



[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.

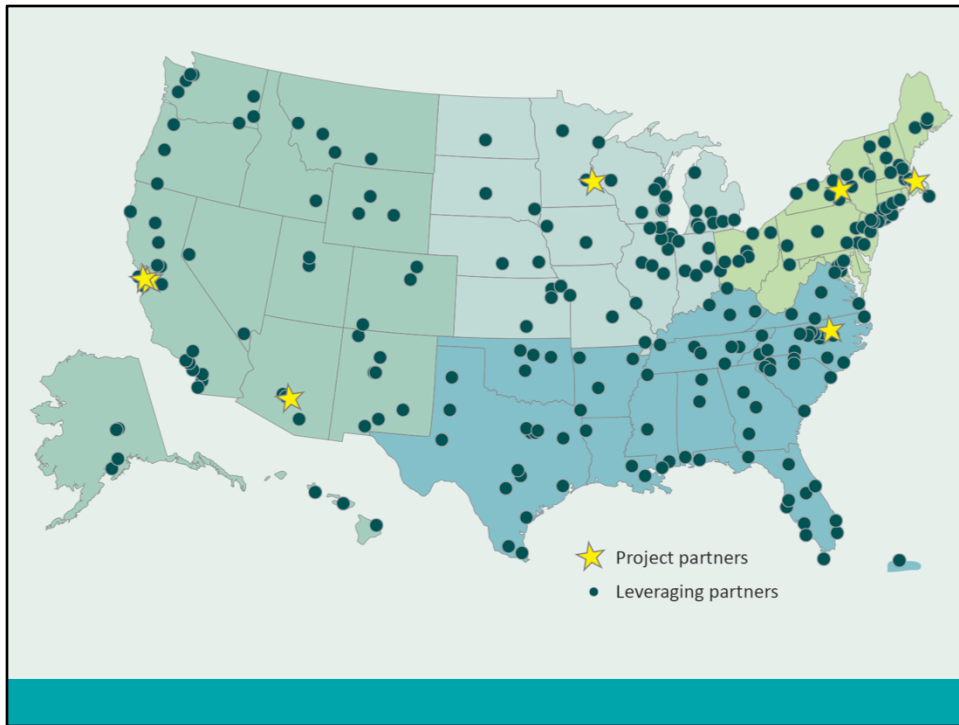
This training has three parts:

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

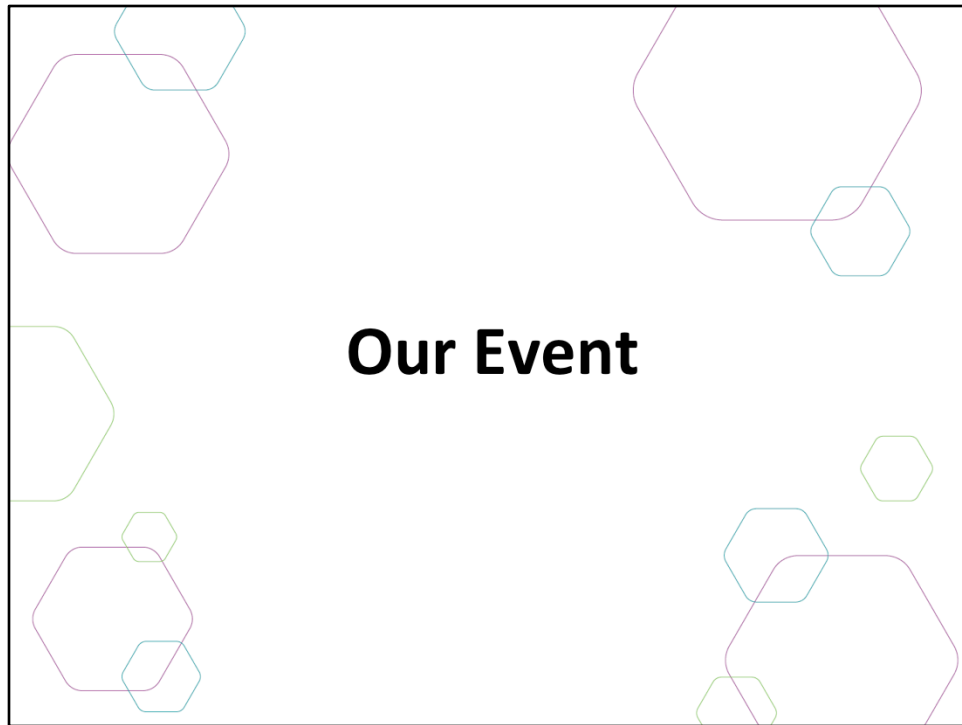
We'll have time at the end for questions, but feel free to ask for clarification throughout.



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 350 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

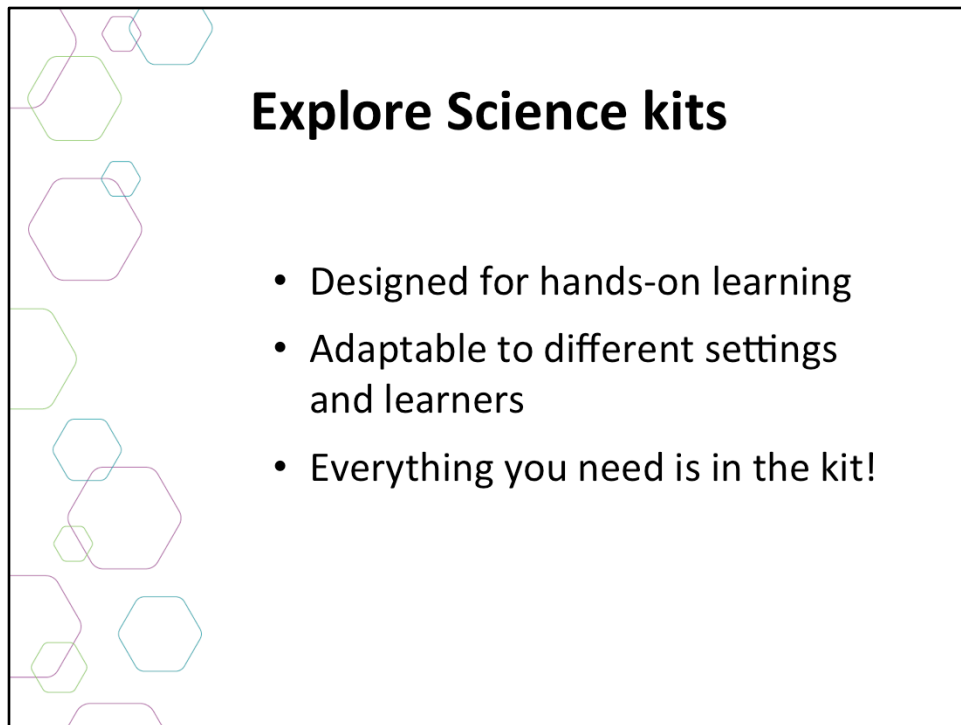
Highlight the schedule for the day.

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.



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.

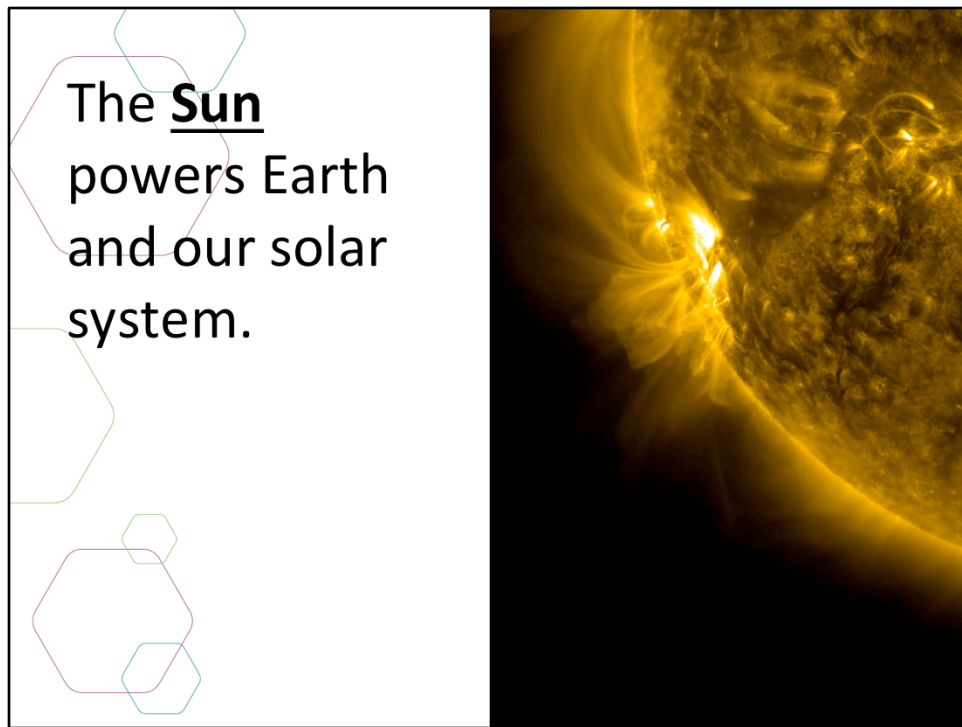


Learning Framework

- 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.



Some of the BIG questions NASA scientists are asking about the Sun include:

1. What causes features on the Sun—like sunspots—to vary?
2. How do Earth and our solar system respond to the dynamic Sun?

Image

Active Region Conga Line

A series of active regions on the Sun were all lined up one after the other as they rotated into view over three days (Sept. 22-24, 2012)

<https://sdo.gsfc.nasa.gov/gallery/ultrahd/>

Image credit: NASA/SDO



Some of the BIG questions NASA scientists are asking about the Earth include:

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

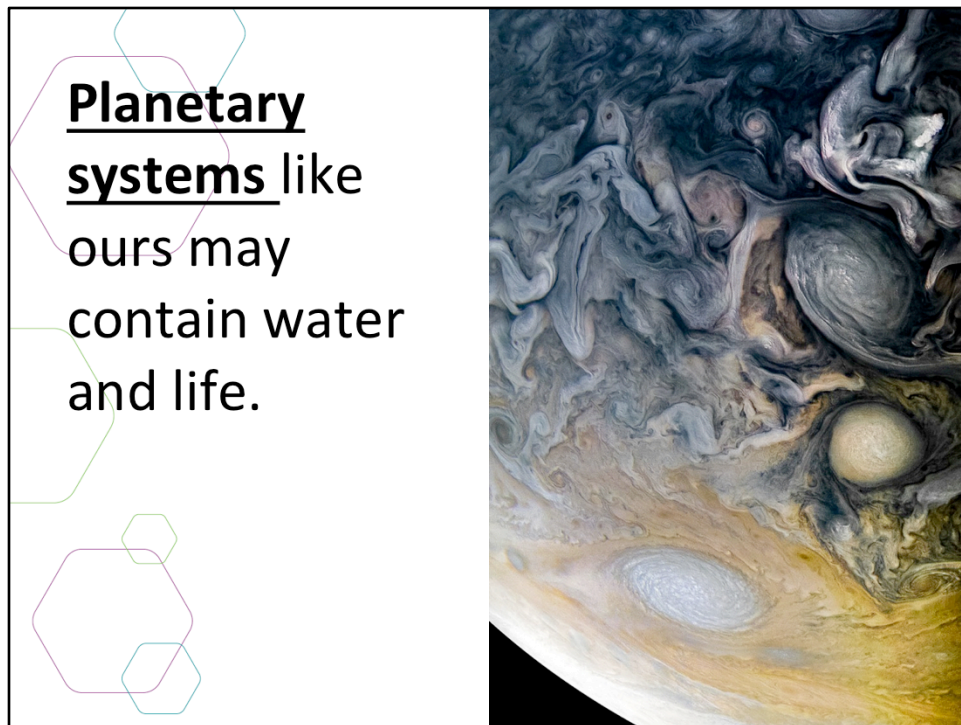
Image

Hurricane Florence as it was making landfall

Hurricane Florence is pictured from the International Space Station as a category 1 storm as it was making landfall near Wrightsville Beach, North Carolina.

<https://www.nasa.gov/image-feature/hurricane-florence-as-it-was-making-landfall-0>

Image credit: NASA



Some of the BIG questions NASA scientists are asking about our solar system and other planetary systems include:

1. How did our solar system form?
2. How did life begin on Earth?
3. Could life exist elsewhere?

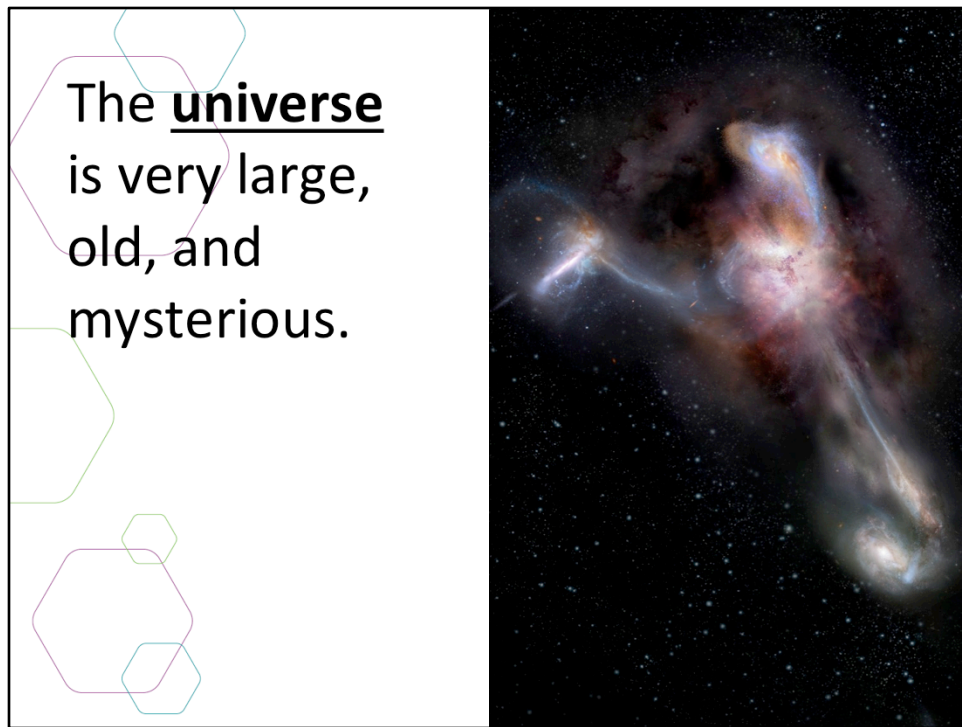
Image

Intricate Clouds of Jupiter

See intricate cloud patterns in the northern hemisphere of Jupiter in this new view taken by NASA's Juno spacecraft.

<https://www.jpl.nasa.gov/spaceimages/details.php?id=PIA21984>

Image credit: NASA/JPL-Caltech/SwRI/MSSS/Kevin M. Gill



Some of the BIG questions NASA scientists are asking about astrophysics include:

1. How did the universe begin?
2. How is the universe changing?
3. Are we alone in the universe?

Image

The Most Luminous Known Galaxy

Artist impression of W2246-0526, the most luminous known galaxy, and three companion galaxies. <https://astropix.ipac.caltech.edu/image/nrao/>

NRAO_Gallery_nrao18ch26_artimp_Final

Image credit: NRAO/AUI/NSF, S. Dagnello



The relationship between Earth & space science and our society is a cross-cutting topic to all NASA science research and missions. Some questions include:

1. How do our values influence science questions about Earth and space?
2. What inspiration does society draw from new NASA technology and discoveries?
3. How do teamwork and specialized tools contribute to NASA research?
4. What impacts do the dynamic processes of the Sun, Earth, and universe have on human society?

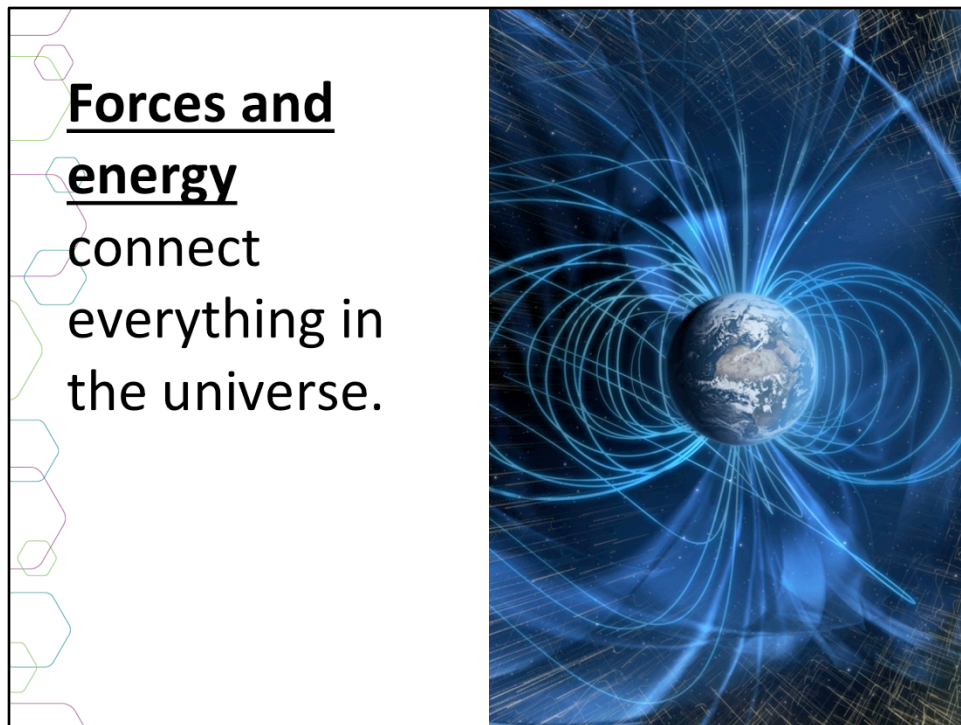
Image

The Mars Science Laboratory Team

The Mars Science Laboratory (MSL) team in the MSL Mission Support Area react after learning the the Curiosity rove has landed safely on Mars and images start coming in at the Jet Propulsion Laboratory on Mars, Sunday, Aug. 5, 2012 in Pasadena, Calif

<https://mars.nasa.gov/resources/4208/the-mars-science-laboratory-team/>

Image credit: NASA/Bill Ingalls



Force and energy are common threads of the universe and how NASA scientists learn about nearby and far-away space objects. Some topics include:

1. The Electromagnetic spectrum
2. Gravity
3. Magnetism

Image

Earth's Magnetic Field

The solar wind is deflected past Earth by a global magnetic field (artist's concept).

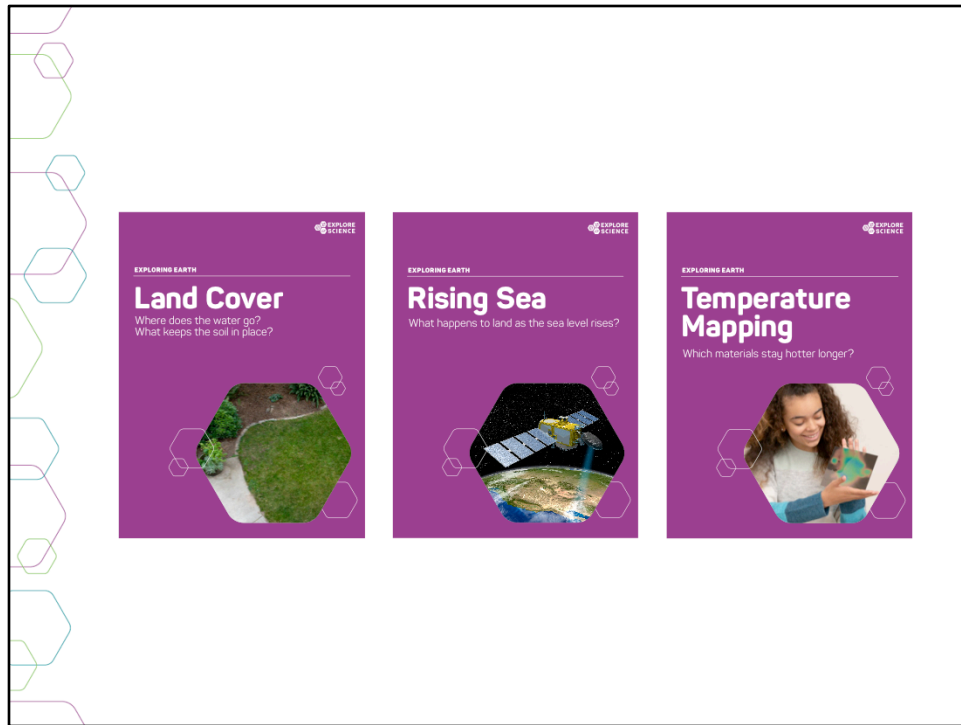
<https://svs.gsfc.nasa.gov/4370>

Image credit: NASA/GSFC



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 2019 toolkit. You may choose to augment your kit with additional activities from the 2017 & 2018 toolkit or other educational resources. The 2017 & 2018 digital toolkits are available for download from nisenet.org. The NISE Network also has a curated list of programs, media, and professional development that directly relate to the toolkits. These resources can be viewed and downloaded from <http://www.nisenet.org/earthspacekitextensions>.]



The Land Cover, Rising Sea, and Temperature activities all help participants **Explore Earth**.

Land Cover explores the following ideas:

- The movement of water over a landscape is a constant force of change.
- Different types of land cover interact with water moving over the landscape in different ways.
- NASA scientists use observations from Earth and space to monitor changes and make predictions about the future of our planet.

Rising Sea explores the following ideas:

- Earth's sea levels are rising, submerging land and causing coastlines to recede.
- Rising sea levels will have major consequences for people all around the world.
- Scientists are monitoring the sea level, providing information that can help us prepare for and adapt to the changing ocean.

Temperature Mapping explores the following ideas:

- Earth is a constantly changing and dynamic system.
- Different types of land cover on Earth absorb or reflect energy from the Sun in different ways.
- NASA scientists study land cover to understand and predict how Earth's climate is



Stomp Rockets, Hide and Seek Moon, and Observe the Sun all help participants **Explore the Solar System**.

The Stomp Rockets activity explores the following ideas:

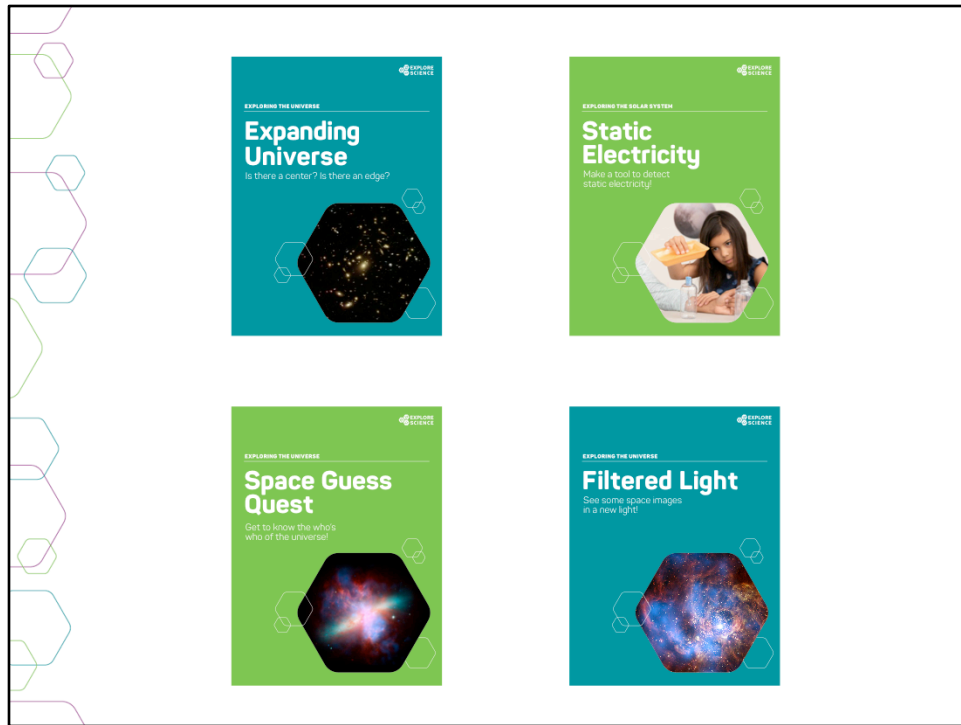
- Some rockets carry science tools—not scientists—into space!
- Sounding rockets take quick, low-flying trips into space.
- Scientists use many different kinds of spacecraft to make new discoveries.

The 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.

The Observe the Sun activity explores the following ideas:

- The Sun, a hot ball of glowing gas, is the star at the center of our solar system
- Special tools allow scientists to carefully and safely observe the Sun.
- Some NASA scientists study solar activity to better understand how Earth and the rest of the solar system respond to the Sun.



And these activities are about **Exploring The Universe**.

The Expanding Universe activity explores the following ideas:

- Astronomers make observations and use mathematical models to understand how the universe changes.
- Most of the galaxies we can observe are moving away from each other as the universe expands.
- The beginning of the universe, over 13.8 billion years ago, was like a sudden expansion from a very hot, very dense state.

The Static Electricity activity explores the following ideas:

- Special tools can help detect invisible forces on Earth and in space.
- Engineers and scientists invent and build tools to answer specific questions.
- Some NASA scientists study how static electricity behaves—here on Earth, in space, and on other worlds.

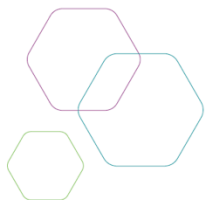
The Space Guess Quest game explores the following ideas:

- Humans are exploring a wide variety of objects, like nebulae, galaxies, stars, and worlds throughout the universe (and now the universe even includes human-made spacecraft!)
- Scientists often use visual clues to identify 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.

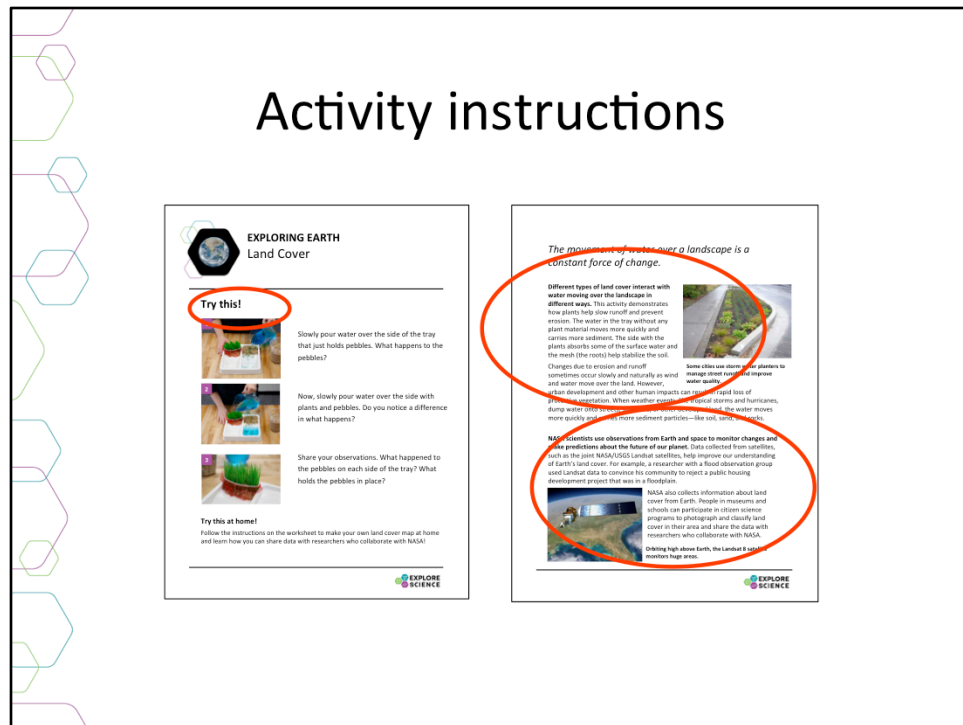
Here is an example of just one activity, Land Cover. Each activity box includes all the physical materials needed to do the activity.

Some of these materials are intended for the learners to use. These include the supplies they need to do the activity--like the pebbles, water, tray, plastic grass and roots (mesh)—shown in this image. You'll also want to share the colorful activity guide and sign, and any additional information sheets, worksheets, or other graphics. These things should all be out and accessible for learners.

The box 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



Now let's look at some of these materials a bit more closely. Here is an example of an activity guide, for the Land Cover 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!" (or in this example, "Let's play a game!")

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.

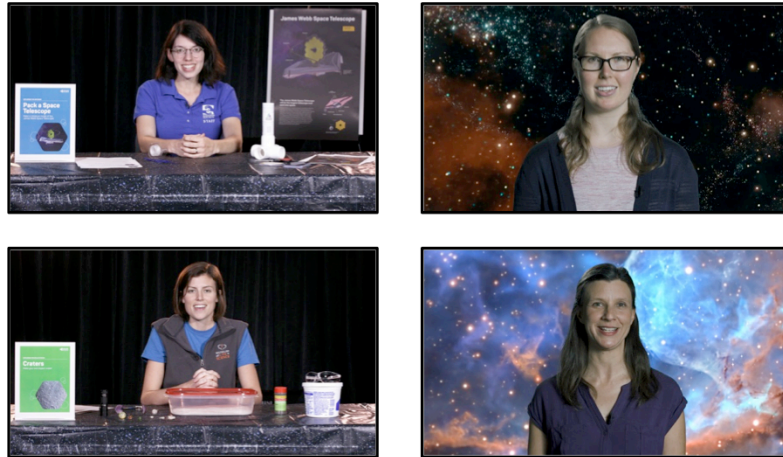
You can leave these guides out on the table both to help you explain the activity and so that learners can read them and look at the pictures.

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

Info sheets and worksheets

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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 training video about facilitation techniques titled **Educathalon** and 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. You can watch these videos together as a group and discuss what you see and notice and how this might change the ways you interact with visitors.]*

Notes and tips



FACILITATOR GUIDE

Land Cover

Learning objectives


Learners engaged in this activity will explore these main ideas:

- The movement of water over a landscape is a complex force of change.
- Different types of land cover interact with water moving over the landscape in different ways.
- Human activities can disrupt patterns from Earth and space to monitor changes and make predictions about the future of our planet.

Materials

- Small double-sided card tray
- Question packets (about 15 packets)
- Printed question sheet
- Small card ("You're out")
- Index marker point
- Water
- Small bowl (optional)
- Microfiber cloth or sponge
- Large flat surface (table)
- Sign, sign stick, information sheets, and activity and facilitator guides
- SCIENCE Resource packets
- "Map your Backyard Land Cover" worksheet
- "Map the Land Cover on a Grid" sheet

The *Explains Science* booklets come complete with all necessary materials for this activity. Materials are also readily available to create or recreate activity kits. Most of the materials in this activity can be purchased through hardware stores, craft stores, or internet online. The plastic card and packets can be found through computer supply companies. The small card "You're out" can be replaced with any similar banner and other small printer. All graphics can be downloaded from www.explains.org.



Using positive responses with difficult concepts

What are misconceptions?
 Misconceptions are ideas that are not based on scientific evidence. They are often based on everyday experiences or on information that is not accurate. Misconceptions can be difficult to change because they are often based on deeply held beliefs or on information that is not easily changed.

How can we use positive responses with difficult concepts?
 When we use positive responses with difficult concepts, we are acknowledging the student's effort and encouraging them to continue to learn. We are also showing them that we value their input and that we are interested in their ideas. This can help to build a positive learning environment and encourage students to share their ideas and to learn from each other.

Tips for leading hands-on activities

Great your goals
 First, make sure you know what you want to achieve. Then, think about how you can achieve it. Finally, think about how you can measure your success. This will help you to stay focused and to know when you have reached your goals.

Encourage exploration
 Encourage students to explore and to learn from their own experiences. This will help them to develop a deeper understanding of the concepts and to become more confident in their own abilities.

Ask open-ended questions
 Ask questions that require more than a simple "yes" or "no" answer. This will encourage students to think more deeply about the concepts and to develop their own ideas.

Be a good listener
 Listen to what your students have to say and to their own ideas and experiences. This will help you to understand their thinking and to provide them with the support they need.

Share what you know
 Share your own knowledge and experiences with your students. This will help them to see that you are also a learner and that you are interested in their ideas.

Use examples from everyday life
 Use examples from everyday life to help students understand abstract concepts. This will make the concepts more relatable and easier to understand.


Offer positive responses
 Offer positive responses to students when they are making progress or when they are trying to solve a problem. This will encourage them to continue to work and to learn from their experiences.

Share accurate information
 Share accurate information with your students when they are making a mistake or when they are not sure. This will help them to correct their understanding and to learn from their mistakes.

Remain positive
 Remain positive and encouraging throughout the activity. This will help to create a positive learning environment and to encourage students to participate.

Thank your guests
 Thank your guests for their participation and for their ideas. This will show them that you value their input and that you are interested in their ideas.

Have fun!
 Have fun! This is a hands-on activity and it should be fun. This will help to create a positive learning environment and to encourage students to participate.



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.

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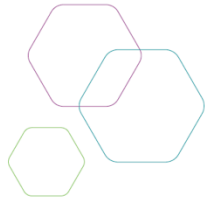
A decorative graphic on the left side of the slide, consisting of several overlapping hexagons in various colors (purple, green, blue, pink) and sizes, some with internal lines.

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
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- Share accurate information
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- Thank your guests
- & HAVE FUN!



Questions?

Questions?

Thank you



Space and Earth Informal STEM Education is supported by NASA under cooperative agreement numbers NNX16AC67A and 80NSSC18M0061. 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. Wessinger. 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 Schmaltz, LANCE/ECOSIS 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!



