



2018 Earth & Space **Activity Overview**

[This slide presentation provides an overview of the Explore Science: Earth and Space Toolkit, and can be used to introduce staff and volunteers to the project and its educational materials. You can customize this training presentation to fit your organization and programming.]



Presentation

- Explore Science: Earth & Space
- Our Event
- Toolkit of Activities
- Leading the Activities
- Questions?

Welcome to the Explore Science: Earth & Space event training! In this presentation, we're going to go through quite a bit of information related to our local event and the national Explore Science: Earth & Space project.

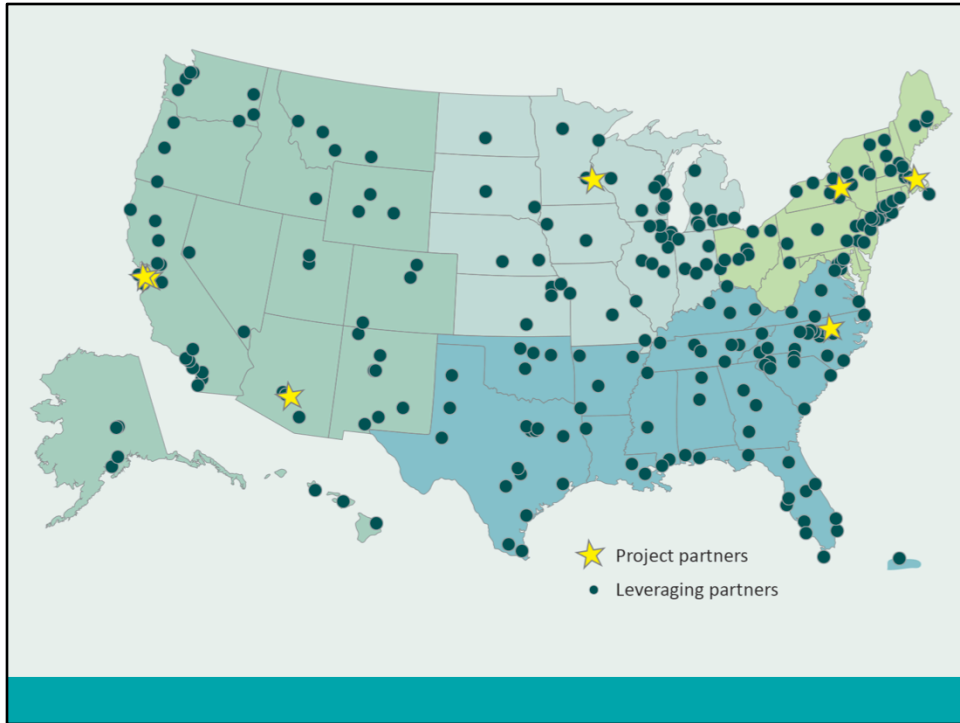
This training has three parts:

1. Quick introduction to the Explore Science: Earth & Space project and toolkit
2. Overview of the toolkit and the individual activities
3. Tips and training resources to help you lead the activities successfully

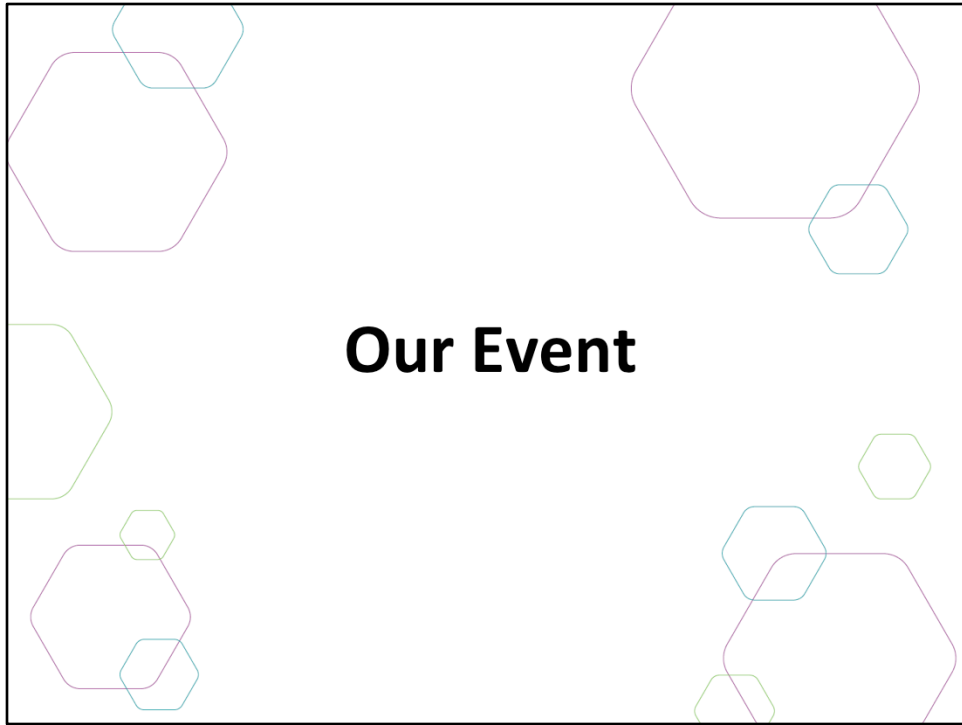
We'll have time at the end for questions, but feel free to ask for clarification throughout.



The Explore Science: Earth & Space project represents an effort by the National Informal STEM Education Network (NISE Network) in collaboration with NASA to engage museum visitors in Earth and space science hands-on activities and experiences with connections to science, technology, and society.



This year, the NISE Network shared 250 physical Explore Science: Earth & Space toolkits. Institutions (including, children’s museums, science centers, NASA Visitor Centers, nature centers, natural history museums, and more!) all across the country are hosting events and engaging visitors through year-round programming!



Here are a few details about our event, today.



Our Event

- Background
- Who's here
- Orientation
- Safety
- Policies
- Schedule
- Future events

[This is for information specifically about your institution]

Background

(Your institution's) mission and goals for this event

Who's here

Introduce collaborators, guest speakers, volunteer groups, and other educators and facilitators.

Orientation, Safety, and Policies

Where are restrooms, lunchrooms, and other places?

Where are the emergency exits?

Who should be contacted in case of emergency?

What do volunteers do if they have a problem? Who should be contacted?

Does your institution have procedures for fire alarms, lost children, and other emergencies?

Schedule

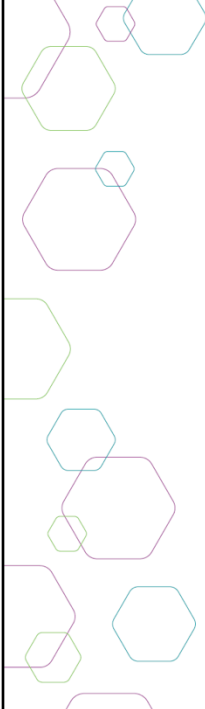
Highlight the schedule for the day.

Are there special presentations? If so, where will they be held and at what time?

When does the event begin and end?



Now, we'll quickly review the Explore Science: Earth & Space Toolkit.



Explore Science kits

- Designed for hands-on learning
- Adaptable to different settings and learners
- Everything you need is in the kit!

The Explore Science: Earth & Space toolkit materials have been designed to engage visitors in Earth and space phenomena, to help visitors reflect on science as a way of knowing, and to encourage them to identify as science learners.

The toolkits focus on hands-on space and earth science activities. They are adaptable to different settings and different kinds of learners.

Each toolkit includes everything you need for all the activities, with supplies for about 100 people.



Learning Framework

- Experience Earth and space **PHENOMENA** and explore science findings.
- Use the scientific **PROCESS** and reflect on science as a way of knowing.
- **PARTICIPATE in** the scientific community and identify as a science learner.

The Toolkit activities were developed around a learning framework that has three main parts: PHENOMENA, PROCESS, and PARTICIPATE.

- Experience Earth and space **PHENOMENA** and explore science findings.
- Use the scientific **PROCESS** and reflect on science as a way of knowing.
- **PARTICIPATE in** the scientific community and identify as a science learner.



The toolkit also covers a range of content from NASA's Science Mission Directorate, including:

Living with the Sun

Some of the BIG questions NASA scientists are asking include:

1. What causes the Sun to vary?
2. How do Earth and the solar system respond?
3. What are the impacts on humanity?



The Changing Earth

Some of the BIG questions NASA scientists are asking include:

1. How is the Earth changing?
2. What cause changes on Earth?
3. How will the Earth change in the future?



Our Solar System and Planets around other Stars

Some of the BIG questions NASA scientists are asking include:

1. How did the solar system form and evolve?
2. Why did life evolve on Earth?
3. Could life exist elsewhere?



Galaxies and Beyond

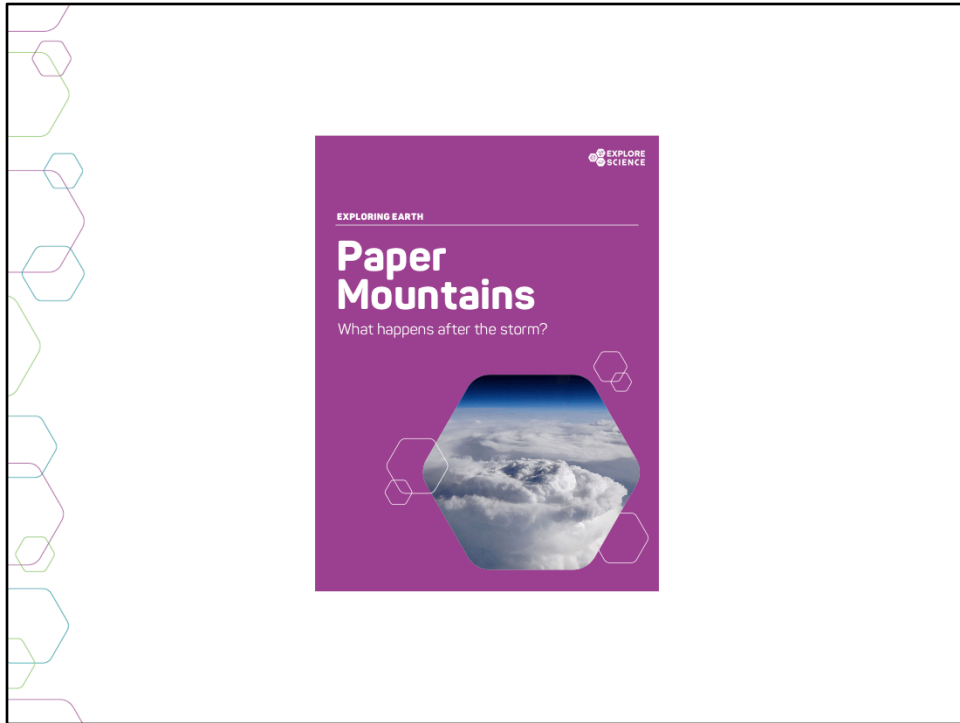
Some of the BIG questions NASA scientists are asking include:

1. How does the universe work?
2. How did we get here?
3. Are we alone?



The Explore Science: Earth & Space toolkit includes 10 hands-on activities. Each activity comes in a box and includes all the physical materials you'll need plus the activity and facilitator guides and additional information sheets.

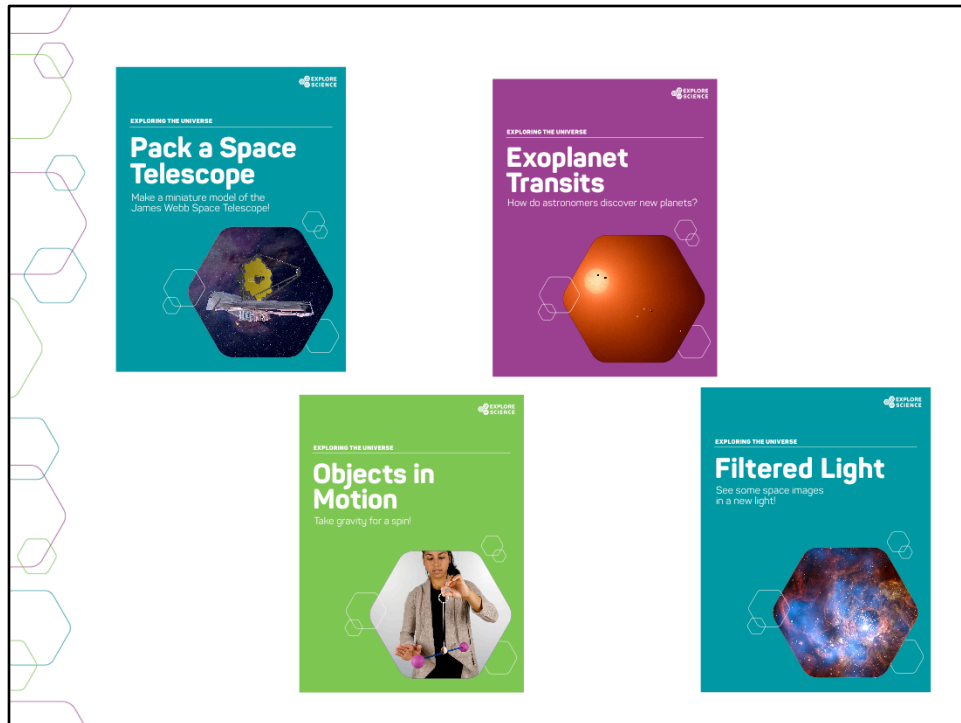
[The following slides include the activities from the Explore Science: Earth & Space 2018 toolkit. You may choose to augment your kit with additional activities from the 2017 toolkit or other educational resources. The 2017 digital toolkit is available for download: <http://www.nisenet.org/earthspacekit-2017>. The NISE Network has a curated list of programs, media, and professional development resources in the NASA Wavelength Digital Library that directly relate to the toolkits. These resources can be viewed and downloaded from nasawavelength.org/users/nisenet.]



The Paper Mountains activity helps participants **Explore Earth**.

The activity explores the following ideas:

- Earth is a constantly changing and dynamic system.
- The shape of the land and the pull of gravity both influence how water moves over Earth.
- NASA scientists use observations to make predictions about the future of our planet.



These activities are about **Exploring The Universe**.

The Pack a Space Telescope activity explores the following ideas:

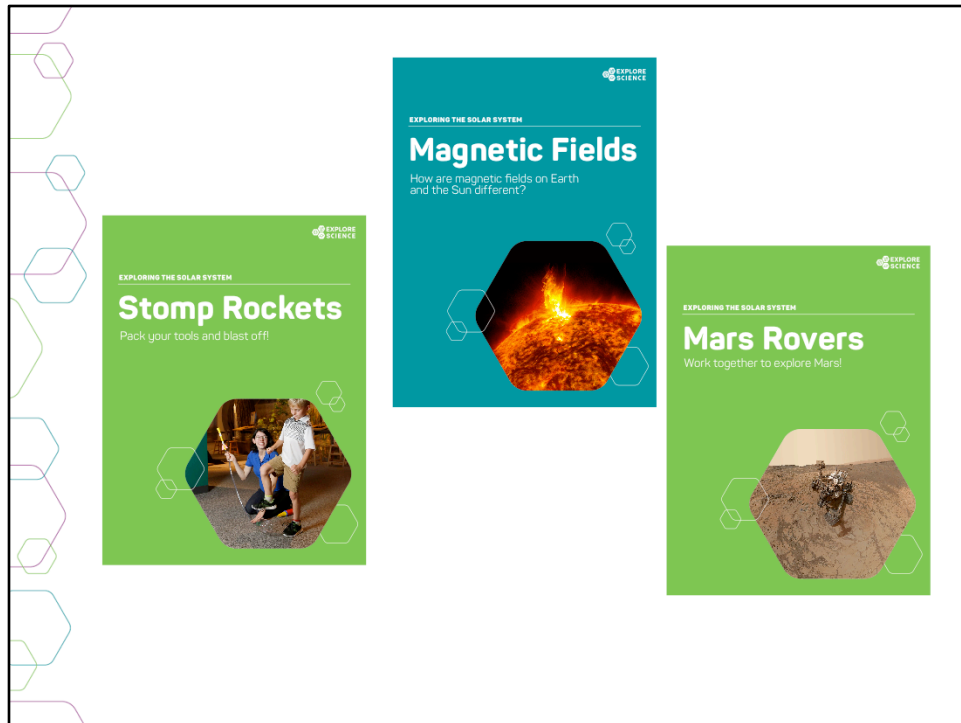
- Engineers design, build, and test new technologies to study the universe.
- Careful planning and design help us make new discoveries and better understand Earth and space.
- NASA teams work together to launch, guide into orbit, and operate a space telescope.

The Exoplanet Transits activity explores the following ideas:

- Scientists are searching the universe for planets orbiting distant stars.
- When a planet, or other object, moves between its star and Earth, some light from that star gets blocked from view.
- The transit method is one of the ways NASA scientists search for distant planets.

The Objects in Motion activity explores the following ideas:

- Objects in the universe interact in complex but predictable ways.
- Stars, planets, moons, and other objects in space orbit around each other because of gravity.
- NASA scientists use what we know about the laws of physics to make new predictions and discoveries.



The other five activities help participants **Explore the Solar System**.

The Stomp Rockets activity explores the following ideas:

- Some rockets carry science tools—not scientists—into space!
- Sounding rockets take quick, low-flying trips into space.
- Scientists use many different kinds of spacecraft to make new discoveries.

The Magnetic Fields activity explores the following ideas:

- Scientists have observed active magnetic fields throughout the solar system.
- Earth has a strong, protective magnetic field.
- The Sun’s magnetic field extends out into space and sends powerful bursts of magnetic energy into the solar system.

The Mars Rovers activity explores the following ideas:

- Teams of scientists and engineers use rovers and other robotic vehicles to explore distant worlds.
- Rover missions, like those to Mars, are carefully planned here on Earth
- NASA missions require large teams of people working together.



The other five activities help participants **Explore the Solar System**.

The Craters activity explores the following ideas:

- Studying the surface of a planet or moon can reveal its history and composition.
- Impact craters form when a meteorite collides with the surface of a moon or planet (or other body in space).
- Scientists use tools to find and observe craters and learn more about the geologic processes on planets, moons, asteroids, and other worlds.

The Hide and Seek Moon activity, specifically designed for early childhood, explores the following ideas:

- Tools help scientists study objects that are very far away.
- Binoculars make distant objects appear closer and brighter.
- NASA scientists use powerful telescopes to study objects in space.



Now, we'll review some tips for leading these activities with participants

Activity materials



We've just taken a very quick look at all 10 activities in the Explore Science: Earth & Space toolkit.

Here is an example of just one activity, Magnetic Fields. The image shows all the physical materials needed to do the activity.

Some of these materials are intended for the learners to use. These include the supplies they need to do the activity (like the Sun and Earth models, tray, and paperclips) and the colorful activity guide and sign, and any additional information sheets or other graphics. These things should all be out and accessible for learners.

It also includes some materials for you, the facilitator, to use. These include the more plain-looking facilitator guide with some notes about things like set-up and safety, and some tips to help you do a great job leading the activity, as well as any materials you'll need for advance preparation. These are just for you and are not meant to be shared with participants.

Finally, please note that there are both activity and content training videos for each activity, which you can watch to help you learn the activity before you do it with participants.

Activity instructions

The image displays two pages of an activity guide for 'Magnetic Fields'. The left page is the front side, titled 'EXPLORING THE SOLAR SYSTEM Magnetic Fields'. It features a 'Try this!' section with three numbered steps and corresponding photos: 1. Moving a pencil probe around a globe, 2. Sprinkling steel pieces on the globe, and 3. Scooping the pieces off. The right page is the back side, titled 'Scientists have used red active magnetic fields throughout the solar system.' It contains several paragraphs of text explaining Earth's magnetic field, the Sun's magnetic field, and auroras, accompanied by images of Earth's magnetic field lines and auroras. Red circles highlight the 'Try this!' section on the front page and the introductory paragraph on the back page.

Now let's look at some of these materials a bit more closely. Here is an example of an activity guide, for the Magnetic Fields activity.

The activity guides are structured to help you lead learners through hands-on science activities.

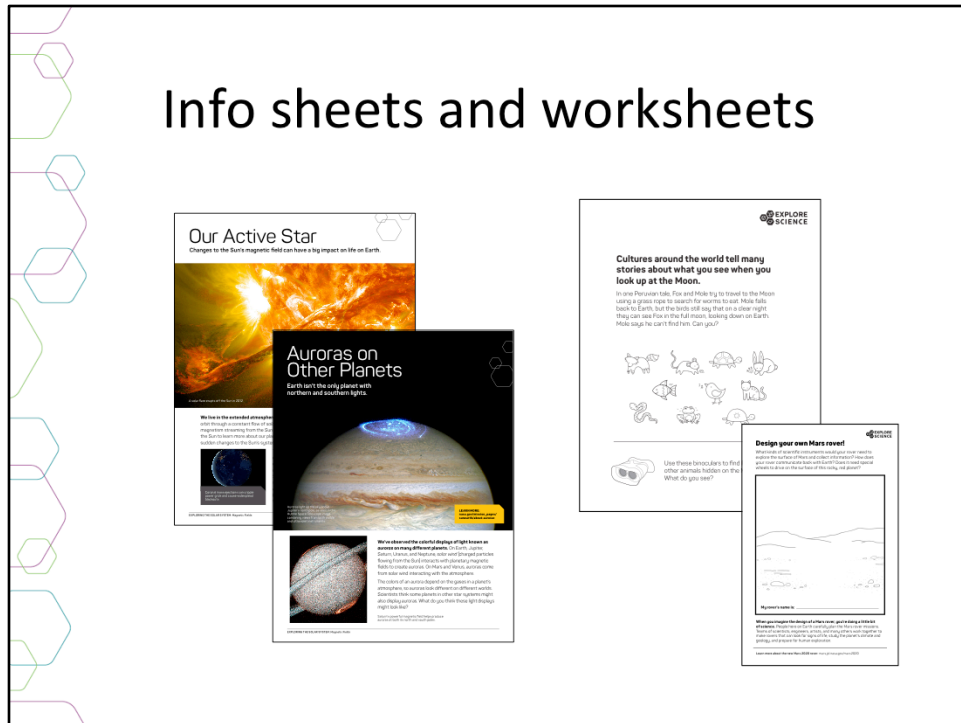
The front side includes step-by-step instructions in the section called "Try this!"

The back side describes what learners observe—and explains why it happens. Finally, the guide relates the activity to current space or Earth related science or NASA research.

You can leave these guides out on the table both to help you explain the activity and so that learners can read them and look at the pictures.

(They're available in both English and Spanish versions.)

Info sheets and worksheets



Many activities include additional information sheets or other graphic assets. Depending on your event or setting you may choose to use these more or less. They provide additional related content about the hands-on activity for participants and facilitators alike.

Training Videos



Each activity in the toolkit comes with an activity training video and a science content training: <https://vimeopro.com/nisenet/explore-science-earth-space>. Facilitators can watch these before the event (or even last minute online!)

*[This year, we have also included a set of training videos on **Strategies for Approaching Difficult Scientific Concepts** in space and Earth science. Part one describes various strategies you can use and provides an annotated example. Part two provides a scripted example of a visitor interaction and invites you to notice which strategies are employed. Watch this as a group and discuss what you see together.*

Part 1: <https://vimeo.com/243358295>

Part 2: <https://vimeo.com/243361942>

Notes and tips

FACILITATOR GUIDE
Magnetic Fields

Learning objectives

- Scientists have observed other magnetic fields throughout the solar system.
- Earth has a strong, protective magnetic field.
- The Sun's magnetic field extends out into space and sends powerful bursts of magnetic energy into the solar system.

Materials

- Simple magnetometer pencil tool
- Earth model with magnetic core
- Sun model with magnetic fields and sun spots
- Small steel pins and container (paper cups)
- Toy for Earth model
- Toy for Sun model
- Information sheets: *Access on Other Planets*, *Magnetic Fields*, *Solar Flares and Coronal Mass Ejections*
- Guides
- Activity and facilitator guides

The Explore Science toolkit comes complete with all necessary materials for this activity. Materials for the materials provided in the physical kit are more common than using 3D. You can substitute 3D objects if you can be downloaded from www.explore-science.org.

Safety

This activity should be conducted in a clean, well-ventilated area. Although there are not a choking hazard, the metal pieces should not be swallowed. If they come loose, the magnetism requires to pose a serious safety risk to children. Use precision and conduct periodic safety checks to be sure they are secured within the Sun model.

Notes to the presenter

When first beginning the activity, set aside the cup of metal pins and the Sun model. This will help the participants focus on finding Earth's invisible magnetic field using the pencil tool. Then by adding the metal pins and the Sun model to the activity, you can extend the metal pins between the north and south poles of the Earth model. This is a nice visual depicting the magnetic field lines covering the entire Earth.

Using positive responses with difficult concepts

What are misconceptions?

Throughout this we make observations and form patterns to try to understand the world around us. However, often our mental models are based on past experiences to make sense of difficult concepts. Our mental models are not always correct. Our mental models are in the face of new information.

That the closer you are to a star, the hotter it is. The temperature that water temperatures to be scientific explanation for magnets on Earth. Right of Earth and the amount of light. Observations we may all have about Earth and the Sun.

Why just providing the correct scientific facts? Think more carefully about the by to build on previous knowledge and learn more questions.

Use the activity or model to demonstrate your saying. Try the "Yes, and..." approach. Knowledge something you said that it might be to consider some new evidence that will be more questions.

Start with very basic information, and then share more with interested learners.

Use examples from everyday life

Facilitator examples can help explain abstract concepts. Be aware of different abilities, keeping in mind that children do not have the same skills or vocabulary as adults.

Other positive responses

If people haven't quite grasped a concept, you might say, "That's a good guess!" or, "Very close, any other ideas?" Don't say, "That's wrong." You can offer hints or suggestions for them to think about or watch carefully. (Use the other side of this sheet for positive ways to deal with difficult concepts.)

Show accurate information

If you aren't sure about something, it's ok to say, "I don't know." That's a great question! Suggest ways that people can learn more, either by trying another activity or looking up information at the library or online.

Repeat as often

Maintain an inviting facial expression, positive tone, and open body language throughout the interaction.

Thank your guests

In your orientation talks, suggest other activities that you think your guests might enjoy.

Have fun!

A positive experience will encourage learning.

Tips for leading hands-on activities

Draw your guests

Use "Hello," make eye contact, and smile. People will come over if you look welcoming, available, and friendly. As much as possible, let your guests do the hands-on parts of the activity, and let them discover what happens. If your activity has a surprise, don't give it away!

Encourage exploration

Provide positive feedback and assistance when people need it, but let them experiment and learn for themselves. Don't force people to do things too "right" - sometimes learning how something doesn't work is just as valuable as learning how it does work.

Ask open-ended questions

Help people observe and think about the activity. Try to use questions that have more than one answer such as "What do you see happening?", "Why do you think that happened?", "What surprised you about what you saw?", and "Does this remind you of anything you've seen before?"

Be a good listener

Be interested in what your guests tell you, and let their curiosity and responses drive your conversation forward.

Show what you know

Use clear, simple language. Don't do more than show - you don't need to explain everything at once! Start with very basic information, and then share more with interested learners.

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The facilitator guide is for you, the activity leader.

The first few pages list the learning objectives, activity materials, and includes important notes related to set-up, safety, presentation, difficult concepts and other aspects of the activity.

Additionally, each activity contains a useful reference sheet with tips about leading hands-on science activities and notes about how to talk to visitors about misconceptions and other difficult concepts.

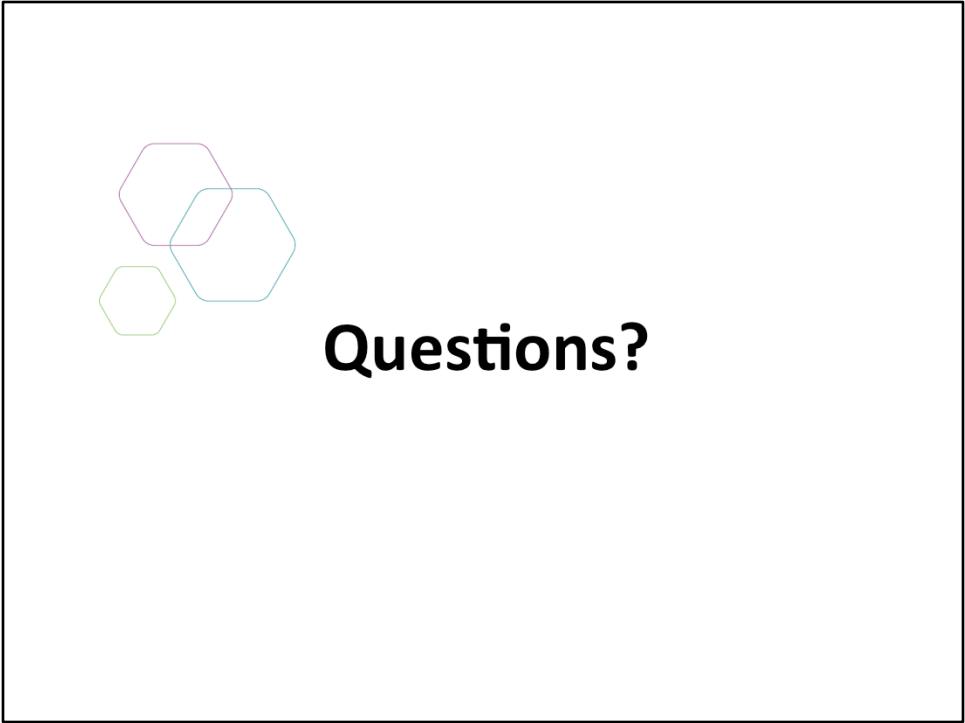


Tips for Leading Hands-on Activities

- Greet your guests
- Encourage exploration
- Ask open-ended questions
- Be a good listener
- Share what you know
- Offer positive responses
- Share accurate information
- Remain positive
- Thank your guests
- & HAVE FUN!

Tips for leading hands-on activities include:

- Greet your guests
- Encourage exploration
- Ask open-ended questions
- Be a good listener
- Share what you know
- Offer positive responses
- Share accurate information
- Remain positive
- Thank your guests
- & HAVE FUN!



Questions?

Thank you



Space and Earth Informal STEM Education is supported by NASA under cooperative agreement number NNX16AC67A. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the view of the National Aeronautics and Space Administration (NASA).

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Activity photos by Emily Maletz and Dave Burbank for the NISE Network. Activity materials screen capture by Museum of Life and Science. Living with the Sun image: composite image of 25 separate images of the Sun from the Solar Dynamics Observatory (SDO) spanning the period of April 16, 2012, to April 15, 2013, courtesy NASA Goddard Space Flight Center/SDO/AIA/S. Weissinger. The Changing Earth image: Late winter storms dropped a fresh coating of snow across the Alps in mid-March 2016, courtesy NASA image by Jeff Schmiltz. LANCE/EOSDIS Rapid Response. Our Solar System and Planets Around Other Stars image: Artistic concept of water plumes on Jupiter's moon Europa courtesy NASA/ESA/K. Retherford/SWRI. Galaxies and Beyond image: Eagle Nebula's "Pillars of Creation" courtesy NASA.

THANK YOU!

