The Moon Adventure

GAME GUIDE

This game takes about
25 MINUTES
Este juego dura aproximadamente 25 minutos

Best for
3–6 PLAYERS
Mejor entre 3 a 6 jugadores

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READ BEFORE PLAYING >

Game Overview

The Moon Adventure Game is designed as a hands-on collaborative experience for STEM learning in museums and planetariums. Players will work together to solve a series of challenges grounded in real science about living and doing research on the Moon. This game was designed to be played live and in person by 3–6 participants in a museum setting, with support from a museum educator or volunteer facilitating the game.

This game is also suitable for use in other informal learning settings such as after-school programs, summer camps, libraries, scouting groups, community organizations, and university public outreach programs. It may also be adapted by educators for use in formal education K–12 classrooms. This material has been reviewed by NASA scientists working on lunar missions, experts on interactive gaming, and museum educators. The game has been tested and evaluated with public audiences.

Story

The premise of the game is a fictional story grounded in actual NASA science and research about what people might need in the future to live and work on the Moon. The challenges are based on real scientific concepts connected to lunar exploration. Players will assume the role of astronauts living and doing research in an outpost on the Moon. As players conduct research, a moonquake causes significant damage to the life support systems on the outpost. Survival on the Moon requires teamwork. Can players work together to quickly restore the necessary systems to survive?

Learning Objectives

As a result of participating in the game, learners will:

1) Strengthen 21st century skills related to collaboration, innovation, critical thinking, and problem-solving
2) Increase their interest in Moon and space exploration
3) Develop a sense of science identity and confidence related to learning about the Moon and space science
4) Learn new content knowledge about the Moon and/or space exploration

Audience

The Moon Adventure Game is designed for families with children and students grades 4–8. For an alternate script for younger audiences with suggestions for adapting content, check out the Early Childhood Adaptation of the Facilitator Narrative Script.

Players

- Best for 3–6 players
- For more than 6 players, check out the Adaptations and Extensions sections of this guide as well as sections on how to create your own additional game sets

Time

- Setup: 10–15 minutes
- Gameplay: about 25 minutes (approx. 5 minutes per challenge)
- Resetting the game between groups: 5–15 minutes (depending on sanitizing needs)

Game Flow and Content

Facilitators read through the game Facilitator Narrative Script, provide cues for players to move on to the next challenge, and lead a reflection once the game is completed. There are five challenges that players must work together to overcome. Each challenge explores different scientific content while drawing on various skills:

- ❑ Welcome
  - ❑ Content: What do you need to live on the Moon? Shelter, food, water, energy, communication, and teamwork!
- ❑ Challenge 1: Make a Travel Plan for Your Rover
  - ❑ Content: Moon craters
  - ❑ Skills: interpreting maps and data, teamwork
- ❑ Challenge 2: Match Rover Data to Locations on the Map
  - ❑ Content: permanently shadowed areas
  - ❑ Skills: interpreting maps and data
- ❑ Challenge 3: Extract Water from Frozen Lunar Material
  - ❑ Content: frozen lunar materials in craters
  - ❑ Skills: sorting material
- ❑ Challenge 4: Fill Your Oxygen Tanks
  - ❑ Content: splitting water molecules into hydrogen and oxygen
  - ❑ Skills: measuring
- ❑ Challenge 5: Reconnect the Power Supply
  - ❑ Content: using conductive materials to close electrical circuit
  - ❑ Skills: teamwork
- ❑ Wrap-up and Reflection
  - ❑ Content: NASA exploration of the Moon

Digital Materials

All digital materials, including this Game Guide, Facilitator Narrative Scripts, signs, and labels can be downloaded from:

- Moon Adventure Game Overview
  https://www.nisenet.org/moongame

First-Time Assembly

Before you play the game for the first time, please see the First-Time Assembly section of this guide for step-by-step instructions on how to assemble the game components, apply labels, etc.

Making Your Own DIY Version of the Game

If you are creating your own do-it-yourself (DIY) version of this game, please refer to the following sections of the this guide:

- Printing DIY for printing graphics and labels
- Materials DIY
- First-Time Assembly section of this guide for how to apply labels and more

Please keep in mind that if you are creating your own DIY version of the game, there is a great deal of flexibility with materials.

When and Where to Use This Game

This game can easily be used in a museum setting such as:

- Room or quiet space on the museum floor—the space does not need to have walls, but it is helpful to have some physical demarcation, such as signs, sign stands, stanchions, tape on the floor, etc.
- Summer camps—as part of a day or week of space science day themes
- Space-themed small-group events such as children's birthday parties or special programs
- Adult-only events

Please see the Adaptations section of the guide for how to use the game with larger groups and younger children.

How to Use This Guide

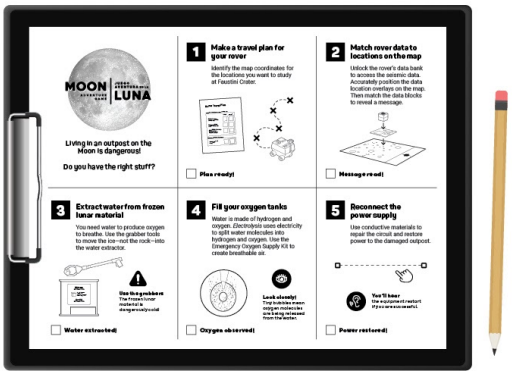
This guide walks facilitators through the game step-by-step, from what to consider when choosing a space, to playing the game, to the specific details of setting up and engaging visitors in each challenge. Note that we advise you to **review the Progress Tracker and Facilitator Narrative Script BEFORE** attempting to navigate this guide. In addition, be sure to play the game yourself with fellow staff before attempting to facilitate it with public audiences.

The first section introduces the overall game atmosphere, including example drawings of ways to set up your environment. Each challenge is described in detail, including objectives, materials, setup, advanced preparations, and notes to the facilitator. Finally, the guide provides tips on ways to engage players in post-game reflection.

The guide also provides information on safety and cleanup. We offer suggestions for safety guidelines and advice for storing game materials. For those planning consecutive gameplay, we also provide a one-page quick reference for resetting all the challenges between groups. The guide concludes with information on adapting the game for other settings, background information, and extensions for longer engagement. You will also find several sections for reprinting and creating your own do-it-yourself (DIY) version of this game.

Progress Tracker

- The Progress Tracker provides a visual overview of the game. The players can keep track of their progress using a clipboard and pencil.
- The player(s) managing the group's progress on the Progress Tracker will read instructions aloud.
- The Progress Tracker is available in English and Spanish.



Facilitator Narrative Script

- The game has a detailed Facilitator Narrative Script, and the intent is that the facilitator will hold this in their hand and read the script aloud to players (it is **NOT** intended to be memorized). There are tips and hints important to gameplay throughout the script.
- Please read through the Facilitator Narrative Script before reading this guide.
- The script is available in both English and Spanish.
- An Early Childhood Adaptation of the Facilitator Narrative Script has been created for use with **younger audiences**. For younger players who are nonreaders, the facilitator should be ready to read all instructions, signs, and prompts aloud.

Training Videos and Resources

Before playing this game with visitors, be sure to watch the training videos:

- Facilitator Training Videos
  https://vimeopro.com/nisenet/moon-adventure-game
- First-Time Setup video
  https://vimeopro.com/nisenet/moon-adventure-game
- Content Training Videos
  https://vimeopro.com/nisenet/moon-adventure-game

Additional training materials available at:

- Moon Adventure Game Overview
  https://www.nisenet.org/moongame
- Moon Adventure Game Digital Download
  https://www.nisenet.org/moonadventuregame
- Extending the Experience
  https://www.nisenet.org/moonadventuregameextensions

Notes to the Facilitator

These notes are for overall gameplay; see specific notes for each challenge on subsequent pages:

- **Teamwork**
  Encourage everyone to work together! Some groups may require more frequent reminders about teamwork and communication to ensure that all players have a part to play and stay engaged.
- **Providing help or clues**: **Mission Control Cards**
  Players may ask for assistance with a challenge by calling "Mission Control" (the facilitator). In order for the game to be fun and exciting, you'll want to give players enough time to make their own discoveries. However, be sure to balance this with offering hints from Mission Control before players become frustrated or get too off track.
- **Expanding the experience**
  Embellish your experience and create a more atmospheric environment. You could use one of NASA's Spotify playlists for background music, keep lights in your space dim, or add relevant content from other NISE Net Explore Science: Earth & Space activities and NASA resources. For more ideas, see the Extensions section at the end of this guide.
- **Bilingual: English and Spanish**
  Table signs, labels, signs, and instructions are bilingual in both English and Spanish.

Overall Game Atmosphere Setup and Welcome

Objective

The facilitator introduces the story and invites participants to play the game. The facilitator begins a conversation about what humans would need to live and do research on the Moon.

Materials

Durable Materials

- ❑ Game Guide
- ❑ Welcome sign (large 22” x 28”)
- ❑ Welcome sign (table sign 8.5” x 11”)
- ❑ Banner (56” x 34”)
- ❑ Clipboard for Progress Tracker sheet
- ❑ Clipboard for facilitator
- ❑ Facilitator Narrative Script
- ❑ Early Childhood Adaptation of the Facilitator Narrative Script for younger audiences
- ❑ Mission Control Cards (3)
- ❑ Pencil (pencil sharpener provided)

Consumable Materials

- ❑ Progress Tracker sheet (1 sheet per gameplay)
- ❑ Stickers and temporary tattoos (for Wrap-up) (should last for hundreds of gameplays)
- ❑ Command™ strips for hanging banner and welcome sign

Welcome

- When the facilitator invites individuals to play the game, they should begin with a conversation about what humans would need to live and do research on the Moon. This provides an opportunity for players to discuss ideas, as well as helps the facilitator introduce the main concepts of the game. After this introduction, players can start Challenge 1: Make a Travel Plan for Your Rover.

Getting Started – First-Time Assembly

- Before you play the game for the first time, please see the First-Time Assembly section of this guide for step-by-step instructions on how to assemble the game components, apply labels, etc.

Setup – Selecting a Space

When selecting a space to play the game, you will want to consider the following:

- **What type of tables are available?** We recommend setting up all the challenges across three six-foot or larger tables. Tables may be arranged in a line with space in between the tables or a U-shape. This provides enough room to set out all the physical resources for each challenge and gives groups of 3–6 players sufficient area to engage with materials during gameplay. If necessary, you can use multiple smaller tables with one challenge setup per table.

- **Is the space large enough?** Not only do you need enough space for all of your tables, but you will need to have room for groups of 3–6 players to gather around tables and move from challenge to challenge in the space. We recommend giving players access to challenges from one side of the table.

- **What about noise in the space?** You want a space where players can discuss challenges and work together to find solutions without distraction. There are also two sound effects in the game that need to be heard to alert players to major events in the game. Finally, excited players will be distractions to other audiences who are not playing the game.

- **Can you easily designate the gameplay area for players?** Players will look everywhere they can for clues. Be sure you can clearly define the gameplay area, and let each group know from the start that everything they will need to play the game is within this space.

- **How will queueing work?** You will need to have a place to queue groups waiting to play the game that is visually separated from gameplay. This is necessary to ensure one group does not reveal solutions to another. This can be accomplished easily if you have a separate room dedicated to the game, with additional groups lined up outside the space. If you are unable to have a completely separate space, be sure to have enough distance between the game and the queue that those waiting can't watch or hear the groups before them. We also recommend engaging participants waiting in line with other hands-on activities such as those found in the Explore Science: Earth & Space toolkits, especially Moon activities described later in this guide.

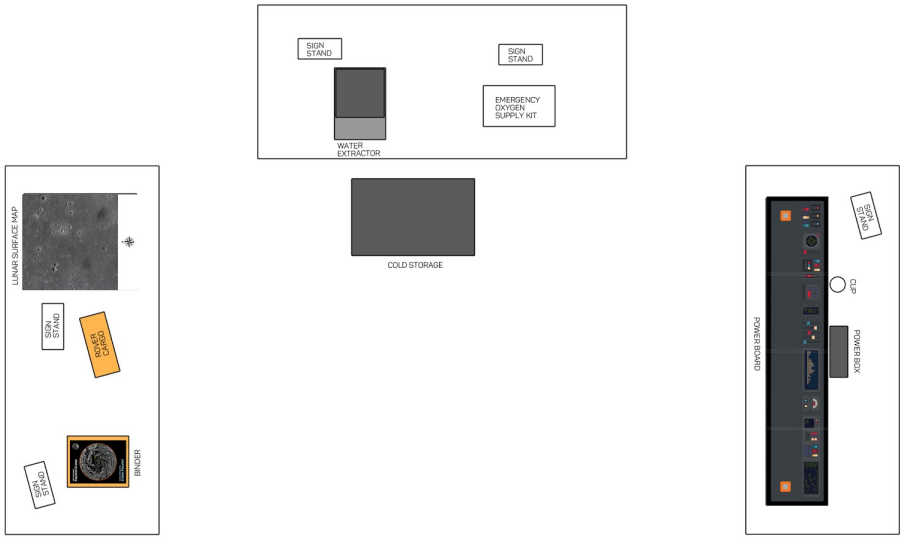
- **Where can the welcome sign and banner be hung?**
  The game materials include one large graphic banner and a poster-sized welcome sign. We also include a table sign version of the welcome sign if hanging this piece is not an option. Both the banner and welcome sign are lightweight cloth and can be attached to an adjacent wall with Command™ strips. If you are not able to hang these on a wall, alternative solutions include hanging from a sign stand, rolling Z-rack, or other similar freestanding structure. You could also hang this from the front of a table that is **NOT** part of gameplay so participants can still view it while playing the game.

- **How do I handle wayfinding and promotion?** We recommend printing additional copies of the 8.5” x 11” welcome sign to use for wayfinding in your space. This is also a great piece to include in any promotion you do for the game. A digital version of this sign as well as multiple versions of the Moon Adventure Game logo can be found among the game’s online resources.
- **Adaptations:** This game was designed for use in museums with groups of 3–6 players at a time. However, the game can easily adapt for use in other settings and with larger groups. Please see the Adaptations section of this guide.
- **Want to add audio? Video? More images? More activities?**
  Please see the Extensions and Extending the Moon Game Experience with NASA Images, Videos, Audio, and Visualizations sections of this guide.

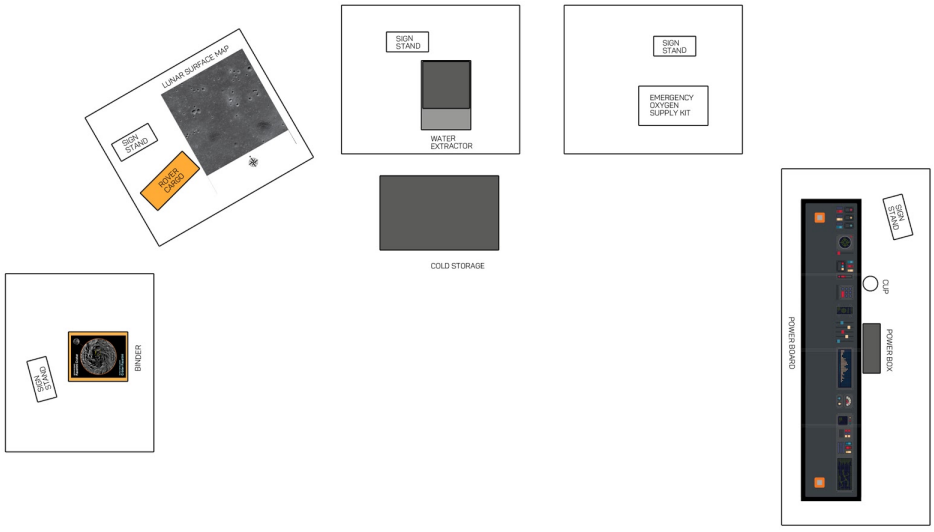
Example Table Arrangements

The following are some examples of ways to set up the game materials. Feel free to adapt as needed to fit your space, and add additional environmental graphics, sounds, or other props to create more atmosphere.

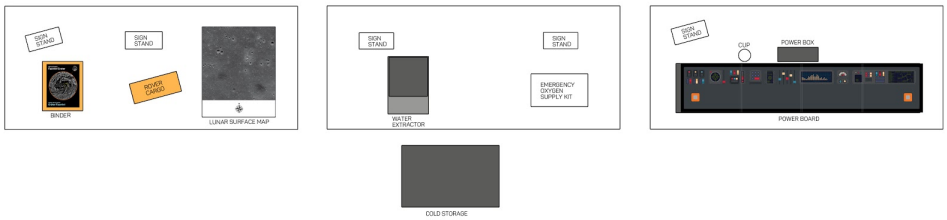
U-shape: three six-foot tables



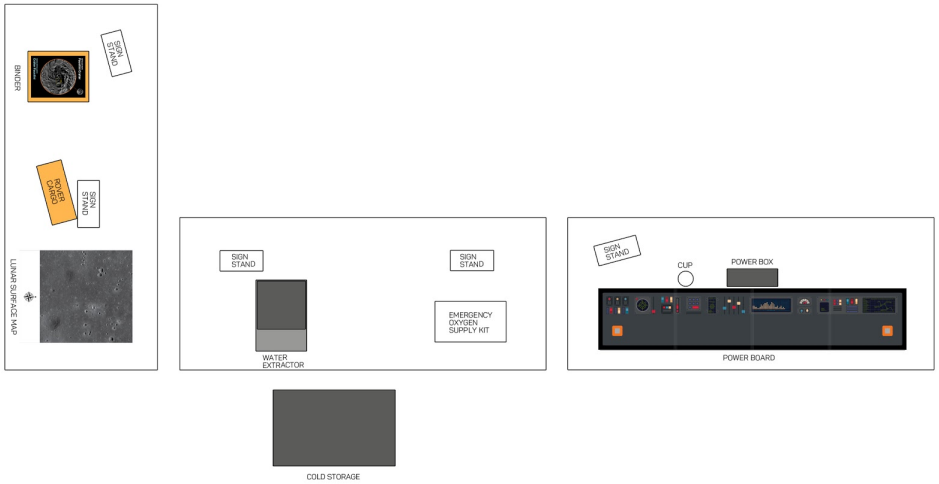
U-shape: five smaller tables



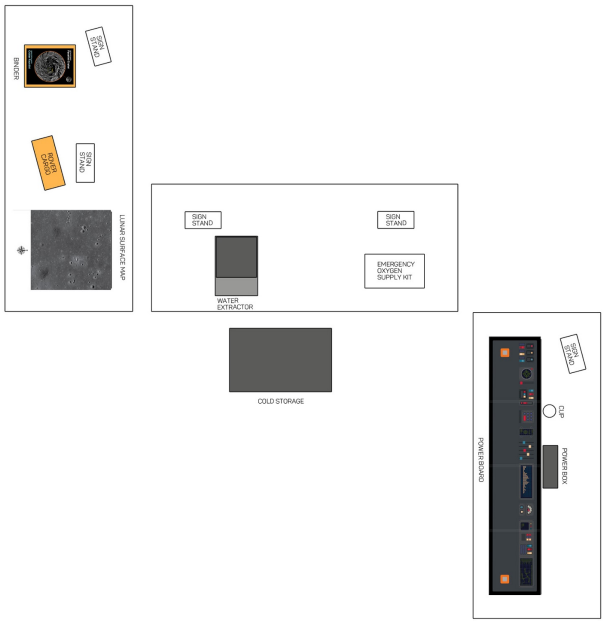
Linear: three six-foot tables



L-shape: three six-foot tables



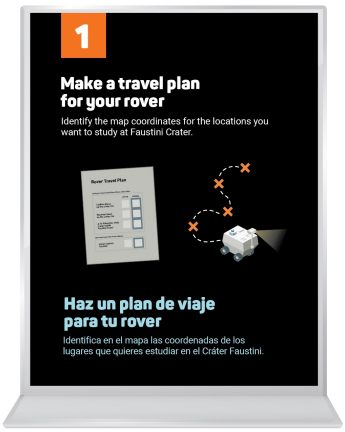
S-shape: three six-foot tables



Challenge 1:
Make a Travel Plan for Your Rover

Objective

Players will identify specific locations on the lunar surface where they will send their remote-controlled rover to collect data. Players will write the coordinates on the Rover Travel Plan. Players will then use the map coordinates to unlock the rover data bank.



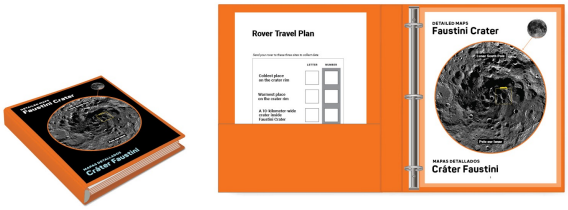
Materials

Durable Materials

- ❑ Table sign in sign holder
- ❑ 3-ring binder with Faustini Crater data maps

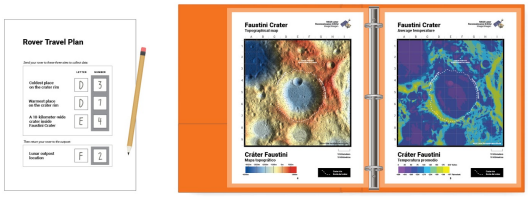
Consumable Materials

- ❑ Rover Travel Plan (1 sheet per gameplay)



Setup

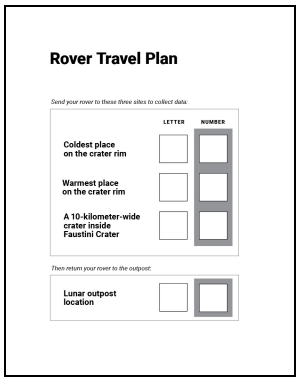
1. Set out the sign and binder
2. Make sure there is a new blank Rover Travel Plan sheet inside



Advanced Prep

- Before you begin, make copies of the Rover Travel Plan sheets so you have enough for as many groups as you plan to take through the game.

- Rover Travel Plan sheet is available in English and Spanish.

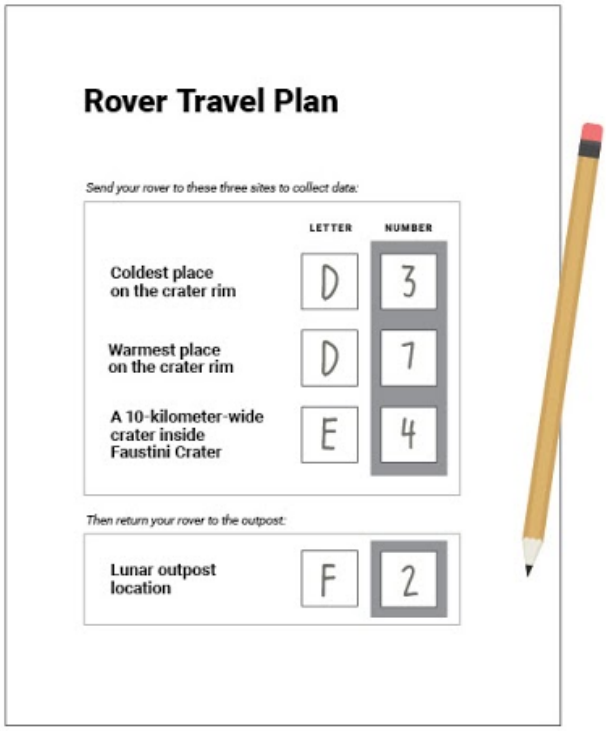


Notes to the Facilitator

- Some of the maps included in the binder are not necessary for completing the challenge, but are included to show relatable comparisons of the size of the Faustini Crater to large US areas.

- For younger players, we offer a suggested adaptation that combines this challenge with Challenge 2. Please see the Early Childhood Adaptation of the Facilitator Narrative Script for more details.

- **Answer Key**
  The numbers 3-7-4-2 from the Rover Travel Plan will open the rover cargo container in the next challenge.



Challenge 2:
Match Rover Data to Locations on the Map

Objective

Outpost sensors have detected strange seismic readings in the area. Using the coordinates from Challenge 1, players will unlock the rover's data bank to access the seismic data their rover has collected. Players will accurately position the data location overlays on the lunar surface map. Players will then match the data blocks on the lunar surface map to reveal a message.

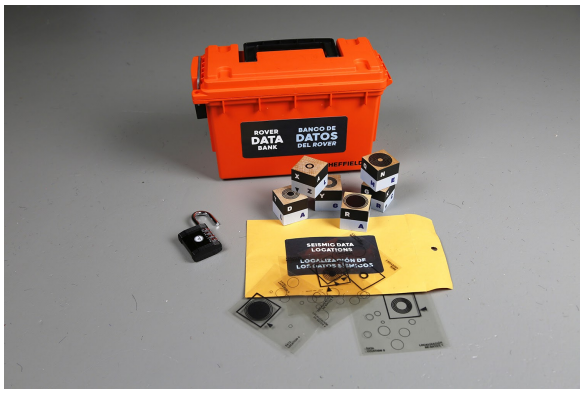
Materials

Durable Materials

- ❑ Table sign in sign holder
- ❑ Lunar surface map
- ❑ Buzzer (should be hidden from players)
- ❑ Locked rover cargo container, including:
  - ❑ Six data blocks
  - ❑ Envelope labeled "Seismic data locations" containing six small plastic overlays (plastic transparency sheets)

Consumable Materials

- ❑ None

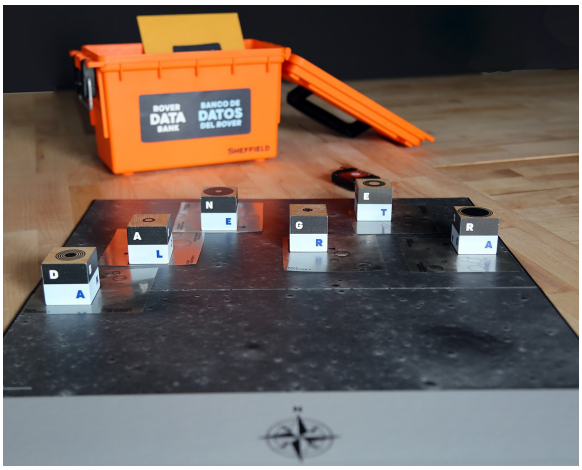


Setup

1. Set out the sign and the map, making certain that north on the map is at the top as players look at it.
2. Set out the rover cargo container, being sure all the data blocks and "Seismic data locations" envelope with six small plastic overlays have been locked inside.
3. Conceal the buzzer on your person or someplace you can easily access it once the message on the blocks is revealed. Players will read "DANGER" aloud on the blocks and you will need to manually set off the buzzer before continuing with the Facilitator Narrative Script.

Advanced Prep

- Place all necessary items in the rover cargo container before the beginning of the game, and lock the container. Be sure to turn the dials on the lock to avoid revealing the combination. Instructions for setting the lock combination are in the First-Time Assembly section of this guide.



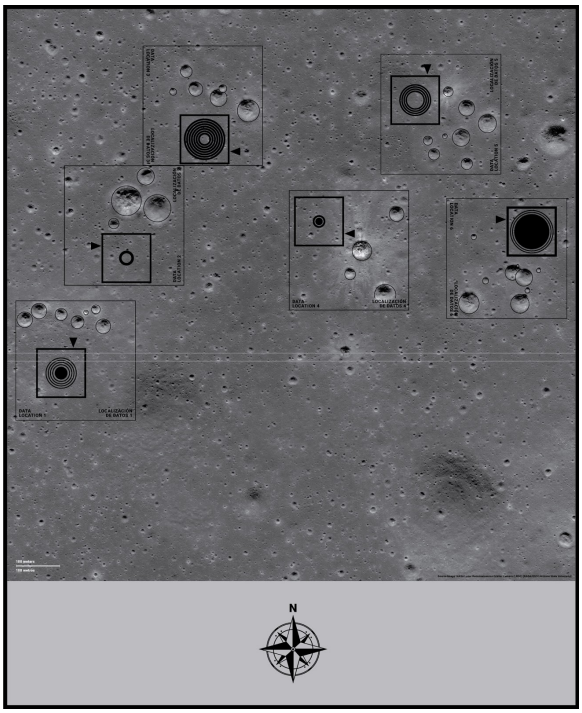
Notes to the Facilitator

- Please note that the facilitator will need to manually set off a buzzer once the message is accurately revealed.

- Players may have a hard time placing the transparencies and blocks onto the map. Make certain the transparencies are right-side up, and that players are placing everything onto the map while facing north.

- For younger players, we offer an adaptation that combines this challenge with Challenge 1. For these audiences you will want to have the transparencies taped to the map from the start instead of including them in the cargo container. Younger players may still need more assistance with placing the blocks. Please see the Early Childhood Adaptation of the Facilitator Narrative Script for more info.

- **Answer Key**
  Lunar surface map data location overlay answer key (on the right).



Challenge 3:
Extract Water from Frozen Lunar Material

Objective

A moonquake cracked the outpost oxygen tanks, so players will need to produce oxygen using water extracted from frozen lunar material. The frozen lunar material is dangerously cold, so players must use the grabber tools to search the cold storage bin and find the ice. Players will then insert the icy material into the water extractor. Once all icy material blocks have been inserted, three vials of water will be released for use in the next challenge.

Materials

Durable Materials

- ❑ Table sign in sign holder
- ❑ Large bin labeled “Cold Storage” including:
  - ❑ Numerous black foam blocks - “Rocky Material”
  - ❑ Five blue wood blocks - “Icy Material”
  - ❑ Grabber tools set on or near the bin
  - ❑ Small box labeled “Water Extractor,” including:
  - ❑ Three vials filled with water (inside)
  - ❑ Large lipped tray (water extractor sits inside to prevent the water vials from falling onto the floor as they drop out)

Consumable Materials

- ❑ Water for three vials (required each time you play)

Setup

- If this is your first time playing the game, please see the First-Time Assembly section of this guide for how to assemble the water extractor.
- Set the water extractor on top of the large tray and place it on the table.
- Fill all three vials with water (tap water is fine) and replace the caps.
- You will want to experiment to ensure the weighted mechanism is operating properly.
    - Load all three vials of water into the water extractor box.
    - To load the vials of water, simply lift the lid of the box and place the vials on the panel inside the box. (The weight of the five blue wooden blocks should cause the mechanism to release the vials.)
    - Set out the sign next to the water extractor on the table.
- The cold storage bin and grabber tools should be placed on the floor next to the table.
- To set up the cold storage bin, mix the five blue wooden blocks in with the black foam blocks. Blue blocks should be fairly concealed so players have to dig through with the grabbers a bit in order to find them. Then close the bin and place the grabbers on top.

Advanced Prep

- Practice using the water extractor yourself. Five wooden cubes should cause the weighted panel mechanism to release the three vials of water.
- Be sure to fill the three water vials and place the vials inside the water extractor before each game. All three vials are necessary in order to have the right amount of water in Challenge 4. Each time you reset the game between groups of players, you will be taking the vials from the test tube rack in Challenge 4, refilling the vials with new water, and placing vials inside the water extractor in Challenge 3.

Notes to the Facilitator

- You may need to remind players that the blue wood blocks and foam represent extremely cold lunar material. This lunar material is too cold to touch with your hands, so players should always use the grabber tools when working with this material.

Challenge 4:
Fill Your Oxygen Tanks

Objective

Players will open the Emergency Oxygen Supply Kit and use the process of electrolysis to split water molecules into hydrogen and oxygen. Players will be able to observe tiny bubbles, indicating oxygen molecules are being released from the water.

Materials

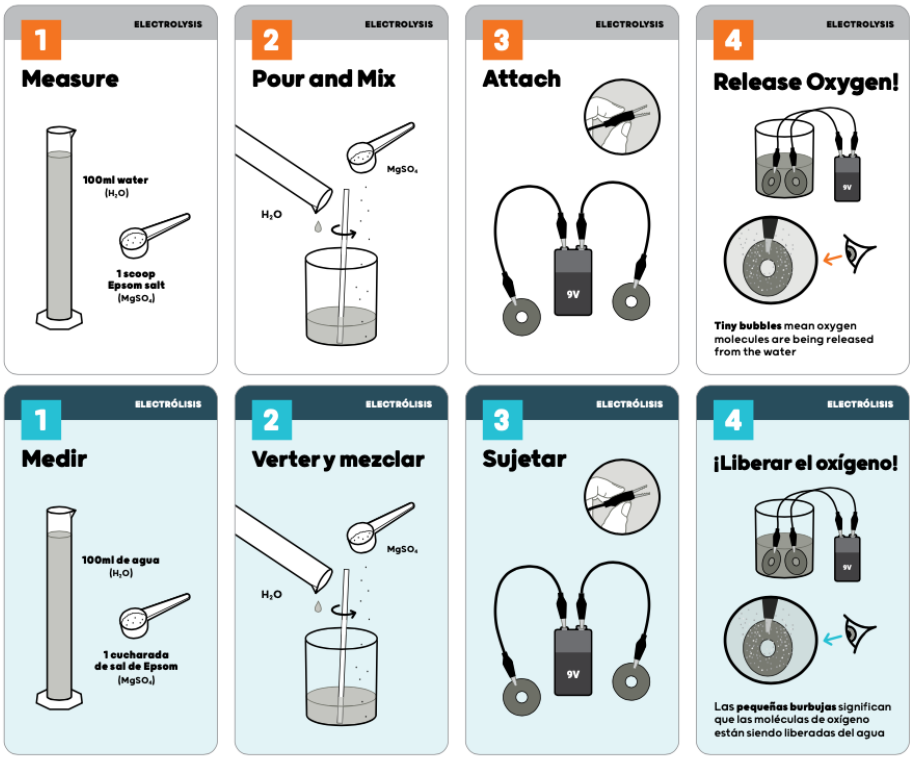
Durable Materials

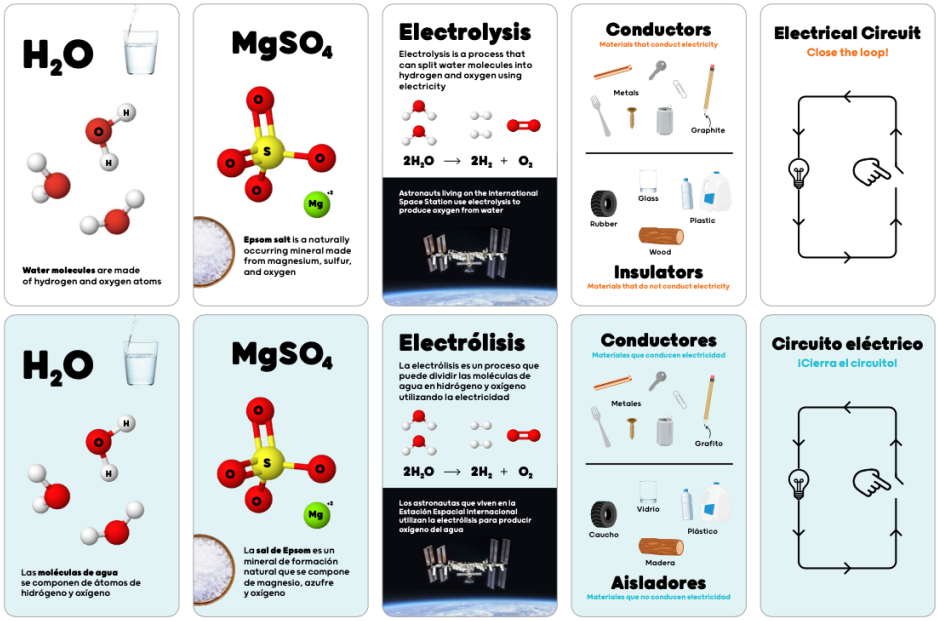
- ❑ Table sign in sign holder
- ❑ Small bin labeled “Emergency Oxygen Supply Kit,” including:
  - ❑ Test tube rack (for water vials from previous challenge)
  - ❑ Container with Epsom salt
  - ❑ Measuring spoon (for Epsom salt)
  - ❑ Graduated cylinder (for measuring water)
  - ❑ Funnel
  - ❑ Clear cup (for mixing)
  - ❑ Wooden stir stick/dowel (for mixing)
  - ❑ Two wires with alligator clips
  - ❑ Two metal washer rings
  - ❑ Instruction cards (includes electrolysis instruction cards and additional cards for next challenge)
- ❑ Bucket (for dumping waste water between groups, if you are not near a sink)
- ❑ Pitcher (for refilling the water vials between groups, if you are not near a sink)
- ❑ Cloth (for wiping down wet surfaces between groups)

Consumable Materials

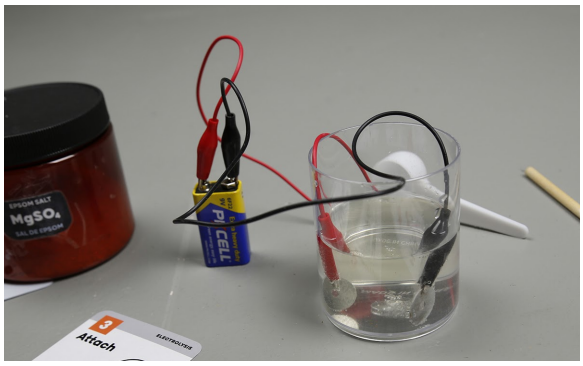
- ❑ Epsom salt (in Emergency Oxygen Supply Kit) (1 tablespoon per gameplay)
- ❑ 9-volt battery (in Emergency Oxygen Supply Kit) (should last for hundreds of gameplays)

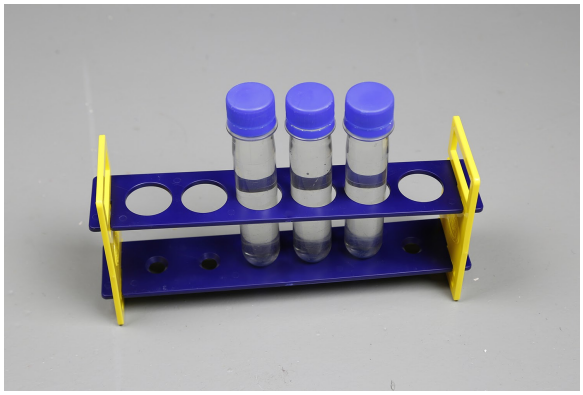
Electrolysis Instruction Cards





Setup





1. To set up the Emergency Oxygen Supply Kit, be sure all items listed above are indeed included in the bin before the start of each game! If you plan to play the game multiple times in a row, make sure you have enough Epsom salt stocked for all rounds. Before closing the bin, check that the electrolysis instruction cards are NOT in order for the start of the game. Note that some of the cards mixed in with these are not necessary for this challenge, but may be helpful to some players for the following challenge.
2. Set out the sign and empty test tube rack next to the Emergency Oxygen Supply Kit. Remember, the test tube rack is for the water vials that players collect in Challenge 3, and thus empty at the start of the game.
3. If you are playing the game multiple times in a row, keep the following handy:
    - Cloth – for wiping down the items in the supply kit that get wet
    - Bucket – for dumping waste water quickly between games (if you are not near a sink)
    - Pitcher – for refilling the vials with new water between games (if you are not near a sink)

Advanced Prep

- Besides checking that all the items are inside the Emergency Oxygen Supply Kit prior to each round of the game, you will also want to periodically restock items as needed. The Epsom salt is a consumable that will need to be replaced regularly; other items like the washers and the 9-volt battery will need to be replaced periodically. Washers not wiped down after each use will eventually corrode, and in time the battery will also need to be replaced.

Notes to the Facilitator

- **Safety note:** As soon as players finish this challenge, the facilitator should disconnect the 9-volt battery to avoid draining the battery. Players should not have access to this battery in Challenge 5.

- **Safety note:** Epsom salt and water containing Epsom salt is not harmful if spilled. Visitors do not need to wear goggles or gloves.

- **Instruction cards:** This challenge includes a set of step-by-step instruction cards for players to use not only in the electrolysis process but also for the following challenge. The additional cards give examples of conductive and nonconductive materials to help players complete the circuit in Challenge 5. Some players may not need these additional cards, but if a group is having trouble with Challenge 5, be sure to refer the players to the cards for suggestions.

- The tiny bubbles released in the electrolysis process are very small! Remind players that they will need to look closely to actually see these.

- Players may be familiar with the term *electrolysis* as a method of hair removal. Despite using the same word, the term has an entirely different meaning when referring to the hair removal process. Electrolysis as demonstrated in this activity is a technique that uses electricity to split oxygen from water molecules. This electrolysis process is how the International Space Station produces some of its oxygen from water.

- Epsom salt is used to increase the conductivity of the water. Epsom salt is a naturally occurring mineral made from magnesium, sulfur, and oxygen. It is named after the town of Epsom, England.

Challenge 5:
Reconnect the Power Supply

Objective

The moonquake damaged the connecting wires to the power supply and the outpost is running on backup batteries. Players will use conductive materials to complete the circuit and restore power to the damaged outpost. Players will hear the equipment restart, indicating power is restored to the outpost.

Remember, some players may need to refer to the instruction cards included in Challenge 4 to learn more about conductive materials.

Materials

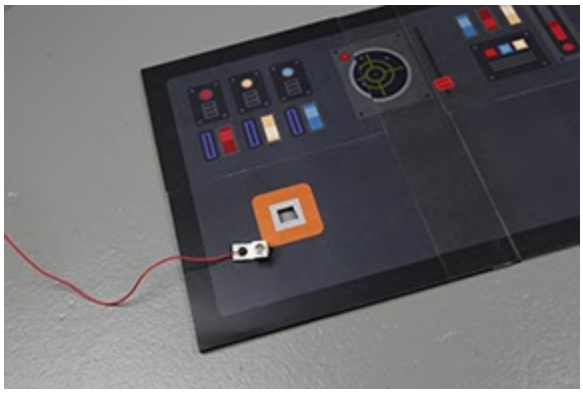
Durable Materials

- ❑ Table sign in sign holder
- ❑ Power board
- ❑ Power box
- ❑ Steve Spangler Energy Stick®
- ❑ Pencil sharpener
- ❑ Plastic mug with miscellaneous conductive and nonconductive items:
  - ❑ Pencil (sharpened on both ends)
  - ❑ Metal ruler
  - ❑ Alligator clips
  - ❑ Mechanical pencil
  - ❑ Metal measuring spoon
  - ❑ Telescoping magnetic retrieval tool
  - ❑ Plastic ruler
  - ❑ Rubber eraser/rubber band
  - ❑ Metal straw
  - ❑ Paper clips
  - ❑ Chopstick
  - ❑ Nonconductive emery board
  - ❑ Paint brush

Consumable Materials

- ❑ Steve Spangler Energy Stick® (should last for hundreds of gameplays)

Setup



1. If this is your first time playing the game, please see the First-Time Assembly section of this guide for how to assemble the power box and power board.
2. To set up the power box, make sure the Energy Stick® is inserted and working.
3. To assemble the power board, start by unfolding the power board and placing it face-down across the table. Once unfolded, look for the two half-inch square holes at each end of the power board. There are two mechanical lugs attached to the two red wires coming out of the power box. These lugs need to be inserted into these holes. Once inserted, the wires should be placed underneath the board. You can apply a small piece of the black electrical tape to hold the wire and lug in place if needed. Again, be sure the board is face-down when inserting the lugs so the wires are hidden from players underneath the board. Finally, carefully flip the power board over, noting that the wires should still be connected to the power box as well. Place the power box at the top center area of the power board.
4. Set out the sign and fill the mug with all the conductive and nonconductive items and place it next to the power board.

Advanced Prep

- Be sure you have a mix of conductive and nonconductive materials in the mug. Also be sure there are enough conductive pieces for players to complete the circuit across the board.

Notes to the Facilitator

- **Safety note:** When discussing conductive materials, point out materials that are conductive and those that have insulating properties shown on the electrolysis instruction cards; encourage players to always be safe around electricity.

- When storing the game, remove the mechanical lugs from the power board before folding it up. You can store the power box with the wires and lugs still connected to the Energy Stick®, just be sure these do NOT touch or they will complete the circuit and drain the battery, which cannot be replaced. One option is to wrap the lugs in nonconductive materials such as paper and tape.

Wrap-up and Reflections

Objective

Players celebrate their team's accomplishments! Players have worked together to survive the moonquake and restore power to the outpost. The facilitator will engage players in a conversation about living on the Moon and discuss how NASA scientists and engineers are working to send humans to the Moon.

Materials

Durable Materials

- ❑ None

Consumable Materials

- ❑ Stickers and temporary tattoos (Artemis logos)

Notes to the Facilitator

- After players have solved the final challenge and restored the necessary systems to survive, you'll want to have the group reflect on their experience. If there is time, this is an excellent opportunity to dive deeper into the science content connections and background information of the game.
- The Facilitator Narrative Script offers prompts to start conversations with visitors. The best way is to simply ask players about their experience:
    - Did you like being an astronaut on the Moon?
    - Would you ever like to live on the Moon?
    - What would you bring from home to the Moon? What about taking your friends and family along?
- If you have time to expand upon your conversations with players, the Facilitator Narrative Script also offers some suggestions for ways to connect responses from players with real NASA missions:
    - NASA scientists and engineers are working to send humans to the Moon by 2024 as part of NASA's Artemis mission.
    - Water ice has actually been found on the Moon and will be crucial for survival and producing energy.
    - Astronauts living on the International Space Station use electrolysis to produce oxygen from water.
- For more content connections and background, including information on NASA's new Artemis mission to the Moon, check out the Background and Extensions section.
- Finally, remember to thank players at the end and offer them an Artemis sticker or tattoo. You should also encourage them to recycle their game tracker—unless they'd like to take it back home to Earth as a souvenir!

Safety and Cleanup

COVID-19

The game can comply with COVID-19 physical distancing recommendations when played in small groups composed of members of the same household. This game has been tested with museum visitors wearing face masks and practicing physical distancing. This may require tables to be spaced farther away from walls so the facilitator can stand behind tables at least six-feet away from visitors.

Given the hands-on nature of this game, and that participants will need to touch materials, you may want to keep hand sanitizer nearby for participants to use before and after the game. Depending on the policies of your institution, you may also need to sanitize physical materials and high-touch surfaces intermittently or between each group of players. Most surfaces can be cleaned using regular methods that are already in place at your museum.

Queuing should be separated from the gameplay area to not give away the ending as well as keep safe distances between groups. If you have multiple groups waiting to play the game, you will want to ensure that there is enough space in the queuing area to put appropriate distances between different groups waiting to play the game.

Specific Safety Notes

- **Challenge 4:** Epsom salt and water containing Epsom salt is not harmful if spilled. Visitors do not need to wear goggles or gloves.
- **Challenge 4:** As soon as players finish Challenge 4, the facilitator should disconnect the 9-volt battery to avoid draining the battery. Players should not have access to this battery in Challenge 5.
- **Challenge 5:** When discussing conductive materials, point out materials that are conductive and those that have insulating properties shown on the electrolysis instruction cards; encourage players to always be safe around electricity.
- **Choking Hazards:** Wood blocks and foam pieces are larger than minimum choking sizes; some pieces in the game (such as the metal washers) do present choking hazards to young children.

Cleanup and Storage

When you are ready to put materials away for storage, we recommend keeping the materials for each challenge together. The best way to do this is to assign each challenge its own bin. Note that items like the power board in Challenge 5 will fold flat for easy storage, but items like the water extractor in Challenge 3 will not fold flat again once assembled. If you are storing components in new bins, you can print your own storage labels; please see the Printing DIY section of this guide for details. Most materials should easily pack away, but for the following, be sure to address these storage guidelines:

- **Challenge 4:** Metal washers from Challenge 4 should be wiped down to prevent corrosion.
- **Challenge 4:** Be sure the 9-volt battery is disconnected to avoid draining the battery.
- **Challenge 5:** Be sure that the mechanical lugs wired to the Energy Stick® do not touch or they will complete the circuit and drain the battery, which cannot be replaced.

Resetting Materials Between Groups and Consumables

Resetting Materials Between Groups

If playing the game multiple times, remember that you will have to reset game pieces before each new group. This should not take more than five minutes. Here is a quick checklist of all items to reset:

Challenge 1: Faustini Crater maps binder

- ❑ Replace the Rover Travel Plan sheet from the previous group with a new sheet
- ❑ Close the binder

Challenge 2: Rover cargo container

- ❑ Return six overlays to the envelope
- ❑ Return the envelope and six data blocks to the container
- ❑ Close and lock the container; make certain the lock combination is not still revealed!

Challenge 3: Cold storage bin and water extractor

- ❑ Cold storage bin
  - ❑ Remove the five blue wood blocks from the water extractor
  - ❑ Mix these blocks back in with the black foam blocks in the cold storage bin
  - ❑ Close the bin and set the grabbers on top
- ❑ Water extractor
  - ❑ Refill the vials of water used in Challenge 4 (use the included pitcher if you are not near a sink)
  - ❑ Place the vials of water inside the water extractor

Challenge 4: Emergency Oxygen Supply Kit

- ❑ Disconnect washers, alligator clips, and battery
- ❑ Dump the water from the cup (use the included bucket if you are not near a sink)
- ❑ Dry the cup, cylinder, washers, and plastic spoon with cloth included
- ❑ Return all materials to the bin
  - ❑ Instruction cards (shuffle and remember some may have been used in Challenge 5)
  - ❑ Epsom salt (check supply periodically and refill as needed)
  - ❑ Graduated cylinder
  - ❑ Funnel
  - ❑ Measuring spoon
  - ❑ 9-volt battery (check battery periodically and replace when necessary)
  - ❑ Clear cup
  - ❑ Two wires with alligator clips
  - ❑ Two metal washer rings (check washers for corrosion and replace as necessary)
  - ❑ Wooden stir stick/dowel for mixing

Challenge 5: Power board and power box

- ❑ Disconnect all materials used to complete the circuit on the power board and return them to the cup

Consumable Materials

Only a small number of materials will be consumed each time you play the game; some additional materials will need to be checked each time the game is played.

Welcome

- ❑ Progress Tracker (1 sheet per gameplay)

Challenge 1: Make a Travel Plan for Your Rover

- ❑ Rover Travel Plan (1 sheet per gameplay)

Challenge 3: Extract Water from Frozen Lunar Material

- ❑ Water for three vials (required each time you play)

Challenge 4: Fill Your Oxygen Tanks

- ❑ Epsom salt (in Emergency Oxygen Supply Kit) (1 tablespoon per gameplay)
- ❑ 9-volt battery (in Emergency Oxygen Supply Kit) (should last for hundreds of gameplays)

Challenge 5: Reconnect the Power Supply

- ❑ Steve Spangler Energy Stick® (should last for hundreds of gameplays)

Wrap-up and Reflection

- ❑ Stickers and temporary tattoos (should last for hundreds of gameplays)

Adaptations for Different Audiences and Settings

This game was designed to be played live and in person by 3–6 participants in a museum setting, with support from a museum educator or volunteer facilitating the game. However, the game can easily adapt for use in other settings and with larger groups.

This game is also suitable for use in other informal learning settings such as after-school programs, summer camps, libraries, scouting groups, community organizations, and university public outreach programs. It may also be adapted by educators for use in formal education K–12 classrooms.

Extending the Length of the Experience

When adapting the game for other educational settings (K–12 classrooms, after-school programs, summer camps, libraries, scouting groups, community organizations, and university public outreach programs), you may find it useful to extend the length of the experience to fit your specific needs. Great places to start building in additional content are at the beginning and end of the game. For example, before the game begins you could talk to players about some basic Moon facts and NASA's past Apollo program. During post-game reflection you could watch one of the many short informational films about NASA's new Artemis mission to the Moon. The Background and Extensions section of this guide reviews these and a number of other resources that could be paired with this game to expand the overall experience.

Roles

In addition to content, you can also build upon the number of roles players can have in the game. The Facilitator Narrative Script includes two suggested roles:

- One player is given the clipboard with the Progress Tracker sheet, manages the group's progress, and reads the instructions aloud.
- Another player is the communications specialist and is given the three Mission Control cards and communicates with the facilitator if the group decides they need assistance from Mission Control on Earth.

However, you could create additional roles to task players with as well. For example, each challenge could have a different specialist who leads the group through that particular challenge. Or with larger groups you may even have specialists for each individual task in all challenges.

Larger Groups

We highly recommend breaking larger groups into smaller teams. With this, it is a good idea to have enough copies of items like the tracker sheet and the maps binder in Challenge 1 so that each team can have their own copy. For other challenges, if creating additional physical resources is not an option, you can divide tasks among players to give everyone hands-on time with the resources. For example, if you have two teams, you could have one team collect all the ice blocks from cold storage in Challenge 3, then the second team can insert these into the water extractor to release the vials of water for Challenge 4.

If you plan to play the game with larger groups of 20 players or more, we recommend that you break up into smaller groups and rotate through other activities in addition to the Moon Adventure Game. This can

be a great opportunity to use activities from the Explore Science: Earth & Space toolkits. Keep in mind that if you do this, you should host other activities in a separate area so that the end of the game is not given away to those who haven't yet had a chance to play. Please see the Background and Extensions section of this guide for more resources.

If you choose to create another copy of the game, you can refer to the Materials DIY and Printing DIY sections of this guide to assist in creating another set of most (if not all) physical resources to ensure all players can still engage with challenge materials.

Younger Audiences

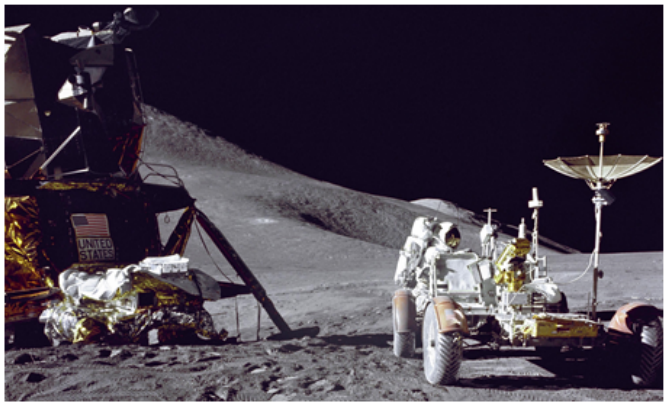
This game is designed to engage a target audience of families with children and students grades 4–8. See the Early Childhood Adaptation of the Facilitator Narrative Script for more information on adapting the game for younger audiences.

BACKGROUND and EXTENSIONS >

Background Content Organized by Challenge

Introduction and Moon Basics

NASA has been exploring the Moon since the late 1950s—starting with spacecraft flybys and impactors before moving on to orbiters and landers. NASA's Apollo program was designed to land humans on the Moon and bring them safely back to Earth. Apollo 11 first achieved this goal with astronauts Neil Armstrong and Buzz Aldrin landing on the Moon on July 20, 1969. Six Apollo missions (Apollos 11, 12, 14, 15, 16, and 17) landed on the Moon and returned a wealth of scientific data and almost 400 kilograms of Moon rocks. Astronauts conducted experiments related to soil mechanics, meteoroids, seismic activity, heat flow, lunar ranging, magnetic fields, and solar wind. In total, 12 men walked the Moon and spent roughly 80 cumulative hours on its surface.



The Moon is dry with almost no atmosphere and no liquid water. Its surface is rocky and covered with dust. It is very hot on the daytime side but gets extremely cold on the nighttime side. Because the Moon is less massive and smaller than the Earth, you'd feel significantly lighter on the Moon. In fact, you'd weigh only about 1/6 of what you weigh on Earth. Walking would be easier, and you could jump higher

and lift things that were too heavy for you on Earth, but you'd need to wear a spacesuit at all times to survive. The spacesuit would allow you to breathe, drink, and maintain your body temperature.[1]

While astronauts have spent long periods of time in space—sometimes over a year on the International Space Station in low Earth orbit—the longest Moon missions so far have only lasted a few days. Extended stays on the Moon would require everything needed for previous Moon missions—food, oxygen, water, and power—but much more of it with a bigger home away from home than the Apollo lander. This game explores the challenges of living and working in a future lunar outpost.

Going Further

- The Exploration of the Moon: A History
  https://moon.nasa.gov/exploration/history/
- The Moon vs. Earth: By the Numbers
  https://solarsystem.nasa.gov/moons/earths-moon/by-the-numbers/

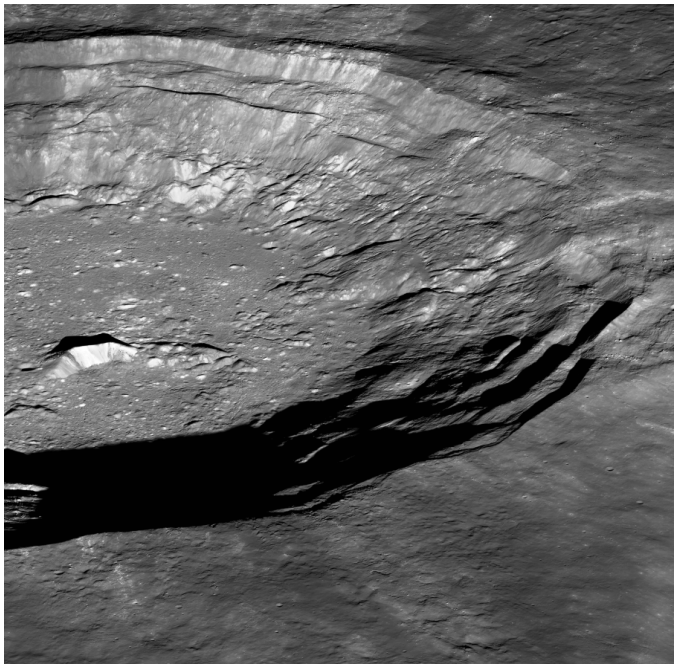
[1] (upper left) Apollo 12 Lunar Module, in Landing Configuration, Photographed in Lunar Orbit, Credit: NASA/JSC
https://moon.nasa.gov/resources/196/apollo-12-lunar-module-in-landing-configuration-photographed-in-lunar-orbit/?category=images
Image credit: NASA/JSC

(lower left) Astronaut Alan Shepard During Apollo 14 EVA on the Moon, Credit: NASA/JSC
https://moon.nasa.gov/resources/215/astronaut-alan-shepard-during-apollo-14-eva-on-the-moon/?category=images

(upper right) Loading the Rover, Apollo 15, Credit: NASA
https://moon.nasa.gov/resources/104/loading-the-rover/?category=images

(lower right) Apollo 17 EVA, Credit: NASA/Gene Cernan
https://moon.nasa.gov/resources/50/apollo-17-eva/?category=images

Challenge 1: Make a Travel Plan for Your Rover (Background)



The Moon is covered with craters. Craters form when a space object, like an asteroid, comet, or meteoroid, hits a rocky body like a planet or moon. Craters can be seen all over the solar system, including on Mercury, the Moon, Earth, Mars, and Pluto. On Earth, weathering caused by soil erosion, rain, and earthquakes can cover up and wear away older craters. On the Moon, where there is almost no atmosphere and very little weathering, most craters remain on the surface, creating a record of the history of impacts.

NASA has used orbiter images of the Moon to plan for missions since the time of Apollo. Apollos 8 and 10 tested various components while orbiting the Moon, and returned photography of the lunar surface to prepare for Apollo 11's celebrated landing. Today, scientists use NASA's Lunar Reconnaissance Orbiter to identify possible landing sites for future lunar landers of NASA's Artemis program, explore permanently shadowed regions of craters for signs of water ice, and produce detailed topographical maps of the Moon's surface.[2]

Faustini Crater, near the Moon's South Pole, was selected for this challenge because part of it is permanently in shadow and there is good evidence for water ice near the surface. Permanently shadowed regions are found inside deep craters that lie almost perpendicular to the Sun, never receiving its warmth or light. The floor of Faustini Crater is shaded from both the Sun and light reflected from Faustini's walls, keeping its permanently shadowed region very cold and a perfect site for water ice to persist. There is also a 10-kilometer-wide interior crater called Malinkin inside Faustini Crater.

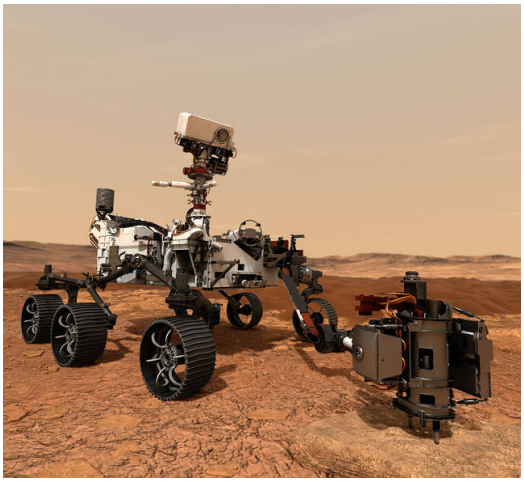
Going Further

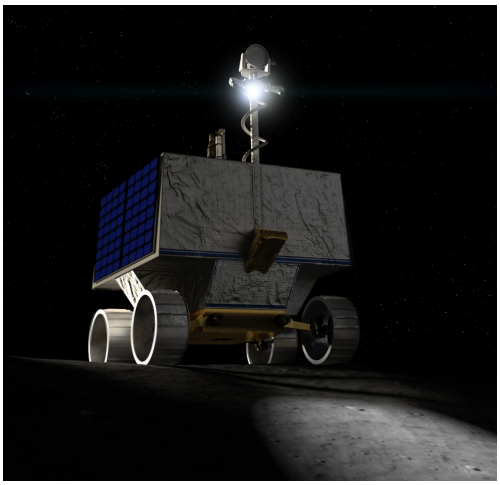
- NASA's Scientific Visualization Studio: The Moon's Permanently Shadowed Regions https://svs.gsfc.nasa.gov/11218

[2] Southside, Aristarchus Crater as photographed by LRO, Credit: [NASA/GSFC/Arizona State University http://www.lroc.asu.edu/posts/592

Challenge 2: Match Rover Data to Locations on the Map (Background)

Rovers are an important tool for NASA scientists. These remote-control mobile laboratories are adept at navigating the rocky terrain of worlds like the Moon and Mars. The Curiosity rover, which is currently exploring Mars, has onboard cameras, spectrometers, and radiation detectors that allow it to carefully study Mars' soil, rocks, and atmosphere. The new Perseverance rover will use a special drill to take a core sample of Martian rocks and soils that will be packaged for a future return trip to Earth. By gathering new surface data about our nearest celestial neighbors, rovers help NASA's astronauts prepare for future exploration missions farther into the solar system.



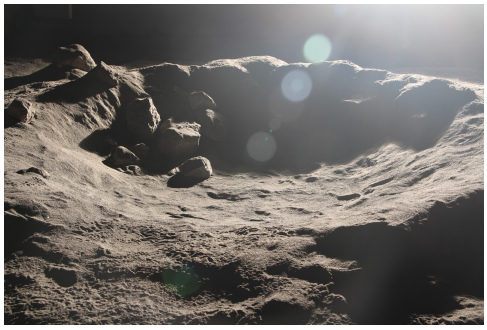


To gather more on-the-ground data about the South Pole of the Moon, NASA plans to launch a golf cart–sized rover called the Volatiles Investigating Polar Exploration Rover (VIPER). Slated for delivery to the lunar surface in the early 2020s, VIPER will help create the first map of the Moon's water ice. After detecting signs of water ice, VIPER will be able to drill roughly one-meter into the Moon's surface to sample its soil. Like previous NASA rovers, scientists have tested VIPER's specialized wheels and motors on various slopes, textures, and soils here on Earth that simulate the target environment. But the VIPER team also faces new challenges different from those tackled by previous rover missions to Mars. For starters, the rover's hardware must withstand massive changes in surface temperatures, over 260°C (500°F) between sunlight and shade on the Moon. A battery, heat pipes, and radiators will help keep the rover's parts from freezing or overheating.[3]

[3] (left image) In this illustration, NASA's Perseverance rover uses its drill to core a rock sample on Mars. Image credit: NASA https://www.nasa.gov/perseverance/images

(right image) An illustration of NASA's Volatiles Investigating Polar Exploration Rover (VIPER), a mobile robot that will roam around the Moon's South Pole looking for water ice. Credit: NASA/Ames Research Center/Daniel Rutter https://www.nasa.gov/perseverance/images https://www.nasa.gov/viper/overview

The extreme swings in light and dark at the poles of the Moon are nothing like those on Earth or Mars and produce very long, fast-moving shadows. The solar-powered VIPER must retreat from these advancing shadows as it seeks out the right territory to sample while maintaining communications with Earth. Given all the shadows and dark craters of the Moon's South Pole, VIPER will also be the first NASA rover to need headlights to help drivers navigate.[4]

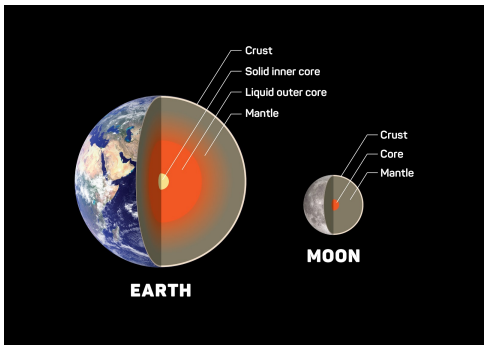


Going Further

- NASA's Mars 2020 Mission Perseverance Rover https://mars.nasa.gov/mars2020/

Moonquake! (Background)

Between Challenges 2 and 3, the players will encounter a quake on the Moon—called a moonquake. Earthquakes typically result from movement in the Earth's crust as large pieces of the Earth's surface (tectonic plates) collide, move apart, or slide next to each other. This movement is caused by convection in the Earth's hot and active mantle. The Moon's internal structure is more rocky and cooler than the Earth's, so there are no active tectonic plates or volcanoes on the Moon.



Because of these differences, scientists were surprised to detect moonquakes. After studying seismic data collected by NASA's Apollo missions, scientists concluded that quakes on the Moon are caused by (1) *tidal forces* as the Moon travels closer to or farther from the Earth; (2) *temperature changes* as different parts of the Moon experience day and night; (3) *shrinkage* as the deeper layers of the Moon continue to cool; and (4) space objects (asteroids, comets, or meteoroids) striking the surface and causing vibrations. Quakes on the Moon appear to be less forceful than those on Earth, but last longer. Moonquakes could be a potential hazard for future lunar missions and long-term habitats.

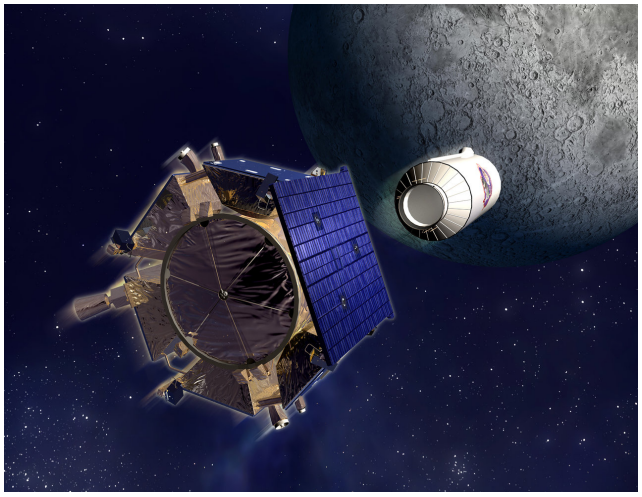
Going Further

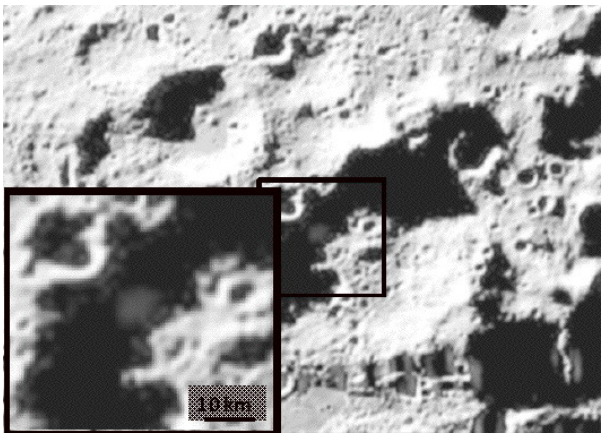
- NASA Science Earth's Moon – The Moon's Interior (select "Core" on the vertical TOOL menu to the right of the interactive Moon for a cut-away view) https://moon.nasa.gov/

[4] (upper right) Lunar Lab testbed at NASA Ames, a 12-foot-square sandbox containing a human-made lunar soil simulant. Light looks different on the Moon because the Moon isn't big enough to hold a significant atmosphere; there is no air and there are no particles in the air to reflect and scatter sunlight. On Earth, shadows in otherwise bright environments are dimly lit with indirect light from these tiny reflections. Credit: NASA/Uland Wong
https://www.nasa.gov/sites/default/files/thumbnails/image/lunartestbed_6116.jpg
https://www.nasa.gov/ames/feature/the-dark-side-of-the-crater-how-light-looks-different-on-the-moon-and-what-nasa-is-doing
(lower right) The Moon and the Earth have differences in their internal structures. For example, scientists believe that the Moon has an inner core that is relatively small compared with the Earth's.

Challenge 3: Extract Water From Frozen Lunar Material (Background)

How do scientists know that the Moon's poles have water ice? After an orbiting spacecraft detected large amounts of hydrogen above the poles, scientists developed NASA's Lunar Crater Observation and Sensing Satellite (LCROSS) mission to slam a projectile into a crater near the Moon's South Pole. The 40-foot-long projectile kicked up a giant plume of debris from its target, the Cabeus Crater, which the LCROSS spacecraft flew through and analyzed. Scientists found evidence for water ice in the plume, presumably from the Moon's accessible crust. This discovery changed our view of the Moon—it was no longer just a dry, dusty rock but instead a world containing a vital resource for human space exploration.[5]





This game helps players understand the importance of finding water ice on the Moon's surface. While no NASA mission has yet mined water ice on the Moon, mapping and extracting water ice will be a critical objective for any long-term lunar residents. Lunar water ice—perhaps amounting to hundreds of millions of tons—may be mixed together with other frozen material and will therefore need to be processed and purified. While LCROSS revealed water ice beneath the Moon's surface, NASA's Moon Mineralogy Mapper (M3) instrument on India's Chandrayaan-1 spacecraft collected evidence for water ice sitting at the surface, within the top few millimeters. NASA scientists will learn more about the water ice of the Moon through robotic missions, like VIPER, and when humans return to the Moon during the Artemis program.

Going Further

- NASA's Scientific Visualization Studio: Water On The Moon
  https://svs.gsfc.nasa.gov/11756

[5] (left image) Artist's rendering of the Lunar Crater Observation and Sensing Satellite (LCROSS) spacecraft. Credit: NASA
https://www.nasa.gov/ames/lcross
https://www.nasa.gov/sites/default/files/thumbnails/image/1171_226580main_2007-08-02_on_way_in.jpg

(right image) The visible camera image showing the ejecta plume at about 20 seconds after impact. Credit: NASA
https://www.nasa.gov/ames/lcross
https://www.nasa.gov/sites/default/files/thumbnails/image/402247main_lcross_results1_full.jpg

Challenge 4: Fill Your Oxygen Tanks (Background)

Water ice on the Moon can be mined for its oxygen, which humans need to breathe. But how do astronauts living in space get their oxygen now? The International Space Station (ISS) currently serves as the only long-term space residence for astronauts and has been in orbit since 1998. Astronauts get their oxygen on the ISS through electrolysis, pressurized oxygen tanks, or using a solid fuel oxygen generator.

The primary Oxygen Generation System is composed of the cell stack, which electrolyzes, or breaks apart, water provided by the Water Recovery System, yielding oxygen and hydrogen as byproducts. The station's football field–sized solar arrays are the power source to electrolyze the water. The resulting oxygen is delivered to the cabin atmosphere while the hydrogen is either vented into space or fed to the carbon dioxide reduction assembly. The assembly uses that hydrogen along with carbon dioxide exhaled by the crew in a Sabatier reactor. The byproducts of that process are methane, which is released into space, and water for use by the crew.[6]

ISS also gets deliveries of oxygen and nitrogen from supply ships, like the SpaceX Dragon and other spacecraft to keep its pressurized tanks full. The gases are mixed together by the ISS life support systems to replicate the atmosphere on Earth. Astronauts can also use a chemical oxygen generator to produce oxygen from burning solid lithium perchlorate—referred to as an oxygen candle. These alternatives are crucial when there are disruptions in electrolysis-based oxygen generation—such as when the Russian-built Elektron system broke down in the early 2000s.

Going Further

- International Space Station Tour
  https://www.nasa.gov/mission_pages/station/main/suni_iss_tour.html

[6] NASA astronaut Doug Wheelock, works to install the new Sabatier system that will extract more water out of the International Space Station atmosphere. Credit: NASA
https://www.nasa.gov/mission_pages/station/research/news/sabatier.html
https://www.nasa.gov/sites/default/files/thumbnails/image/14-269c.jpg

Challenge 5: Reconnect the Power Supply (Background)

Any future lunar outpost would most likely use solar panels to power its components. Engineers have developed technologies to convert solar energy to electrical power efficiently. Solar arrays that convert energy to electricity are made of thousands of solar cells. The solar cells are made from purified chunks of the element silicon. These cells directly convert light to electricity using a process called photovoltaics.

For the ISS, NASA and its partners developed a method of mounting solar arrays on a "blanket." The blanket can be folded like an accordion for delivery to space and then deployed, or spread out, to its full size once in orbit. Once in orbit, ground controllers sent commands to deploy the blankets to their full size. Gimbals are used to rotate the arrays so that they face the sun to provide maximum power to the space station. Each of the eight solar arrays is 112 feet long by 39 feet wide.[7]

Altogether, the solar arrays can generate 84 to 120 kilowatts of electricity, enough to provide power to more than 40 homes. The solar arrays produce more power than the station needs at one time for station systems and experiments. When the station is in sunlight, about 60 percent of the electricity that the solar arrays generate is used to charge the station's batteries. At times, some or all of the solar arrays are in the shadow of Earth or the shadow of part of the station. This means that those arrays are not collecting sunlight. The batteries power the station when it is not in the Sun.

In addition to solar arrays and batteries, a lunar outpost may also require a nuclear power source. While an outpost placed on the South Pole could receive constant sunlight in the right location, a backup power source would be helpful in emergency situations. Many NASA missions have been powered by the heat generated by radioactive decay in a nuclear generator. Miniature fission reactors may also be considered.

Going Further

- Why NASA thinks nuclear reactors could supply power for human colonies in space https://cen.acs.org/energy/nuclear-power/NASA-thinks-nuclear-reactors-supply/98/i19

[7] International Space Station (ISS) solar panel intersecting Earth's horizon. Image source: https://en.wikipedia.org/wiki/Electrical_system_of_the_International_Space_Station#/media/File:ISS_solar_panel_intersecting_Earth's_horizon.jpg

Wrap-up and Reflections (Background)

With the Artemis program, NASA plans to land the first woman and next man on the Moon by 2024, using innovative technologies to explore more of the lunar surface than ever before. Learn more about Artemis from the NASA fact sheets on the next two pages.

Background Content Source Documents

- Lunar Reconnaissance Orbiter (LRO) Peers into Permanent Shadows
- https://svs.gsfc.nasa.gov/4043
- What is LCROSS, the Lunar Crater Observation and Sensing Satellite? https://www.nasa.gov/ames/lcross
- All About the Moon https://spaceplace.nasa.gov/all-about-the-moon/en/
- New VIPER Lunar Rover to Map Water Ice on the Moon https://www.nasa.gov/feature/new-viper-lunar-rover-to-map-water-ice-on-the-moon
- VIPER Mission Overview https://www.nasa.gov/viper/overview
- Ice Confirmed at the Moon's Poles https://www.nasa.gov/feature/ames/ice-confirmed-at-the-moon-s-poles
- Breathing Easy on the Space Station https://science.nasa.gov/science-news/science-at-nasa/2000/ast13nov_1
- Environmental Control and Life Support System (ECLSS) Fact Sheet https://www.nasa.gov/sites/default/files/atoms/files/g-281237_eclss_0.pdf
- International Life Support https://www.nasa.gov/pdf/602090main_44s_international_life_support.pdf
- The Sabatier System: Producing Water on the Space Station https://www.nasa.gov/mission_pages/station/research/news/sabatier.html
- About the Space Station Solar Arrays https://www.nasa.gov/mission_pages/station/structure/elements/solar_arrays-about.html

WHAT IS ARTEMIS?

National Aeronautics and Space Administration

NASA is committed to landing American astronauts, including the first woman and the next man, on the Moon by 2024. Through the agency's Artemis lunar exploration program, we will use innovative new technologies and systems to explore more of the Moon than ever before. We will collaborate with our commercial and international partners to establish sustainable missions by 2028. And then we will use what we learn on and around the Moon to take the next giant leap—sending astronauts to Mars.

WHY GO TO THE MOON?

With the Artemis program we will:

- Demonstrate new technologies, capabilities, and business approaches needed for future exploration including Mars
- Establish American leadership and a strategic presence on the Moon while expanding our U.S. global economic impact
- Broaden our commercial and international partnerships
- Inspire a new generation and encourage careers in STEM

WHAT WILL WE DO THERE?

While Mars remains our horizon goal, we have set our sights first on exploring the entire surface of the Moon with both human and robotic explorers, and the Gateway giving us more access than ever before. We will send astronauts to new locations, starting with the lunar South Pole. On the Moon, we will:

- Find and use water and other critical resources needed for long-term exploration
- Investigate the Moon's mysteries and learn more about our home planet and the universe
- Learn how to live and operate on the surface of another celestial body, where astronauts will be just three days from home
- Prove the technologies we need before sending astronauts on missions to Mars, which can take up to three years round-trip

Going forward to the Moon will be the shining moment of our generation. This moment will belong to you—the Artemis Generation. Are you ready?

ARTEMIS

HOW DO WE GET THERE?

NASA's powerful new rocket, the Space Launch System (SLS), will send astronauts aboard the Orion spacecraft nearly a quarter million miles from Earth to lunar orbit. Astronauts will dock Orion at the Gateway and transfer to a human landing system for expeditions to the surface of the Moon. They will return to the orbital outpost to board Orion again to return safely to Earth.

WHEN WILL WE GET THERE?

Ahead of the human return, we will send a suite of science instruments and technology demonstrations to the lunar surface through commercial Moon deliveries beginning in 2021. The agency will fly two missions around the Moon to test its deep space exploration systems. NASA is working toward launching Artemis I, an uncrewed flight to test the SLS and Orion spacecraft together, followed by Artemis II, the first SLS and Orion flight test with crew. NASA will land astronauts on the Moon by 2024 on the Artemis III mission and about once per year thereafter.

National Aeronautics and Space Administration

Headquarters
300 E Street, SW
Washington, DC 20546
www.nasa.gov/centers/hq

www.nasa.gov

NP-2019-07-2748-HQ

nasa.gov/artemis
#Artemis

ARTEMIS

Extensions

Extending the Moon Game Experience with Explore Science: Earth & Space Hands-on Activities

Explore Science: Earth and Space activities can be used with players before or after the game to go further in depth with Moon content. Activities can also be used to engage players waiting to start the game. Digital versions of all NISE Network activities are found at the links below.

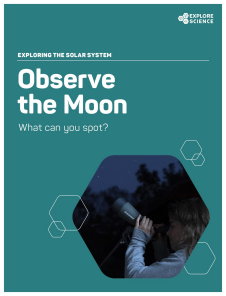
Exploring the Solar System: Hide and Seek Moon is an engaging way for early childhood learners to experiment with some of the tools scientists use to study objects that are very, very far away, and to learn about how cultures around the world have viewed the Moon.
(Suitable for early childhood.)
https://www.nisenet.org/catalog/exploring-solar-system-hide-and-seek-moon-2018

Exploring the Solar System: Big Sun, Small Moon demonstrates the concept of apparent size and how the Sun and Moon appear the same size in our sky, even though the Sun is much bigger than the Moon.
https://www.nisenet.org/catalog/exploring-solar-system-big-sun-small-moon

Exploring the Solar System: Pocket Solar System encourages learners to make a scale model of the distances between objects in our solar system and discover that there is a lot of space between planets in the process.
https://www.nisenet.org/catalog/exploring-solar-system-pocket-solar-system

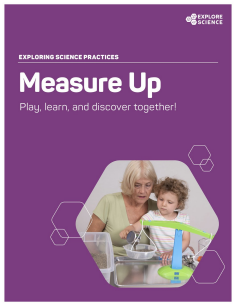
Exploring the Solar System: Craters demonstrates how impact craters form, what they can teach us about the history and composition of planets and moons, and geological processes on other planets, moons, and asteroids.
https://www.nisenet.org/catalog/exploring-solar-system-craters-2018

Exploring the Solar System: Observing the Moon supports facilitators in hosting observing the Moon events and using low-powered viewing devices with participants—includes information on finding night sky objects and difficult Moon concepts.



https://www.nisenet.org/catalog/observing-the-moon

Exploring Science Practices: Measure Up! provides caregivers a structured experience to practice important early childhood appropriate science process skills, including measuring, using tools, and counting with their young learner. (Suitable for early childhood.)

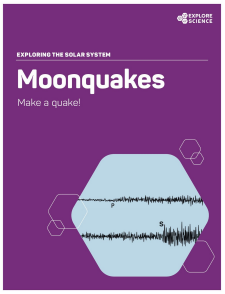


https://www.nisenet.org/catalog/measure-up

Exploring the Solar System: Story Blocks provides a creative opportunity for participants to tell their own story of exploring the Moon using blocks featuring components of future NASA Moon missions. (Suitable for early childhood.)

https://www.nisenet.org/catalog/moon-story-blocks

Exploring the Solar System: Moonquakes encourages learners to discover differences and similarities between natural processes on the Earth and Moon while interacting with a hands-on model of a quake.



https://www.nisenet.org/catalog/moonquakes

Extending the Moon Game Experience with NASA Images, Videos, Audio, and Visualizations

NASA offers a wide variety of different types of media. The following resources may be helpful if you are considering adding printable take-aways and posters, imagery, videography, or multimedia experiences.

Printable Moon take-aways for the public

- NASA printable Moon bookmarks
  https://spacestem.nasa.gov/sites/default/files/2019-05/blue%20bootprint%20v8a%20copy.pdf
  https://spacestem.nasa.gov/sites/default/files/2019-05/Large%20type%20v7a%20copy.pdf
- NASA paper Moon cutouts
  https://www.nasa.gov/sites/default/files/atoms/files/paper_moon_cut_out-01.pdf
- NASA's "Forward to the Moon with Artemis" activity booklet
  https://www.nasa.gov/exploreractivities/
- Legacy of the Apollo 11 Moon Landing Handout
  https://moon.nasa.gov/resources/386/legacy-of-the-apollo-11-moon-landing-handout/
- Moon Observation Journal
  https://moon.nasa.gov/resources/12/moon-observation-journal/

Printable Moon posters

- NASA printable Moon posters
  https://spacestem.nasa.gov/printables
- Decorative Poster for International Observe the Moon Night
  https://moon.nasa.gov/resources/400/decorative-poster-for-international-observe-the-moon-night/
- NASA Solar System Exploration Poster set
  https://solarsystem.nasa.gov/resources/925/solar-system-and-beyond-poster-set/

Audio Playlists and Songs

- Atmospheric sound clips which can be played on a continuous loop:
  - "Dinks and donks" from Mars from InSight Lander InSight's seismometer
    https://www.nasa.gov/specials/InSight-Sounds/Cropped-Dinks-and-Donks-sample.wav
  - Sonification of a Hubble Deep Space Image
    https://soundcloud.com/nasa/hubble-treasure-trove-sonification?in=nasa/sets/spookyspacesounds
- More NASA Sounds and Music
  https://www.nasa.gov/connect/sounds/index.html
  - Atmospheric Sounds – NASA Voyager Space Sounds (about 30 minutes each)
    https://music.apple.com/us/album/nasa-voyager-space-sounds/336195159
    https://open.spotify.com/playlist/2Mkw0XZjzLe4q67mdaoOXS
  - Atmospheric sounds – Spooky Space Sounds
    https://www.nasa.gov/vision/universe/features/halloween_sounds.html
    https://soundcloud.com/nasa/sets/spookyspacesounds

NASA Moon Trek

Moon Trek provides easy-to-use tools for browsing, data layering, and exploring high-resolution images of the lunar surface. Using Moon Trek, many hundreds of lunar data products can be visualized, stacked, blended, and downloaded. Detailed metadata for each data product is also made available to the user. While emphasizing mission planning, Moon Trek also addresses the lunar science community, the lunar commercial community, education and public outreach, and anyone else interested in accessing or utilizing lunar data. Its analysis tools allow users to perform a wide range of analyses such as measuring distances, creating elevation plots, and conducting lighting and slope analysis. Users can also draw bounding boxes around any areas of interest to generate output files for 3D printing of desired surface features.

- https://trek.nasa.gov/moon

LROC Resources – Quickmap and Image Gallery

The Lunar Reconnaissance Orbiter Camera, or LROC, is a system of three cameras mounted on the Lunar Reconnaissance Orbiter (LRO) that capture high-resolution black and white images and moderate resolution multi-spectral images of the lunar surface. The LROC team consists of scientists, staff, student researchers, and an Instrument Development Team from various disciplines, led by Arizona State University. The LROC website includes a lunar image gallery and a highly customizable web-based mapping and analysis tool that covers the lunar surface.

- https://quickmap.lroc.asu.edu/
- http://www.lroc.asu.edu/posts

AstroPix

A one-stop shopping experience that makes finding the right astronomy image easier than ever. AstroPix offers access to the public image galleries of many of the leading astronomical observatories under a single unified interface. Images are organized by featured topics, image type, telescope, subject, and electromagnetic spectrum band. This site is supported by NASA under the NASA's Universe of Learning program. Content is curated and supplied solely by the partnering institutions.

- https://astropix.ipac.caltech.edu

NASA Image and Video Library

A simple search interface drives discovery across images, videos, and audio clips from decades of the agency's history. Browse famous historical and up-to-date mission photos along with beautiful Earth and space images. The recently revised website is a good place to start any media search associated with space exploration. The *Most Popular* tab is a great way to browse some of NASA's most iconic images.

- https://images.nasa.gov/

NASA's Scientific Visualization Studio (SVS)
Located at the NASA Goddard Space Flight Center, SVS works closely with scientists to create data visualization products that promote a greater understanding of NASA Earth and space science. Thousands of visualizations are available—with new ones added frequently—and include images, animations, and short movies on wide-ranging topics like NASA science. Browse the collection by theme, as well as search by keyword, mission, instrument, etc. Visualizations can be downloaded in a variety of formats and resolutions.

- https://svs.gsfc.nasa.gov

NASA Jet Propulsion Laboratory (JPL) Media Galleries and Interactives
A wide range of media from NASA missions, research, and educational efforts connected to JPL. This collection is heavily weighted toward planets, dwarf planets, and moons in the solar system, including amazingly detailed surface imagery of rocky bodies and dynamic swirling clouds of gas giants.

The Solar System Treks are online, browser-based portals that allow you to visualize, explore, and analyze the surfaces of other worlds using real data returned from a growing fleet of spacecraft. You can view the worlds through the eyes of many different instruments, pilot real-time 3D flyovers above mountains and into craters, and conduct measurements of surface features. The portals provide exciting capabilities for mission planning, planetary science, and public outreach. In addition to Moon Trek described above, the Solar System Treks include Mars Trek, Vesta Trek, and Phobos Trek.

Mars Trek is a unified viewing experience for all NASA data about the surface of Earth's closest planetary neighbor. Mars Trek provides easy-to-use tools for browsing, data layering, and feature search, including detailed information on the source of each assembled data product. Using Mars Trek, many hundreds of Martian data products can be visualized, stacked, blended, and downloaded, including 3D maps.

- **Solar System Treks:** https://trek.nasa.gov/
- **Mars Trek:** https://trek.nasa.gov/mars/
- **Vesta Trek**: https://trek.nasa.gov/vesta/
- **Images:** https://www.jpl.nasa.gov/spaceimages
- **Videos:** https://www.jpl.nasa.gov/videos
- **Infographics:** https://www.jpl.nasa.gov/infographics/

PROMOTIONAL MATERIALS >

Logos

A set of logos is available for publicizing and promoting the game within your institution.

- **Horizontal 1 Logo**

- **Horizontal 2**

- **Square Logo**

- **Text Logo**

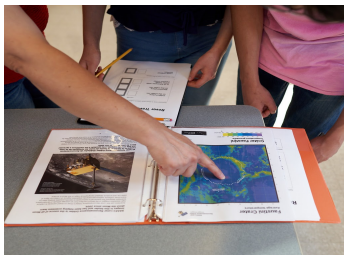
Welcome Sign

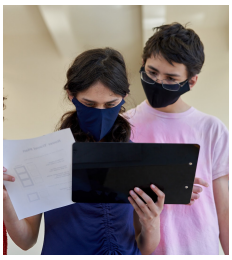
The welcome sign poster can be printed at various sizes to promote the game and to use for queuing.

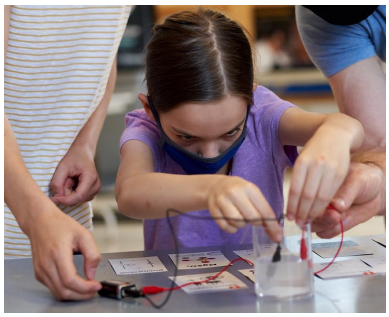
Photos

Promotional photos are available here:

- https://nisenet.smugmug.com/MoonAdventureGame







Fonts

Fonts used in the game graphics are:

- Panton
  https://www.myfonts.com/fonts/font-fabric/panton/

- Roboto
  https://fonts.google.com/specimen/Roboto

- Grold Rounded
  https://www.myfonts.com/fonts/typesketchbook/grold-rounded/

FIRST-TIME ASSEMBLY >

Assembly, Repair, and Spare Materials

Some assembly will be required when you first open the game. Each box is clearly labeled and the following information will assist you when setting up the game for the very first time. If you need to print new labels or other graphics, all files for the game can be found online, please see the Printing DIY section of this guide.

Assembly and Repair Materials

Included in the game materials are some assembly and repair materials that will be useful for first-time setup.

Durable Materials

- ❑ Scissors
- ❑ Wire stripper

Consumable Materials

- ❑ Black electrical tape
- ❑ Gorilla tape 1" x 30'
- ❑ Scotch Magic tape
- ❑ Hot glue gun
- ❑ Hot glue sticks (pack of 25)
- ❑ Velcro (pack of 12)
- ❑ Foil conductive tape

Spare Materials

Also included is a set of spare materials in case some of your materials are damaged or need to be replaced.

- ❑ Welcome: Mission Control Cards (6 extra)
- ❑ Challenge 2: Data blocks (1 backup set, shipped in pack of 12 data blocks) (2 sets)
- ❑ Challenge 2: Blue Blocks (1 backup set, shipped in packs of 10 blue blocks) (2 sets)
- ❑ Challenge 2: “Seismic data locations” six small plastic overlays (plastic transparency sheets) (1 backup set)
- ❑ Challenge 2: Buzzer (3 extra)
- ❑ Challenge 2: Water vials (3 extra)
- ❑ Challenge 4: 9-volt battery (1 extra)
- ❑ Challenge 4: Instruction cards (1 backup set)
- ❑ Challenge 5: Steve Spangler Energy Stick® (2 extra)
- ❑ Challenge 5: Mechanical lugs (2 extra)

Applying Labels

The following graphic labels will need to be applied to the following components:
Note that once labels are applied they CANNOT be removed or reused!

- ❑ **Apply Graphic Label – Welcome Mission Control Label**:
  apply label to the facilitator clipboard

- ❑ **Apply Graphic Label – Challenge 2 Rover Data Bank label**:
  apply label to the orange rover cargo container

- ❑ **Apply Graphic Label – Challenge 2 Envelope label**:
  apply label to envelope

❑ **Apply Graphic Label – Challenge 3**
Water Extractor label:
apply label to the front side of the water extractor

❑ **Apply Graphic Label – Challenge 3**
Load Here label:
apply label to the top of the water extractor

❑ **Apply Graphic Label – Challenge 3**
Cold Storage label:
apply label to the top (lid) of the Cold Storage bin

❑ **Apply Graphic Label – Challenge 3**
Cold Storage label:
apply label to the front side of the Cold Storage bin

❑ **Apply Graphic Label – Challenge 4**
Emergency Oxygen Supply Kit label:
apply label to the box

❑ **Apply Graphic Label – Challenge 4**
Epsom salt label:
apply label to the side of the bottle for Epsom salt

❑ **Apply Graphic Label – Challenge 5:**
Power label: apply label to the power box

Some Assembly Required

The following pieces of the game require minimal assembly:

- ❑ **Table signs**:
  Make sure the paper table signs have been inserted into each of the plastic sign stands.

- ❑ **Challenge 1: Make a Travel Plan for Your Rover**
  Assemble the binder
  If not already assembled, you will need to put plastic sleeves into the binder, and insert maps. The maps required for the game have page numbers to designate order. Geographic comparison maps of many US cities may be placed in the back in any order you wish.

- ❑ **Challenge 2: Match Rover Data to Locations on the Map**
  Set the combination lock
  The lock will come preset with the combination 3-7-4-2. When you first open the kit, be sure to check that this combination is working! However, if you experience problems with this, you can use the following directions to reset the lock.
  1. Make sure codes are set to default (0-0-0-0). Pull up the shackle and turn it to the code setting gap.
  2. Push the shackle down until the tiny pin is fully inside the gap. Hold it there and turn the shackle counterclockwise to the code line.
  3. Scroll the numbers to set the combination code (3-7-4-2), making sure the numbers are completely in the windows.
  4. Turn the shackle clockwise until it pops up.

How to **Set Your Own Combination**

Step 1

Hold the padlock showing the dials on the **right-hand side**.

Step 2

Align the dials to 0-0-0-0, between the arrows **on the side**.

Step 3

Pull up the shackle and rotate it 90 degrees **counterclockwise** (towards yourself).

Step 4

Push down the shackle until the small pin fully enters the gap, **hold it there** and rotate the shackle another 90 degrees **counterclockwise**.

Step 5

Move the dials, one by one, to your desired combination. In this example we use 8-0-1-3.

Make sure the dials are not set between digits.

Write down your new combination or take a picture of it and store it safely.

Step 6

Rotate the shackle back **clockwise** (opposite to before), until the pin pops back up from the gap.
Your new combination is now set.

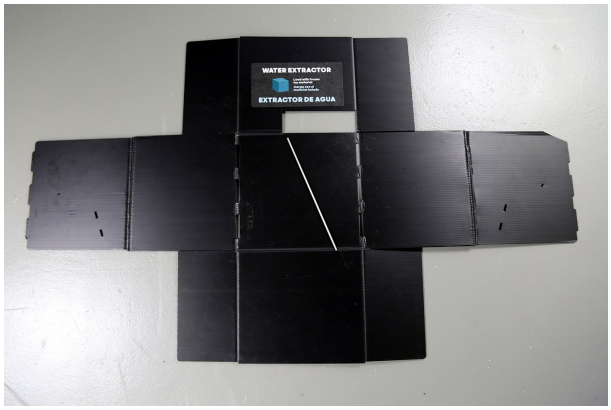
Test your new combination before you start using the padlock.

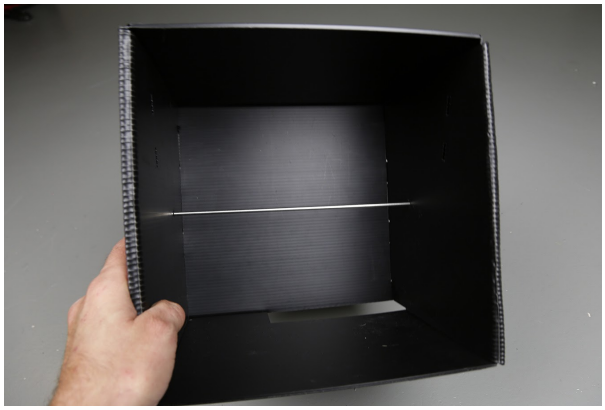
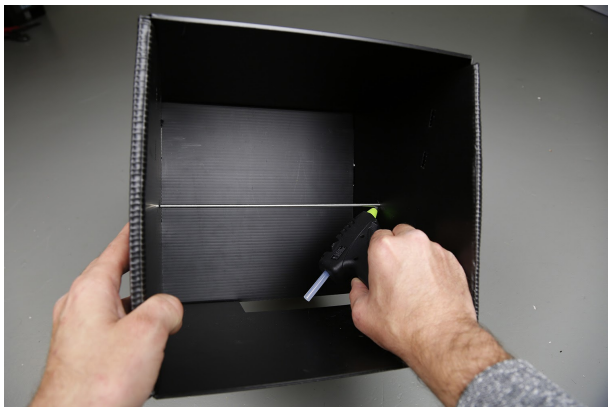
❑ **Challenge 3: Extract Water from Frozen Lunar Material**
Assemble the water extractor

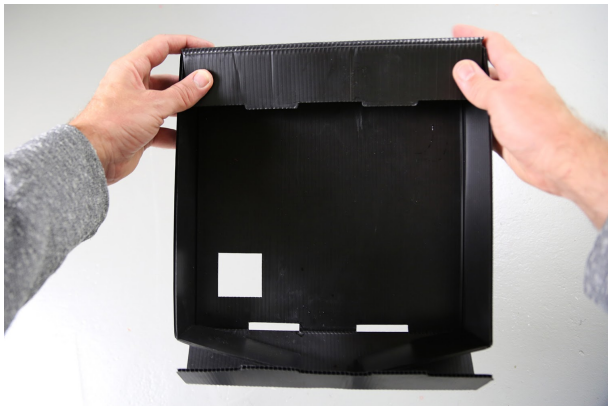
You will need to assemble the water extractor box, which ships flat. To complete the assembly of the box you will need the following parts: extractor box flat pieces (7), hot glue gun and sticks, black duct tape, pencil, ruler, and cord clips. The plastic Coroplast® box material is flexible and as a result can be unpredictable. In some cases you may find that scoring, gluing, and other simple spot modifications will improve the functionality of your boxes.

To assemble the water extractor, please follow the steps below in order:

A) box (steps 1–6)
B) lid (steps 7–10)
C) weighted panel (steps 11–20)
D) tilt panel (steps 21–26)
E) testing the water extractor (steps 27–29)

Water extractor step-by-step assembly instructions	
A. Water extractor box	
Step 1 Lay the flat box label side down so when the flap with the label is folded up, the label will be on the outside facing you.	**Step 2** Fold the front and back panel up and the two side pieces inward.
	

A. Water extractor box	
Step 3 Next fold the two flat side walls up and over the side pieces, making sure that the tabs “snap” into place on the bottom of the box.	**Step 4** Take the included 10” stainless steel rod and carefully insert the ends into the die-cut holes in the center of the box.
	
Step 5 Apply a drop of hot glue to secure both ends of the rod into the box.	**Step 6** Set the box aside and move onto the next step.
	

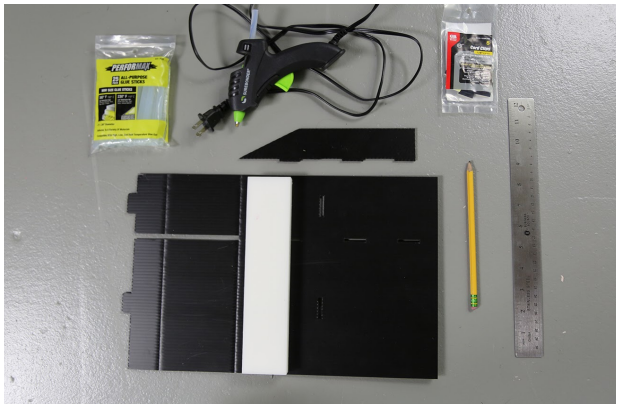
B. Water extractor lid	
Step 7 The lid folds together using the same steps that were used to assemble the box. Start with the box lid flat on a table top surface.	**Step 8** Fold the two sides without tabs up and the ends inward.
	
Step 9 Fold the top and bottom panels over the previous inward folded pieces. Again, the lid will be secure when the tabs “snap” into place.	**Step 10** Set the box lid aside and move onto the next step.
	

C. Water extractor weighted panel

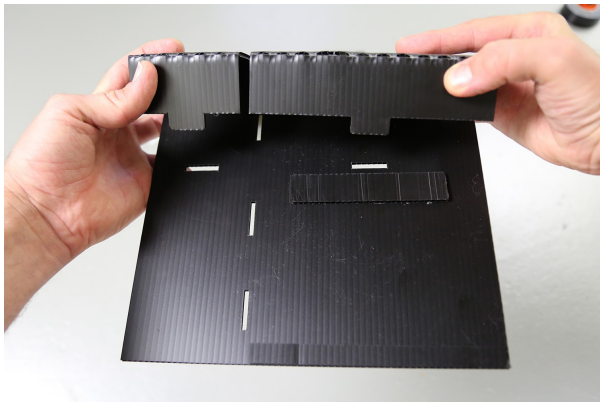
Now we will continue to the internal elements of the box. The weighted panel is designed to tip when four to five blue wooden blocks are inserted dispensing the three vials of water. It is very important that you measure correctly during the following steps and place pieces accordingly to ensure correct operation.

For the weighted panel assembly you will need the panel piece (a black panel with a solid block of white plastic) as well as the small slanted divider piece, cord clips, pencil, and ruler.

Step 11
Locate the weighted panel piece and the slanted divider piece. You will also need the ruler, pencil, glue gun, and cord clips.

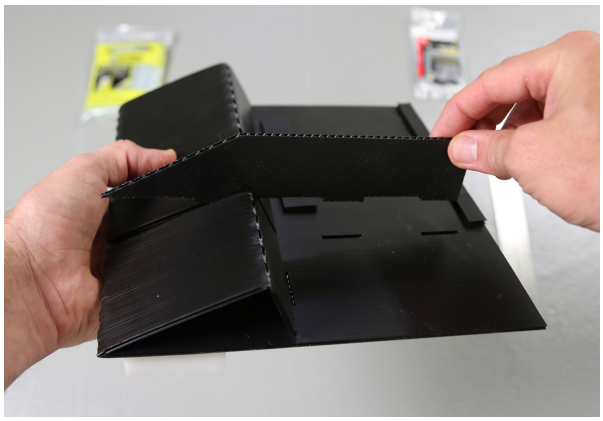


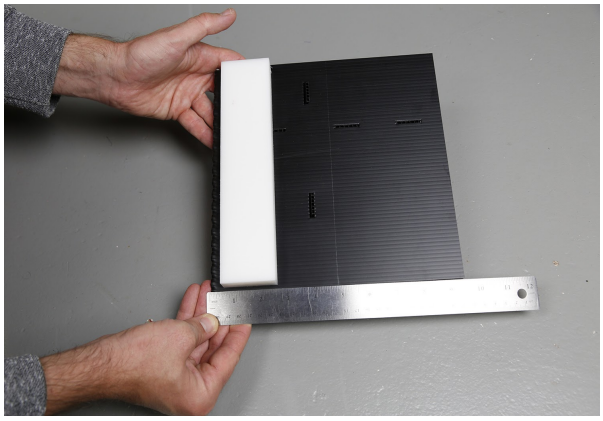
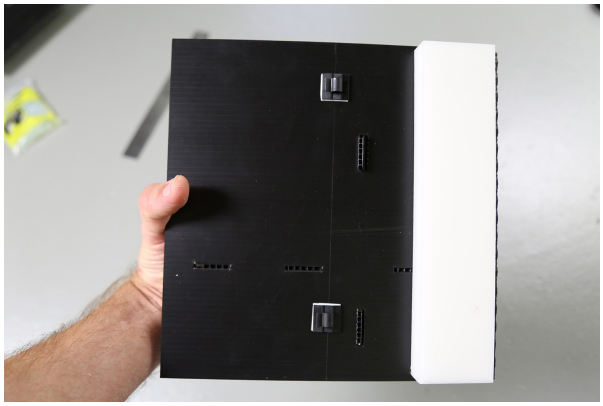
Step 12
Take the large piece and fold the two sections at the end of the panel up, inserting the two tabs into the openings on the panel.

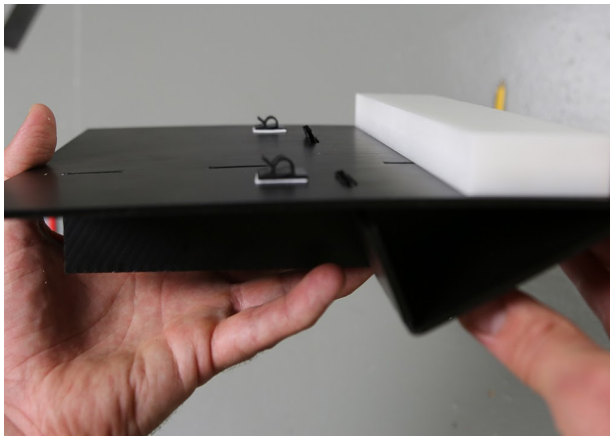
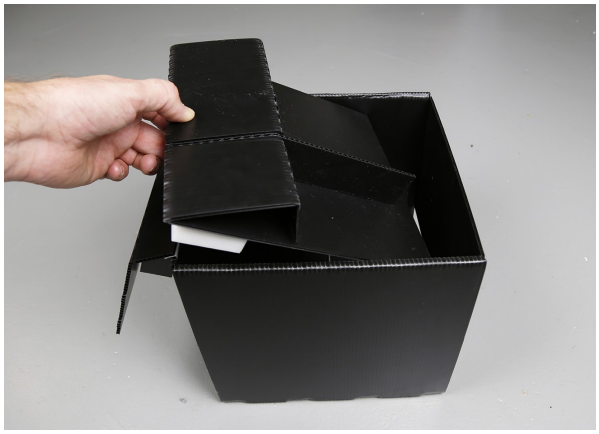
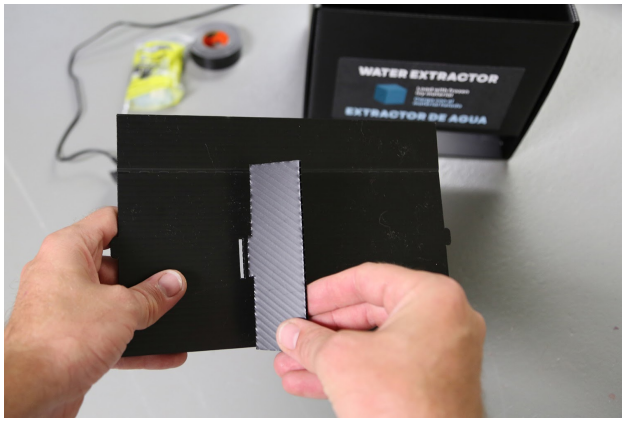
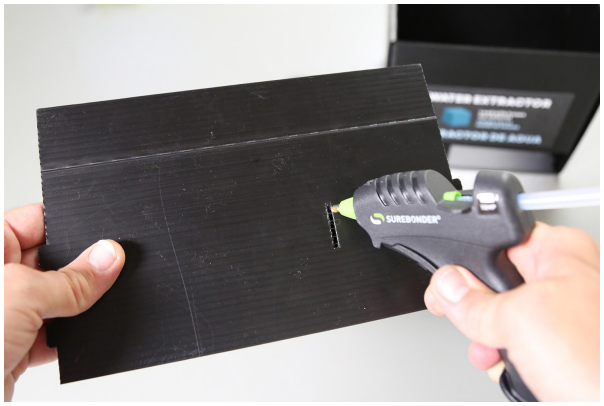


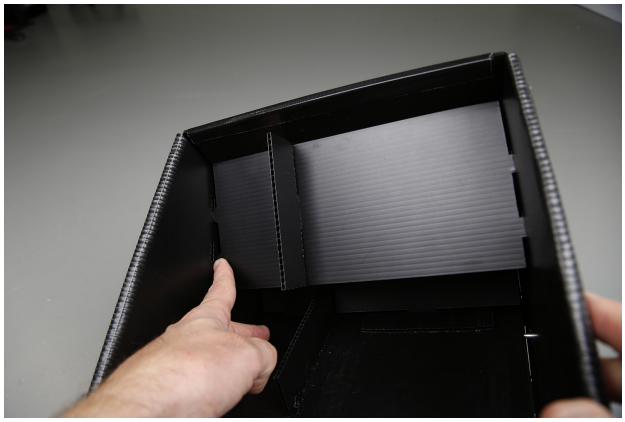
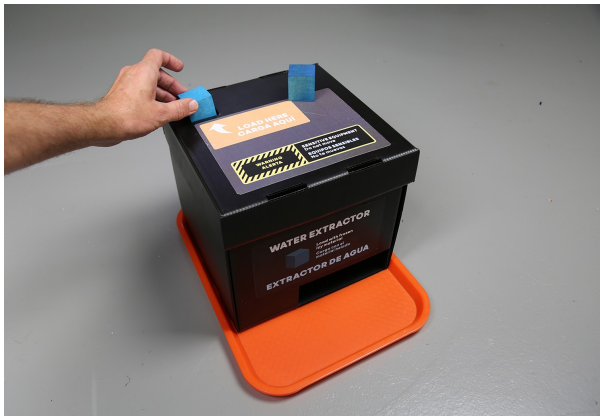
Step 13
Flip the panel over and apply a small bead of hot glue to secure the tabs. Hold in place until the hot glue dries.

Step 14
Take the small black divider panel and insert the tabs into the openings on the panel. The slant should be oriented so that it is flush with the top of the two folded sections.



C. Water extractor weighted panel	
Step 15 Again, flip the panel over and apply hot glue to secure the divider.	**Step 16** Next, with the white plastic block facing up, measure 4.75” from the edge of the black Coroplast® on the white plastic block side.
	
Step 17 Draw a line with a pencil 4.75” toward the center, parallel to the white block.	**Step 18** Finally, take two plastic cord clips, remove the backing and press them into place, centered on each end of the drawn pencil line.
	

C. Water extractor weighted panel	
Step 19 Note that the cord clips are shaped like an “R”; the bottom of the “R” should face away from the white block.	**Step 20** The weighted panel can now be inserted into the box. The white plastic block should be facing down so that when placed, the clips can attach to the stainless steel rod inside the box. The panel should be positioned so that the flat part of the weighted panel is facing toward the rectangular opening at the front of the box.
	
D. Water extractor tilt panel	
You are almost there! The final part of the water extractor box is the tilt panel.	
Step 21 Find two rectangular pieces of black Coroplast — the smaller piece is 1.5” x 5” and the larger piece is 6.5” x 9.5”. Insert the tab of the smaller piece into the opening of the larger piece.	**Step 22** Apply a bead of hot glue to secure the divider to the panel.
	

D. Water extractor tilt panel	
Step 23 Apply a strip of tape to the top back edge of the tilt tray.	**Step 24** Tape the tilt panel to the top back side of the extractor box so that it can be lifted as needed for adjusting the activity.
	
Step 25 The tilt tray has two tabs on both sides, the extractor box has two tab openings on both sides. Insert the tabs into the openings.	**Step 26** **Ready for testing** The box is now assembled and ready for use.
	

E. Water extractor testing

Now that the box is assembled, you will want to experiment to ensure the weighted mechanism is operating properly. To do this, you'll also need the three water vials and five blue wooden blocks included with this challenge.

Step 27
Fill all three vials with water and replace the caps. Then load all three vials of water into the water extractor box. Simply lift the box lid and place the vials on the panel inside the box. The weight of the five blue wooden blocks should cause the mechanism to release the vials.

Step 28
Practice using the water extractor yourself until you are confident the mechanism works.

Step 29
A hole in the back of the box will allow the facilitator to insert their finger to tip the tray if it does not automatically dispense the three vials of water.

Assembly is complete!

❑ **Challenge 4: Fill Your Oxygen Tanks**
Assemble the test tube rack
The test tube rack ships flat and needs to be put together, and then placed in the Emergency Oxygen Supply Kit box.

❑ **Challenge 4: Fill Your Oxygen Tanks**
Fill the jar of Epsom salt
- ❑ Add Epsom salt from the bag to the amber-colored jar

❑ **Challenge 4: Fill Your Oxygen Tanks**
Assemble the Emergency Oxygen Supply Kit
The Emergency Oxygen Supply Kit will hold the following materials:
- ❑ Test tube rack (for water vials from previous challenge)
- ❑ Container with Epsom salt
- ❑ Measuring spoon (for Epsom salt)
- ❑ Graduated cylinder (for measuring water)
- ❑ Funnel
- ❑ Clear cup (for mixing)
- ❑ Wood stir stick/dowel (for mixing)
- ❑ 9-volt battery
- ❑ Two wires with alligator clips
- ❑ Two metal washer rings
- ❑ Electrolysis instructions cards

❑ **Challenge 5: Reconnect the Power Supply**
Assemble the power box and the power board

The power box and power board both ship flat and need some assembly.

The power box needs to be assembled with the Steve Spangler Energy Stick® inside and the two red wires attached, one on each end. Then you will attach the power box to the power board and attach the two mechanical lugs.

The plastic Coroplast® box material is flexible and, as a result, can be unpredictable. In some cases you may find that scoring, gluing, and other simple spot modifications will improve the functionality of your boxes.

Follow these steps in order:

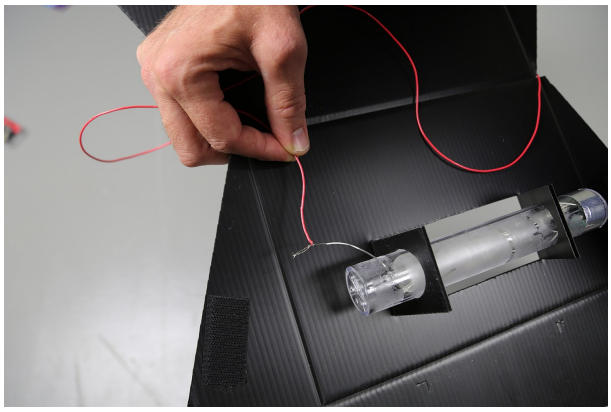
Power box and power board step-by-step assembly instructions	
Step 1 Take the black flat box piece with the two large holes and lay it on the table.	**Step 2** Open the Energy Stick® package and peel off the label.
	

Power box and power board step-by-step assembly instructions

Step 3
Fold the two squares with circular openings up toward you and insert the Energy Stick® into the openings on both ends.

Step 4
Then look for the end of the Energy Stick® with seven round holes. On this end, peel back the metal foil tape and expose the silver wire.

Step 5
Twist one end of the first red wire to the exposed silver wire on the Energy Stick®. You may need to remove some of the plastic coating on the silver wire to expose more of the silver wire.



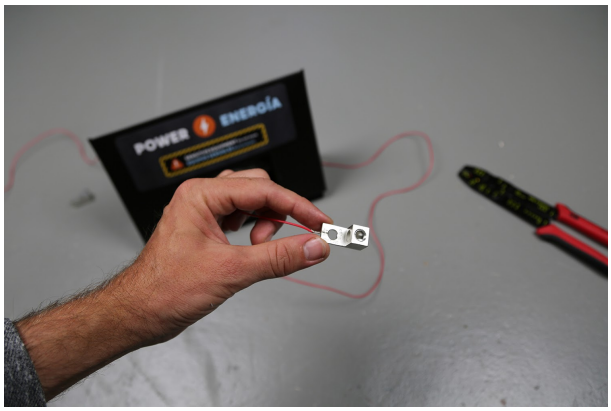
Step 6
Tape the two twisted wires together and then tape them to the energy stick using the conductive foil tape.

Power box and power board step-by-step assembly instructions

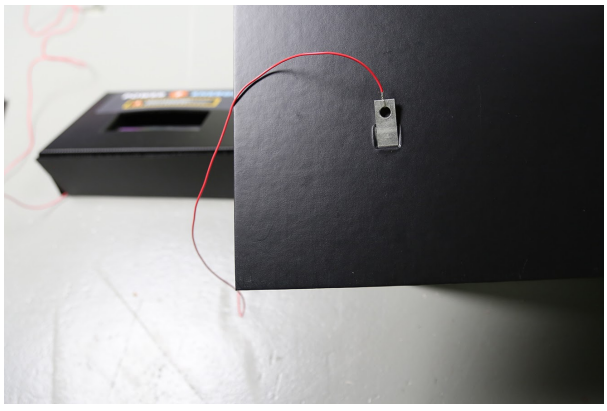
Step 7
On the other end of the Energy Stick® (without the seven round holes), using the conductive foil tape, tape the second red wire to the existing foil on the end of the Energy Stick® —you do not need to peel back the foil on this side of this stick.

Step 8
Fold the power box into shape, using the Velcro to hold it in place, and guide the two red wires outside of the power box on either side of the box.

Step 9
Wrap the exposed end of the first red wire through the hole in one of the mechanical lugs. Repeat with the second red wire and the second mechanical lug.

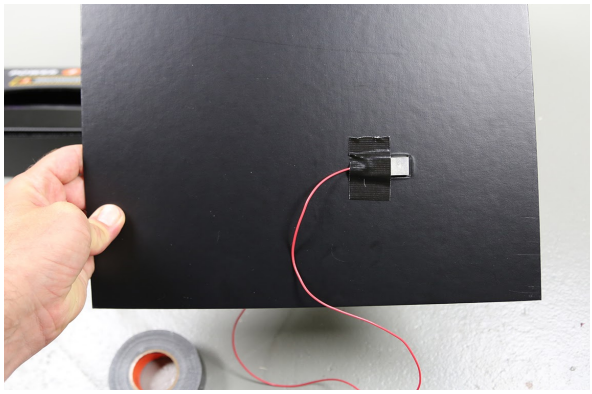


Step 10
Now attach the power box to the power board. To do so, unfold the power board and attach the two mechanical lugs. With the power board facedown, insert the mechanical lugs into the two half-inch square holes at each end of the power board. When doing this, be sure the wires are underneath the board, hidden from players.



Power box and power board step-by-step assembly instructions

Step 11
Apply a small piece of the black electrical tape to hold the wire and lug in place.



Step 12
Carefully flip the power board over, noting that the wires should still be connected to the power box as well. Place the power box at the top center area of the power board to begin.

Step 13
Troubleshooting
This is a circuit you will need to test. It is easiest to test by putting a finger from each of your hands onto the two mechanical lugs. If the stick does not activate, recheck each of your connections to be sure that you have metal-to-metal contact.

Be sure the mechanical lugs wired to the Energy Stick® do not touch or they will complete the circuit and drain the battery, which cannot be replaced. Spare power sticks have been included with the game.

Assembly is complete!

MATERIALS DIY >

The following is a list of materials you will need if you are creating your own do-it-yourself (DIY) version of this game or finding replacement materials. Please keep in mind, if you are creating your own DIY version of the game, there is a great deal of flexibility with materials. Printed materials are listed in the Printing DIY section of this guide.

All consumable materials are marked with an asterisk *.

If you are making your own version of this game, please refer to the following sections of this guide for how to apply labels and more:

- Printing DIY for printing graphics and labels
- Materials DIY
- First-Time Assembly

Consumable	Physical Materials	Description	Examples of Vendors
	Overall		
	Table sign holders (5) (optional)	**Original version of game:** 8.5” x 11” paper table signs can be inserted into 9” x 12” vertical plexiglass sign stands, or **Simplest option**: tape signs to a horizontal or vertical surface	Available from office supply stores: OfficeDepot, OfficeMax, Staples, etc.
	Printing Supplies		
	Printing supplies for signs and graphics	**Simplest option**: 8.5” x 11” paper	Available from office supply stores: OfficeDepot, OfficeMax, Staples, etc.
	Printing supplies for Mission Control cards, electrolysis instruction cards, and Challenge 5 power board	**Simplest option**: 8.5” x 11” heavyweight cardstock paper	Available from office supply stores: OfficeDepot, OfficeMax, Staples, etc.
	Printing supplies – full-sheet adhesive labels	**Simplest option 1**: 8.5” x 11” full-sheet stickers such as Avery 8165 for labels in all challenges and data blocks; see First-Time Assembly section of this guide for where to apply labels **Simplest option 2**: print onto paper and then tape the paper to the blocks or containers	Available from office supply stores: OfficeDepot, OfficeMax, Staples, etc.

	Printing supplies for Challenge 2 data location overlays	**Simplest option:** 8.5” x 11”plastic transparency sheets that are printer safe (three sheets)	Available from office supply stores: OfficeDepot, OfficeMax, Staples, etc.
	Welcome		
	Clipboard for Facilitator (optional)	**Original game:** 9” x 12” clipboard **Simplest option**: Facilitator holds Facilitator Narrative Script without clipboard	Available from office supply stores: OfficeDepot, OfficeMax, Staples, etc.
	Clipboard for Progress Tracker	**Original version of game:** 9” x 12” clipboard	Available from office supply stores: OfficeDepot, OfficeMax, Staples, etc.
	Pencil	Pencil for Progress Tracker	Available from office supply stores: OfficeDepot, OfficeMax, Staples, etc.
	Challenge 1: Make a Travel Plan for Your Rover		
	3-ring binder (optional)	**Original version of game:** 3-ring binder (do not need larger than 1”) **Simplest option**: Place loose pages on the table (the pages do not need to be in sleeves in a binder)	Available from office supply stores: OfficeDepot, OfficeMax, Staples, etc.
	3-ring binder sleeves (optional)	**Original version of game:** Plastic 3-ring binder sleeves for each page **Simplest option**: Put pages directly in binder without sleeves or place loose pages on the table (the pages do not need to be in sleeves in a binder)	Available from office supply stores: OfficeDepot, OfficeMax, Staples, etc.
	Challenge 2: Match Rover Data to Locations on the Map		
	Data blocks (6)	**Original version of game:** Six 1.5” wooden blocks with custom printed graphics **Simplest option**: Six 1.5” wooden blocks with self-adhesive or taped labels	Available from toy stores and craft stores
	Envelope for data overlay transparency sheets	**Original version of game:** Manilla envelope for data overlay transparency sheets (6" x 9") **Simplest option**: Any envelope	Available from office supply stores: OfficeDepot, OfficeMax, Staples, etc.
	Lock box	**Original version of game:** Plastic field box with locking options designed for outdoor storage for hunting ammo or fishing kit **Simplest option**: Any lockable container; could be a container with a built-in lock	Available from outdoor stores, hardware stores, or online
	Combination	**Original version of game:** Resettable 4-digit combination	Available from hardware

	padlock, 4-digit	padlock that can be reset to combination 3-7-4-2	stores or online
	Alarm sound buzzer (optional)	**Original version of game:** Battery-powered, press activated buzzer **Simple option**: Use alarm sound on a phone **Simplest option**: Simply drum fingers on a table and sway back and forth	Available from office supply stores or online
	Screwdriver for buzzer (optional)	**Original version of game:** Small Phillips head screwdriver to access buzzer battery	Available from hardware stores
*	AAA batteries for buzzer (optional)	**Original version of game:** AAA batteries needed for buzzer	Available from office supply stores, grocery stores, or hardware stores
	Challenge 3: Extract Water from Frozen Lunar Material		
	Cold storage bin	**Original version of game:** Large plastic bin with a latching lid, 56 quart, 24" x 15" x 13" **Simplest option**: Any large container such as a cardboard or plastic box that can be filled with foam or packing materials representing rocky lunar material and five blocks representing icy lunar material	Available from hardware store or craft stores
	Blocks (5) to represent icy lunar material	**Original version of game:** Five 2-inch square wooden blocks painted blue to represent water ice; in the original version of the game, the five blocks weigh a total of 215 grams **Simplest option**: Any wooden block or other object to represent icy lunar material	Available from toy stores and craft stores
	Foam material to represent rocky lunar material	**Original version of game:** Square 2-inch packing foam cubes to fill a large box **Simplest option**: Packing peanuts or similar packing materials	Available from packing supply stores
	Grabber tools	**Original version of game:** Reacher grabber claw pickup tools designed to help people reach objects; adult and child-sized toy versions **Simplest option**: Kitchen tongs; the challenge is for players to move the blocks without touching them with their hands	Available from hardware stores and toy stores
	Container to hold at least 150 milliliters of water	**Original version of game:** The three vials are plastic test tubes with a screw-on cap holding 50 millimeters of water each; tubes designed not to break if dropped; the three vials weigh a total of 215 grams; also known as "baby soda bottles" **Simplest option**: Water in some type of container with a secure lid that can be handed by facilitators to players once they have removed the five blocks of icy lunar materials from the cold storage bin	Available from online educational supply stores
	Water extractor box	**Original version of game:** Custom-cut water extractor box constructed from Coroplast® corrugated plastic. Re-creating this exact box is NOT necessary for making a DIY version of this	Custom Coroplast® box CAD file: Moon3_WaterExtractorB

		game. If you do want to re-create this exact box, the original CAD DWG files are available for download from https://www.nisenet.org/moonadventuregame using a computer-assisted cutting device such as a laser or CNC machine; the box counter-weight required to offset the blocks is 330 grams in the original version; the box also includes 10.25" rod, and a 0.25" cord clip **Simplest option:** Players place the blocks (icy lunar material) into any container; the challenge will be for players to move the blocks; when all the blocks have been placed in the container, the Mission Control facilitator will simply hand the players three vials of water	ox_CAD_DWG_file_for_CoroplastBox.dwg
	Tray for water extractor box (optional)	**Original version of game:** Plastic 10" x 14" food tray to place under the water extractor box to prevent water vials from rolling onto the floor	Available from restaurant supply store or online
	Challenge 4: Fill Your Oxygen Tanks		
	Emergency Oxygen Supply Kit box	**Original version of game:** Plastic 6-quart latching storage box **Simplest option**: A cardboard box about the size of a shoebox	Available from craft stores and hardware stores
*	Epsom salt	**Original version of game:** Epsom salt magnesium sulfate, designed for soaking aid in the bath	Available from pharmacies or grocery stores
	Epsom salt container	**Original version of game:** 16 oz. amber PET Straight Sided Jar with screw-top lid **Simplest option**: Any container with lid about 1 cup in size	Available from grocery or housewares store
	Clear mixing container	**Original version of game:** Clear plastic acrylic cotton swab holder **Simplest option**: Very clear plastic cup to ensure that players can see bubbles form	Available from grocery or housewares store
	100ml graduated cylinder	**Original version of game:** Plastic polypropylene graduated cylinder (100ml) **Simplest option**: Measuring cup or beaker with 100ml indicator	Available from online educational supply stores
	Funnel (optional)	**Original version of game:** Plastic funnel for water vials to graduated cylinder; features a wide top opening of 4.7" and 0.6" at the bottom **Simplest option 1**: any small funnel to aid pouring water into graduated cylinder **Simplest option 2**: Not needed	Available from grocery or hardware store
	Measuring scoop	**Original version of game:** Tablespoon measuring scoop (15ml) **Simplest option**: Tablespoon measuring spoon	Available from grocery stores
	Stir stick	**Original version of game:** Wooden craft dowel 6" x 1/4" **Simplest option**: Spoon or other stirring tool	Available from craft stores
	Washers (2)	**Original version of game:** #10 x 1" OD stainless steel fender	Available from hardware

		washer, stainless steel **Simplest option**: Any stainless steel washer	stores
	Test tube rack (optional)	**Original version of game:** Special test tube rack designed to hold the large “baby soda bottle” plastic water vials **Simplest option**: Not needed	Available from educational supply stores
*	9-volt battery	**Original version of game:** 9-volt battery	Available from hardware and grocery stores
	Alligator clips (2)	**Original version of game:** Alligator clip double-ended test leads, 50 cm jumper wire for electrolysis **Simplest option**: Double-ended alligator clip test lead	Available from hardware and electronic stores
	Small bucket (optional)	**Original version of game:** Plastic 10-quart bucket to pour out waste water with Epsom salt **Simplest option**: Pour out water with Epsom salt into sink	Available from grocery or hardware stores
	Water pitcher (optional)	**Original version of game:** Plastic water pitcher to replenish water **Simplest option**: Refill vials at sink	Available from grocery or restaurant supply stores
	Microfiber cloth (optional)	**Original version of game:** Microfiber cloth to wipe up spills **Simplest option**: Cloth or paper towel to wipe up spills	Available from grocery or housewares stores
	Challenge 5: Reconnect the Power Supply		
	Power box	**Original version of game:** power box constructed from Coroplast® corrugated plastic; re-creating this exact box is NOT necessary for making a DIY version of this game. (If you do want to re-create this exact box, the original DWG files are available for download from https://www.nisenet.org/moonadventuregame using a computer-assisted cutting device such as a laser or CNC machine.) **Simplest option 1:** Place the Steve Spangler Energy Stick® in a cardboard box and connect wires to the power board **Simplest option 2**: Could also create a circuit with supplies you may have using a battery, alligator clips, and an indicator such as a battery-operated buzzer or lightbulb	Custom Coroplast® box CAD file: Moon5_PowerBox_CAD_DWG_file_for_Coroplast Box.dwg
*	Steve Spangler Energy Stick®	**Original version of game:** Steve Spangler Energy Stick® **Simplest option**: Could also create a circuit with supplies you may have to connect a buzzer or LED light	Available from online educational supply store
	Power board	**Original version of game:** Custom-printed board, 12” x 60” **Simplest option**: Tape paper onto 12” x 60” piece of cardboard or foam core or foam board	Custom printed
	Power board mechanical lugs	**Original version of game**: Gardner Bender® 14-2 AWG Aluminum Mechanical Wire Lugs, Model Number: GTA-2N **Simplest option:** metal conductive contact on each side of the power board	Available from hardware stores

	Coated wire	**Original version of game:** 10 feet of thin coated wire with stripped ends; Red TXL Cross-Link Wire, 22 Gauge; wire is placed under the power board **Simplest option**: Thin coated wire with exposed ends that can be placed under power board and connected to the power box	Available from hardware or electronics stores
	Plastic mug	**Original version of game:** Plastic mug with Apollo 13 sticker **Simplest option**: Cup or mug heavy and stable enough to hold a collection of conductive and insulator materials	Available from grocery or housewares stores
	Collection of conductive materials ● Pencil (sharpened on both ends) ● Metal ruler ● Alligator clips (20") ● Metal measuring spoon ● Magnetic retrieval tool ● Metal Straw ● Paper Clips	**Original version of game:** Collection of conductive metal objects that could end up in a desk mug **Simplest option**: Conductive metal objects that you might already have on hand and can fit in the mug	Available from grocery, hardware, or housewares stores
	Collection of nonconductive insulator materials ● Mechanical pencil ● Metal ruler ● Alligator clips (20") ● Plastic ruler ● Rubber eraser ● Chopstick (wood) ● Emery board (nonconductive) ● Pencil sharpener ● Paint brush	**Original version of game:** Collection of nonconductive insulator materials that could end up in a desk mug **Simplest option**: Nonconductive insulator materials that you might already have on hand and can fit in the mug	Available from grocery, hardware, or housewares stores
	Wrap-up and Reflection		
	Stickers and temporary tattoos (optional)	**Original version of game:** Artemis mission stickers and temporary tattoos **Simplest option**: Any sticker or temporary tattoo that is Moon or space related	Available from craft stores, online temporary tattoo stores
	Supplies		
	Scissors	Needed for cutting tape	Available from hardware

			and craft stores
*	Command™ strips	**Original version of game:** Needed for hanging banner and welcome sign **Simplest option**: Any tape that won't damage walls	Available from hardware and craft stores
	Black electrical tape	**Original version of game:** Needed for taping power board and power box **Simplest option**: Any tape	Available from hardware and craft stores
*	Gorilla Tape	**Original version of game:** Needed for taping power board and power box **Simplest option**: Any tape	Available from hardware and craft stores
*	Scotch Magic Tape	**Original version of game:** Needed for early childhood version to tape down Challenge 2 data overlays to the lunar surface map	Available from hardware and craft stores
	Hot Glue gun	**Original version of game:** Needed for assembly of Challenge 3 water extractor	Available from hardware and craft stores
*	Hot Glue sticks	**Original version of game:** Needed for assembly of Challenge 3 water extractor	Available from hardware and craft stores
	Velcro – sticky	**Original version of game:** Needed for assembly of Challenge 5 power box	Available from hardware and craft stores
*	Foil conductive tape	**Original version of game:** Needed for assembly of Challenge 5 power box and connecting wires to Steve Spangler Energy Stick®	Available from hardware and craft stores

PRINTING DIY >

The following is a list of printed materials you will need if you are creating your own do-it-yourself (DIY) version of this game or finding replacement materials. Please keep in mind if you are creating your own DIY version of the game, there is a great deal of flexibility with materials.

Printing Notes
In general, all the files have been sized to be able to print on standard 8.5” x 11” paper.
Always print on your printer at “Actual Size” or “100% size” (rather than “scale to fit”).

Printing materials and supplies needed include:

- 8.5” x 11” paper
- Full-sheet stickers (or print-on paper and then tape) for labels and blocks
- 8.5” x 11” plastic transparency sheets that are printer safe (2 sheets)
- Large banner and welcome sign

If you are making your own version of this game, please refer to the following sections of this guide for how to apply labels and more:

- Printing DIY for printing graphics and labels
- Materials DIY
- First-Time Assembly

Consumable Materials
All consumable materials are marked with an asterisk *.

Digital Materials
All digital materials including this guide, Facilitator Narrative Scripts, signs, and labels can be downloaded from:

- Moon Adventure Game Overview
  https://www.nisenet.org/moongame

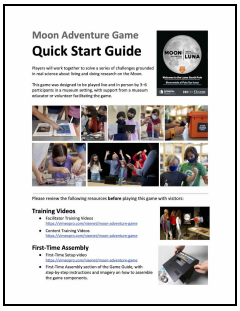
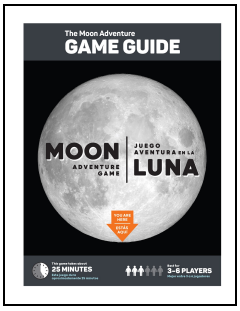
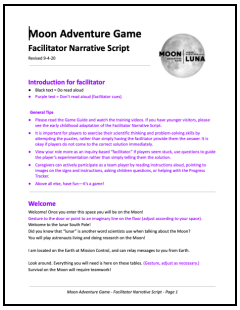
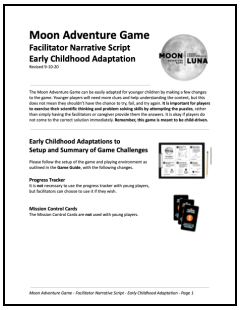
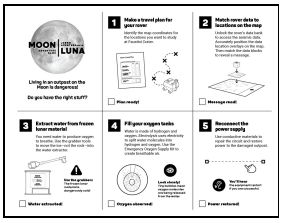
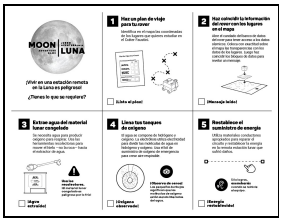
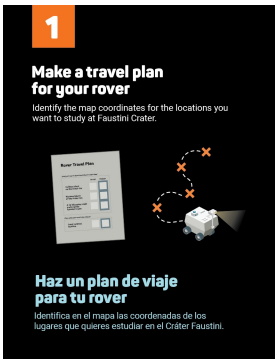
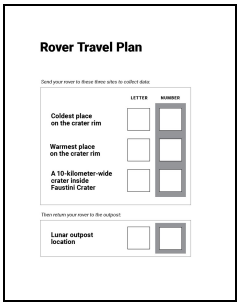
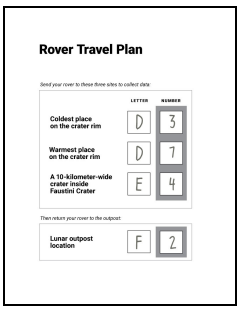
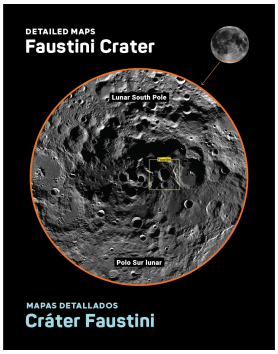
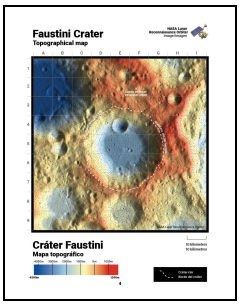
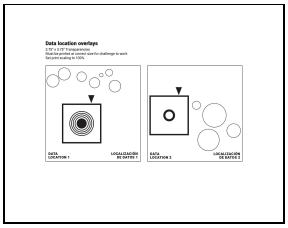
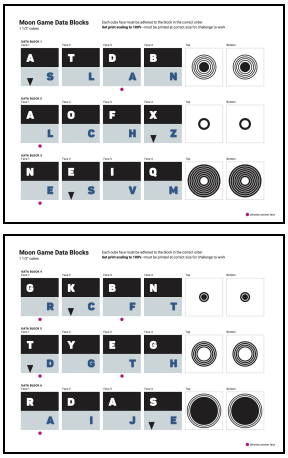
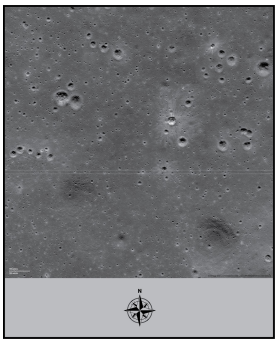
Consumable	Image Thumbnail	Print Item	Print Size and Materials	File Name
	Overall			
		Quick Start Guide	8.5” x 11” paper	Moon0_QuickStart.pdf
		Game Guide	8.5” x 11” paper Multiple pages (95) Can be bound, clipped, or stapled	Moon0_GameGuide.pdf
		Welcome sign	22” x 28” cloth or paper **Option**: Can print using an on-demand fabric banner service such as Spoonflower, or large-format paper service such as Staples or FedEx **Simplest option**: Print on 8.5” x 11” paper	Moon0_WelcomeSign.pdf
		Banner	56” x 34” cloth or paper **Option**: Can print using an on-demand fabric banner service such as Spoonflower, or large-format paper service such as Staples or FedEx **Simplest option 1**: Print on 8.5” x 11” paper **Simplest option 2**: Print tiled version on 8.5” x 11” paper (6 pages), trim, and tape together	**Version for large format printers:** Moon0_Banner.pdf **Tiled 8.5” x 11” version - must be trimmed and taped:** Moon0_Banner_tiled.jpg

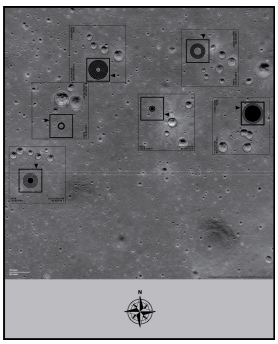
	 	Table signs	8.5” x 11” paper Multiple pages (6) Can be inserted into plexiglass sign stands or simply taped to a horizontal or vertical surface)	Moon0_TableSigns.pdf
		Labels	8.5” x 11” full-sheet stickers (such as Avery 8165) See First-Time Setup section of this guide for how to apply the stickers **Simplest option**: Print on 8.5” x 11” paper and tape onto surface	Moon0_Labels.pdf
		Labels for storage boxes	2” X 4” Can print multiple pages (7) or print all 7 labels on one page **Where to apply:** On the outside of your storage boxes **Option:** Print on 8.5” x 11” full-sheet stickers (such as Avery 8165) and trim **Simplest option**: Print on 8.5” x 11” paper, trim, and tape onto surface	Moon0_BoxLabels.pdf (one to a page, can print larger) Moon0_BoxLabels_layup.pdf (multiple on a page)
		Contents sheet for each box	8.5” x 11” paper Multiple pages (7) May want to laminate and tape to inside lid of storage box to provide a handy checklist	Moon0_BoxContentsLists.pdf

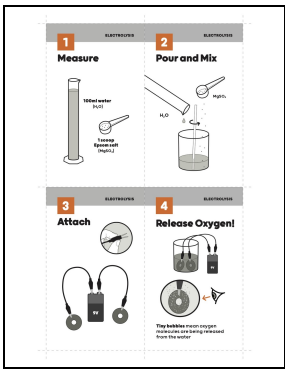
	Welcome			
		Facilitator Narrative Script (English and Spanish language versions)	8.5” x 11” paper Multiple pages Must be printed in color so that the two colors are distinct	**English version:** Moon0_NarrativeScript.pdf **Spanish version:** Moon0_NarrativeScript_Spanish.pdf
		Facilitator Narrative Script – Early Childhood Adaptation (English and Spanish language versions))	8.5” x 11” paper Multiple pages Must be printed in color so that the two colors are distinct	**English version:** Moon0_NarrativeScriptEarlyChildhood.pdf **Spanish version:** Moon0_NarrativeScriptEarlyChildhood_Spanish.pdf
*		Progress Tracker (English)	8.5” x 11” paper	Moon0_ProgressTracker.pdf
*		Progress Tracker (Spanish)	8.5” x 11” paper	Moon0_ProgressTracker-Spanish.pdf
		Mission Control cards (3)	2.75” x 4.75” **Simplest option**: Print on 8.5” x 11” cardstock or paper (double-sided), trim	Moon0_MissionControlCards.pdf

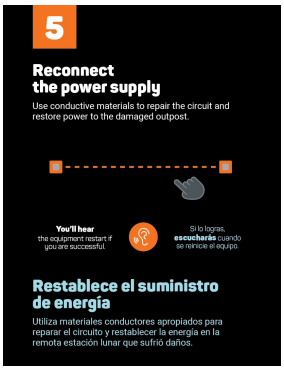
		Label – facilitator clipboard label	2.75” x 4.75” **Where to apply:** See First-Time Setup section of this guide **Option:** Print on 8.5” x 11” full-sheet stickers (such as Avery 8165) and trim **Simplest option**: Print on 8.5” x 11” paper, trim, and tape onto surface	Moon0_Labels.pdf
	Challenge 1: Make a Travel Plan for Your Rover			
		Table sign	8.5” x 11” paper Can be inserted into plexiglass sign stands or simply taped to a horizontal or vertical surface	Moon0_TableSigns.pdf
*		Rover Travel Plan (English)	8.5” x 11” paper	Moon1_RoverTravelPlan.pdf
*		Rover Travel Plan (Spanish)	8.5” x 11” paper	Moon1_RoverTravelPlan-Spanish.pdf

		Rover Travel Plan - answer key	Printing is not necessary, since the image is included in Facilitator Narrative Script	Moon1_RoverTravelPlanAnswerKey.pdf
		Binder cover sheet	8.5” x 11” paper	Moon1_BinderCover.pdf
		Binder map pages (19 pages)	8.5” x 11” paper Multiple pages (19 pages) Must be printed in full color	Moon1_BinderMapPages.pdf
	Challenge 2: Match Rover Data to Locations on the Map			
		Table sign	8.5” x 11” paper Can be inserted into plexiglass sign stands or simply taped to a horizontal or vertical surface)	Moon0_TableSigns.pdf
		Label – data locations envelope	5” x 3” **Where to apply:** See First-Time Setup section of this guide **Option:** Print on 8.5” x 11” full-sheet stickers (such as Avery 8165) and trim	Moon0_Labels.pdf

			Simplest option: Print on 8.5” x 11” paper, trim, and tape onto surface	
		Label – rover data bank	6.25” x 2.625” **Where to apply:** See First-Time Setup section of this guide **Option:** Print on 8.5” x 11” full-sheet stickers (such as Avery 8165) and trim **Simplest option**: Print on 8.5” x 11” paper, trim, and tape onto surface	Moon0_Labels.pdf
		Data location overlays	3.75” x 3.75” Six overlays on three sheets (two per sheet) Set print scaling to 100% - must be printed at correct size for challenge to work **Simplest option**: Print on three 8.5” x 11” plastic transparency sheets that are printer safe, then trim	Moon2_DataOverlayTransparencies.pdf
		Data blocks	Two sheets with images for six 1.5” cube blocks Each cube has four different side images plus an identical top and bottom image Each cube face must be adhered to the block in the correct order Set print scaling to 100% - must be printed at correct size for challenge to work **Option:** Print on 8.5” x 11” full-sheet stickers (such as Avery 8165), trim, and then adhere to the 1.5” wooden blocks **Simplest option**: Print on 8.5” x 11” paper, trim, and then tape to the 1.5” wooden block	Moon2_DataBlocks.pdf
		Lunar Surface Map	18” x 22” **Option:** Print full-size on large-format printer **Simplest option**: Print tiled version on 8.5” x 11” paper or cardstock Multiple pages Must print at actual size Then trim and tape sheets together	**Version for large format printers:** Moon2_LunarCraterMap.pdf Moon2_LunarCraterMap.jpg **Tiled 8.5” x 11” version - must be trimmed and taped:** Moon2_LunarCraterMap_tiled.jpg

		Lunar surface map answer key	8.5” x 11” Printing is not necessary, since image is included in the Facilitator Narrative Script	Moon2_LunarSurfaceMap.pdf
	Challenge 3: Extract Water from Frozen Lunar Material			
		Table sign	8.5” x 11” paper Can be inserted into plexiglass sign stands or simply taped to a horizontal or vertical surface	Moon0_TableSigns.pdf
		Label – cold storage (front side)	8” x 5” **Where to apply:** See First-Time Setup section of this guide **Option:** Print on 8.5” x 11” full-sheet stickers (such as Avery 8165) and trim **Simplest option**: Print on 8.5” x 11” paper, trim, and tape onto surface	Moon0_Labels.pdf
		Label – cold storage (top)	10” x 3” **Where to apply:** See First-Time Setup section of this guide **Option:** Print on 8.5” x 11” full-sheet stickers (such as Avery 8165) and trim **Simplest option**: Print on 8.5” x 11” paper, trim, and tape onto surface	Moon0_Labels.pdf
		Label – water extractor (front side)	8” x 4.125” **Where to apply:** See First-Time Setup section of this guide **Option:** Print on 8.5” x 11” full-sheet stickers (such as Avery 8165) and trim **Simplest option**: Print on 8.5” x 11” paper, trim, and tape onto surface	Moon0_Labels.pdf

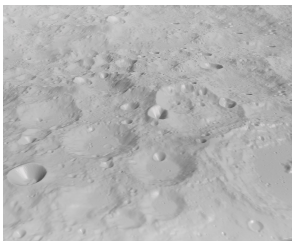
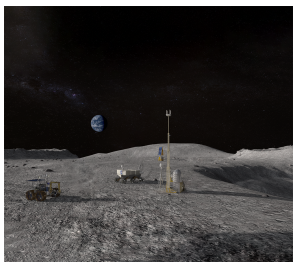
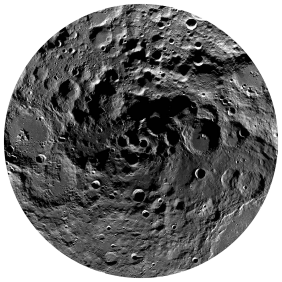
		Label – water extractor (top)	8.5” x 6.5” **Where to apply:** See First-Time Setup section of this guide **Option:** Print on 8.5” x 11” full-sheet stickers (such as Avery 8165) and trim **Simplest option**: Print on 8.5” x 11” paper, trim, and tape onto surface	Moon0_Labels.pdf
	Challenge 4: Fill Your Oxygen Tanks			
		Table sign	8.5” x 11” paper Can be inserted into plexiglass sign stands or simply taped to a horizontal or vertical surface	Moon0_TableSigns.pdf
		Label – Emergency Oxygen Supply Kit	9” x 2.5” **Where to apply:** See First-Time Setup section of this guide **Option:** Print on 8.5” x 11” full-sheet stickers (such as Avery 8165) and trim **Simplest option**: Print on 8.5” x 11” paper, trim, and tape onto surface	Moon0_Labels.pdf
		Label – Epsom salt	2” x 1.25” **Where to apply:** See First-Time Setup section of this guide **Option:** Print on 8.5” x 11” full-sheet stickers (such as Avery 8165) and trim **Simplest option**: Print on 8.5” x 11” paper, trim, and tape onto surface	Moon0_Labels.pdf
		Electrolysis instruction cards	2.75” x 4.75” Nine double-sided card printed on three double-sided sheets **Simplest option**: Print on 8.5” x 11” paper or cardstock, double-sided for English and Spanish, trim	Moon4_ElectrolysisInstructionCards.pdf

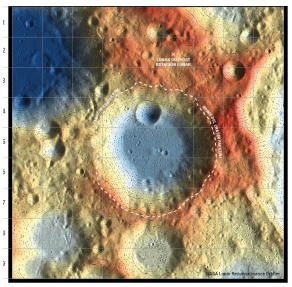
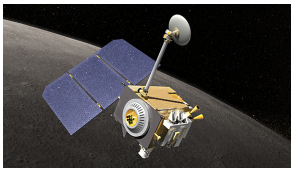
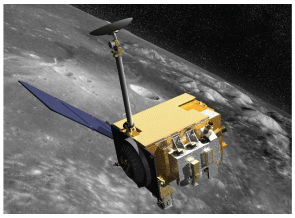
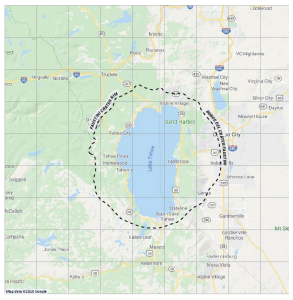
	Challenge 5: Reconnect the Power Supply			
		Table sign	8.5” x 11” paper Can be inserted into plexiglass sign stands or simply taped to a horizontal or vertical surface	Moon0_TableSigns.pdf
		Label – power	8.25” x 3” **Where to apply:** See First-Time Setup section of this guide **Option:** Print on 8.5” x 11” full-sheet stickers (such as Avery 8165) and trim **Simplest option**: Print on 8.5” x 11” paper, trim, and tape onto surface	Moon0_Labels.pdf
		Power board	60” x 12” **Option:** Print full-size on large-format printer **Simplest option 1**: Print tiled version on 8.5” x 11” cardstock heavyweight paper, trim, and tape together **Simplest option 2**: Print tiled version on 8.5” x 11” paper, trim, then tape onto table surface or cardboard	**Version for large format printers:** Moon5_PowerBoard.pdf **Tiled 8.5” x 11” version - must be trimmed and taped:** Moon5_PowerBoard_tiled.pdf
		Mug label – Apollo 13 insignia	2” circle **Simplest option 1:** 8.5” x 11” full-sheet stickers (such as Avery 8165), trim **Simplest option 2**: Print on 8.5” x 11” paper, trim, and tape onto surface	NASA_Apollo13_insignia.jpg

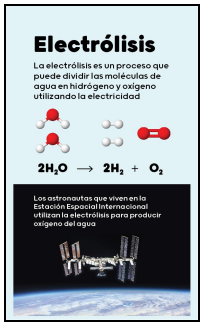
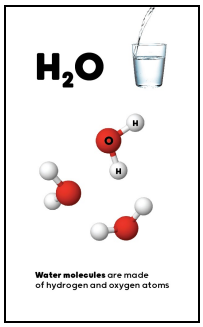
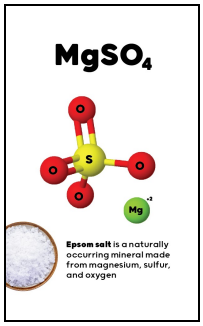
	Wrap-up and Reflection			
		Sticker – NASA Artemis lunar exploration program identity	2” x 2” **Option 1**: Custom labels or temporary tattoo on-demand services **Option 2**: Print on small square labels (such as Avery template 22806) **Simplest option**: Use any Moon or space sticker or temporary tattoo	NASA_Artemis_identity full color.png
		Sticker – NASA Artemis I identifier Patch	2” x 2” **Option 1**: Custom labels or temporary tattoo on-demand services **Option 2**: Print on small square labels (such as Avery template 22806) **Simplest option**: Use any Moon or space sticker or temporary tattoo	NASA_Artemis_I_patch_alternate.jpg
		Temporary Tattoo – NASA Artemis I identifier Patch	1.5” x 1.5” **Option 1**: Custom labels or temporary tattoo on-demand services **Option 2**: Print on small square labels (such as Avery template 22805) **Simplest option**: Use any Moon or space sticker or temporary tattoo	NASA_Artemis_I_patch.jpg
	Logos			
		Logo horizontal 1	Logos provided in JPG, PNG, PDF, and Adobe Illustrator (AI) formats	Moon_Game_Logo_horizontal_1
		Logo horizontal 2	Logos provided in JPG, PNG, PDF, and Adobe Illustrator (AI) formats	Moon_Game_Logo_horizontal_2
		Logo square	Logos provided in JPG, PNG, PDF, and Adobe Illustrator (AI) formats	Moon_Game_Logo_square
		Logo text	Logos provided in JPG, PNG, PDF, and Adobe Illustrator (AI) formats	Moon_Game_Logo_text

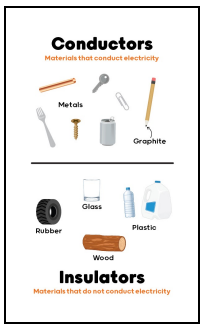
ACKNOWLEDGMENTS >

Image Credits

	**Welcome Poster and Banner Image** This image based on data from NASA's Lunar Reconnaissance Orbiter spacecraft shows the face of the Moon we see from Earth. Credit: NASA/GSFC/Arizona State University https://www.nasa.gov/feature/goddard/2020/moon-more-metallic-than-thought NASA images are subject to NASA Media Usage Guidelines https://www.nasa.gov/multimedia/guidelines/index.html
	**Banner Image** 3D file image generated using Moon Trek, NASA Jet Propulsion Laboratory https://trek.nasa.gov/moon/ NASA images are subject to NASA Media Usage Guidelines https://www.nasa.gov/multimedia/guidelines/index.html
	**Banner Image** Source Image: An artist's depiction of work on the Moon as part of the Artemis lunar exploration program Credit: NASA NASA images are subject to NASA Media Usage Guidelines https://www.nasa.gov/multimedia/guidelines/index.html
	**Challenge 1 – Binder Cover** Lunar South Pole region Credit: NASA Lunar Reconnaissance Orbiter Camera (LROC) [NASA/GSFC/Arizona State University] NASA images are subject to NASA Media Usage Guidelines https://www.nasa.gov/multimedia/guidelines/index.html

	**Challenge 1 – Binder Images – Faustini Crater** Credit: NASA Lunar Reconnaissance Orbiter Camera (LROC) [NASA/GSFC/Arizona State University] NASA images are subject to NASA Media Usage Guidelines https://www.nasa.gov/multimedia/guidelines/index.html
	**Challenge 1 – Binder Image – Lunar Reconnaissance Orbiter** Artist's concept of the Lunar Reconnaissance Orbiter above the Moon Credit: NASA/GSFC https://www.nasa.gov/mission_pages/LRO/multimedia/LROimg2_20080423.html NASA images are subject to NASA Media Usage Guidelines https://www.nasa.gov/multimedia/guidelines/index.html
	**Challenge 1 – Binder Image – Lunar Reconnaissance Orbiter** Artist's concept of the Lunar Reconnaissance Orbiter above the Moon Credit: NASA/GSFC https://www.nasa.gov/mission_pages/LRO/overview/index.html NASA images are subject to NASA Media Usage Guidelines https://www.nasa.gov/multimedia/guidelines/index.html
	**Challenge 1 – Binder Images – Size Comparison Maps** Google Maps Credit: Map data ©2020 Google As per Google guidelines: https://www.google.com/permissions/geoguidelines/attr-guide/
	**Challenge 2 – Lunar Surface Map** Source Image: NASA Lunar Reconnaissance Orbiter Camera (LROC) [NASA/GSFC/Arizona State University] http://lroc.sese.asu.edu/posts/484 NASA images are subject to NASA Media Usage Guidelines https://www.nasa.gov/multimedia/guidelines/index.html

	**Challenge 4 – Electrolysis Instruction Cards – Electrolysis Card** The International Space Station photographed by Expedition 56 crew members from a Soyuz spacecraft after undocking. Credit: NASA/Roscosmo https://www.flickr.com/photos/nasa2explore/31763901878/ https://www.nasa.gov/mission_pages/station/structure/elements/space-station-assembly NASA images are subject to NASA Media Usage Guidelines https://www.nasa.gov/multimedia/guidelines/index.html
	**Challenge 4 – Electrolysis Instruction Cards – Electrolysis, H_2O Water, and $MgSO_4$ Epsom Salt Cards** Images: Molecule images generated with MolView Images exported in MolView are free to use for any purpose http://molview.org
	**Challenge 4 – Electrolysis Instruction Cards – H_2O Water Card** Image: Glass of water Stock Image from Raw Pixel https://www.rawpixel.com Stock images are not covered under the terms of Creative Commons license https://www.rawpixel.com/image/2340598/free-illustration-png-water-pour-water-2340598
	**Challenge 4 – Electrolysis Instruction Cards – $MgSO_4$ Epsom Salt Card** Image: Salt Stock images under license from Adobe Stock images https://stock.adobe.com/images/ Stock images are not covered under the terms of Creative Commons license https://stock.adobe.com/images/closeup-coarse-or-rock-natural-sea-salt-in-brown-bowl-isolated-on-white-background-clipping-path-top-view/296034360?asset_id=296034360
	**Challenge 4 – Electrolysis Instruction Cards – Conductor and Insulators Card** Conductor images: metal key, metal aluminum can, graphite pencil Stock Images from Raw Pixel https://www.rawpixel.com Stock images are not covered under the terms of Creative Commons license https://www.rawpixel.com/image/393760/free-illustration-vector-key-free-key-key-vector https://www.rawpixel.com/image/469845/people-recycling-garbage https://www.rawpixel.com/image/390675/free-illustration-vector-pencil-icon-office

	**Challenge 4 – Electrolysis Instruction Cards – Conductor and Insulators Card** Conductor images: metal fork, metal screw Insulator image: rubber tire Stock images under license from Vector Portal https://www.vectorportal.com Free stock vector images https://www.vectorportal.com/StockVectors/Clip-art/Fork-knife-and-a-spoon-vector-clip-art/30384.aspx https://www.vectorportal.com/StockVectors/Various/Self-tapping-screw-vector-image/31003.aspx https://www.vectorportal.com/StockVectors/Vehicles-transportation/Automobile-tire-and-a-rim-vector/31654.aspx
	**Challenge 4 – Electrolysis Instruction Cards – Conductor and Insulators Card** Conductor images: metal copper pipe, plastic liter bottle, plastic gallon jug Insulator images: wood log, glass Stock images under license from Adobe Stock images https://stock.adobe.com Stock images are not covered under the terms of Creative Commons license https://stock.adobe.com/images/copper-pipes-collection-construction-material-polished-metal-texture-glossy-gradient-vector-illustration/346958029 https://stock.adobe.com/images/plastic-bottles-water-cooler-bottle-pet-package-for-liquids-and-soda-drink-beverage-liquid-bottles-storage-fresh-cold-water-empty-packages-isolated-vector-illustration-icons-set/291099562 https://stock.adobe.com/images/gallon-of-milk-vector/164604454 https://stock.adobe.com/images/wooden-log-collection/62982552 https://stock.adobe.com/images/transparent-vector-glass-of-water-on-light-background/270033667
	**Challenge 4 – Electrolysis Instruction Cards – Conductor and Insulators Card** Conductor image: paperclip Stock images from PublicDomainVectors.org https://publicdomainvectors.org Vector images in public domain https://publicdomainvectors.org/en/free-clipart/Paper-clips-vector-graphics/26572.html
	**Challenge 5 – Mug label** Apollo 13 insignia Credit: NASA https://www.nasa.gov/mission_pages/apollo/missions/apollo13.html NASA images are subject to NASA Media Usage Guidelines https://www.nasa.gov/multimedia/guidelines/index.html

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	**Sticker** Artemis I identifier Patch (alternate) Credit: NASA https://www.nasa.gov/feature/artemis-i-identifier NASA images are subject to NASA Media Usage Guidelines https://www.nasa.gov/multimedia/guidelines/index.html
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Please note, the electrolysis of water experiment in Challenge 4 is a common chemistry activity that exists in many variations.

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