of the ingredients in a large bowl to make the dough.

To make a to-scale model, divide your dough in the following way:

- 1) Make a label for each planet.
- 2) Divide the entire ball of dough into 5 equal parts. Put three of these parts on the label for Jupiter. Put 1 part on the label for Saturn.
- 3) Cut the remaining piece into 10 equal parts. Put 7 of these parts on the label for Saturn. Put 1 part on the Neptune label and 1 part on the Uranus label.
- 4) Cut the remaining piece left over from Step 3 into 10 more equal parts. Put two of these parts on the Saturn pile. Put 4 pieces on the Uranus pile. Put 3 parts on the Neptune pile.

- 5) Cut the remaining piece from Step 4 into 10 more equal parts. Add 5 of these parts to the Saturn pile. Put 2 of these parts on the Earth label. Put 2 parts on the Venus label.
- 6) Cut the remaining piece from Step 5 into 10 more equal parts. Add 4 of these parts to the Earth pile. Add 1 part to the Saturn pile. Put 1 part on the Mercury label. Put 3 parts on the Mars label.
- 7) Cut the last remaining piece into 5 equal parts. Add 2 of these parts to the Mars pile, and the last 3 parts to the Mercury pile.
- 8) Roll each pile of pieces into an even sphere representing the planet. You may want to take a Sharpie marker and mark each planet so you can remember which one is which.
- 9) Salt dough can be left to air dry for a few days or can be baked in the oven. Preheat the oven to 200 degrees and bake for an hour. Check periodically to make sure they are drying, not turning brown. Smaller planets may need less time in the oven than the larger planets.
- 10) When the planets are dry, paint them. Here is an article from Universe Today that tells you about the surface of each planet and what color it looks like from space.  
<https://www.universetoday.com/33642/the-colors-of-the-planets/>

## **Step 2: Circle the Sun**

*What I'll do:*

I will learn how long it takes the Earth to orbit the Sun, and how old I am on other planets.

*What I'll need:*

- Paper
- Pen or Pencil

*How I'll do it:*

Each year in our calendar represents one orbit of Earth around the sun. It takes the earth 365.25 days to make it all the way, which is why every four years we have an extra day called Leap Day, to make up for this extra .25 days. (2020 is a Leap Year! Leap Day was February 29<sup>th</sup>.)

Take a look at this time-lapse video of Earth taken over a year. It was taken by the DSCOVR spacecraft in 2015-2016. The article has some great information about things to watch for during the time-lapse. You can see the tilt of the earth while it rotates, making the seasons change. You can also see a lunar eclipse partway through the year.

<https://slate.com/technology/2016/07/epic-time-lapse-animation-of-the-earth-spinning-over-a-single-year.html>

A year for each planet is different, based on how much time it takes to orbit the sun once. The closer the planet is to the sun, the shorter the orbit, and therefore the shorter the year. The planets that are farther from the sun have longer orbits, and therefore longer years.

Here's an article about how long a year is on each planet in our solar system:

<https://spaceplace.nasa.gov/years-on-other-planets/en/>

Your birthday happens once a year here on Earth. Everyone becomes a year older on their birthday each year. But what if you didn't live on Earth? How old would you be on Mars? On Jupiter? Use this calculator to find out!

<https://www.exploratorium.edu/ronh/age/>

Pick an age of at least 10 years in the future and write yourself a letter. What do you expect to be different by the time you are that old? What will you be doing? Where will you live? What will have changed in the world? Write it all down in your letter and seal it in an envelope. Ask a parent to help you tuck it away to open in the future.

### **Step 3: Discover the Stars**

*What I'll do:*

I will learn how far away the stars are from Earth and participate in a Night Sky Scavenger Hunt.

*What I'll need:*

- Paper
- Pen or Pencil

*How I'll do it:*

Do you know what the closest object to Earth in space is? Check out this monster graphic that illustrates to scale how far away things are in space.

<https://www.bbc.com/future/article/20120321-how-big-is-space?referer=https%3A%2F%2Fwww.sciencelearn.org.nz%2Fresources%2F1624-distances-in-space>

The moral of the story is that things that seem close in the sky aren't. Even though the stars in the sky look really bright and close, they are very far away.

To see more, plan a Night Sky Scavenger Hunt with your family. Find a spot outside that is good for stargazing, or use a smartphone app such as SkyView (iOS and Android), Night Sky (iOS), SkySafari (iOS and Android), or Sky Map (Android and Kindle).

If you are headed outside, you can also make a Star Wheel to help you find what you are looking for. Follow these simple directions (you will need access to a printer) to create your own tool.

<https://skyandtelescope.org/astronomy-resources/make-a-star-wheel/>

Once you've made your plan, make up your own scavenger hunt game for everyone joining you. Feel free to add some of these ideas to your list:

- Ursa Major (otherwise known as The Big Dipper constellation)
- The brightest star in the sky and what constellation it's in
- Taurus (the Bull)
- The red giant- Aldebaran
- The moon. Draw its current phase.

- Canis Major (the Large Dog)
- Cygnus (the Swan). The eye of the constellation is the double star Cygnus, which can be seen through a telescope.
- Pegasus (the Flying Horse)
- Orion (the Hunter). His right shoulder is the super-giant Betelgeuse. It is 640 light-years away!
- Leo (the Lion)
- Scorpius (the Scorpion)
- A planet. What color is it? What's its name?

If you can't get outside (or you would just like a closer look at the sky), another option is to use the MicroObservatory to take pictures of specific stars and planets in the sky and have them sent to your email. Here is a great webinar that teaches you everything you need to know. You will need to have an email address to send the photos to once the telescope takes your photo.

<https://www.youtube.com/watch?v=WADvgNMSoiQ&feature=youtu.be>

Dive in Deeper:

Find out more about your favorite constellations. There are 88 constellations in the night sky. Here's a great video to introduce you to constellations:

<https://www.youtube.com/watch?v=MZffhapfOgg>

This article that explains a bit more about the origins of the current constellations:

<https://www.space.com/15486-night-sky-constellations-names.html>

How many of these stories do you know? Here's a great resource for you to read a short version of the stories of the constellations. If you enjoy these, try researching the longer versions!

<http://www.tcoe.org/scicon/instructionalguide/constellations.pdf>

As you are reading these constellation stories, do any characters from your favorite books come to mind? Many authors name characters in their stories after constellations. See if you can name any.

If you like Harry Potter, here's a list of the characters author JK Rowling named after stars:

<https://www.wizardingworld.com/features/the-harry-potter-characters-named-after-constellations>

#### **Step 4: Use Tools to Explore**

*What I'll do:*

I will drive the Mars Rover, Curiosity, on the surface of Mars and design my own rover.

*What I'll need:*

- Cardboard
- Toilet Paper Tubes, Cereal Boxes, Shoe Box or other cardboard shapes
- Tin Foil

- Scissors

(These are just suggestions. Feel free to get creative!)

*How I'll do it:*

NASA sent the rover, Curiosity, to Mars on November 26, 2011. It landed on the surface of Mars on August 5, 2012. Its mission is to find out if Mars has or ever did have the right conditions to support life.

Try driving Curiosity over the surface of Mars here:

<https://accessmars.withgoogle.com/>

What do you notice about Mars? How is it different from Earth? How is it the same?

To find out more about Curiosity's latest missions, follow NASA's website here:

<https://mars.nasa.gov/msl/home/>

If you were to design the next rover, what would its mission be? What tools would it need to accomplish that mission? Use materials you find around your house to design a 3D model of your rover or draw it on paper. Share your design with your family and your troop!

### **Step 5: Share Your Sky**

*What I'll do:*

I'll share what I've learned during my research with my family and friends.

*What I'll need:*

- A group of family members to share my research (could be via Zoom or Skype or Facetime)

*How I'll do it:*

An important part of being a scientist is sharing your findings. Scientists share their research with other scientists, but also teach others what they've learned. Now it's your turn!

Find a way to share your research with someone else. You could make a star show for your family, or create a video or an activity about space and what you've learned to share with a younger troop or the rest of your Girl Scout troop. Show off your to-scale model of the solar system, show them how to drive Curiosity on the surface of Mars, and make a handout of your scavenger hunt they can use on their own. Get creative and have fun sharing everything you've learned on your mission!

### **Where I Can Purchase the Badge:**

Once you have shared your research, have an adult visit the Girl Scout store online to purchase the Junior Space Science Investigator badge. Congratulations!

<https://www.girlscoutshop.com/Junior-Space-Science-Investigator-Badge>