Engineering Adventure 2: Everyday Gloves: Exploring Glove Uses

Educator Preview

Adventure Snapshot

Learners try doing simple tasks wearing different kinds of gloves and compare results. Learners then find out about space hazards and spacesuit design.

Timing | 75 minutes

Get Ready & Team Up	10 min.
Which Glove Works Best?	50 min.
Reflect & Wrap Up	15 min.
Total	**75 min.**

Level Up Activities 5–45 min. each

Prep Snapshot*

Prep Time 55 min.

- Set up materials stations.
- Print handouts.
- Prepare ice and sponges for upcoming adventures, as noted in Materials & Preparation.

**See Materials & Preparation for full info.*

21st Century Skills

Connection

- Collaboration

Habits of Mind

- Collaborate effectively.
- Construct models and simulations.

Guiding Question

Which gloves work best for everyday tasks?

Learners Will Do

Connect test results for different gloves with the performance of spacesuits that protect astronauts from space hazards.

Learners Will Know

Engineers design technologies that protect people from different hazards.

Connecting Across Adventures

Adventure 1: Sharing Experiences	Adventure 2: Exploring Glove Uses	Adventure 3: Protecting Against Cold
Last time, learners shared experiences with and stories about making hazards safer.	**Today**, learners do simple tasks wearing different gloves and compare results. Then they learn how spacesuit gloves protect astronauts from space hazards.	**Next time**, learners will test different materials to see how well they protect against cold temperatures. Later, they'll use that info to design space gloves.

Activity Resources

Access videos and digital resources using the link or QR code below. More information for teaching this curriculum is available in the Educator Guide Introduction (pgs. iii–xxvi). Access more PLANETS units, research, and pathways at https://planets-stem.org/.

weblink: https://hov.to/4179271c

Materials and Preparation

Materials

For the whole group

- *Our Ideas* poster (on paper or a shared digital document) Examples | Templates
  - index cards
  - markers
  - scissors
  - tape
- 1 box of food-safe gloves
- 1 box of vinyl gloves
- 1 permanent marker
- 1 tablespoon measure

For the Glove Test Stations

- access to water
- directions and results sheets for Stations 1–3, pgs. 36-41.
- 1 bottle of dish soap
- 1 roll of masking tape
- 2 rolls of paper towels
- 4 jars with twist lids
- 4 fuzzy sticks
- 4 plastic cups, 16 oz.
- 6 aluminum trays, 12" × 10"
- 8 timers
- 28 washers, 1.25"
- 60 beads
- 160 paper clips

For each pair of learners

- 1 pair of gloves: dish, food-safe, garden, oven mitt, vinyl, or winter
- tongs, plastic bags, socks (as needed)
- Engineering Adventure 2 Glove Testing Directions Handout, pg. 42

For each learner

- Engineering Notebook (PDF)

Adventure 2 Materials Preparation (55 min.)

Ahead of Time

1. Check to ensure the foil trays did not develop holes in the previous adventure. If they did, find other containers to hold liquids during this adventure.
2. Make 1 copy of each of the directions and results sheets for Stations 1–3, pgs. 36-41.

Teaching Tip

This is a very messy adventure. Ensure you have enough time to clean up afterward, and consider using page protectors that will make it easier to clean materials.

3. Make 1 copy of Engineering Adventure 2 Glove Testing Directions Handout, pg. 42, for each pair of learners.
4. If you did not do so before the Ready, S.E.T., Go Adventure, prepare an *Our Ideas* poster by following the Prep & Setup Guide (PDF). Add the Guiding Question "Which gloves work best for everyday tasks?" so learners can refer to it throughout the adventure.

In Your Space

5. Place the *Our Ideas* poster in a location all learners can access. Make a plan to store it between activities.
6. See Glove Test Setup Instructions, pg. 33.

Ice and Sponge Preparation for Other Adventures

7. Be aware that you will need 12 cups of ice **each** for Adventures 3, 6, and 7.
8. Take sponges out of packages to give them time to dry out. Sponges need to be dry so tape will stick to them. Dry sponges are for Adventures 3–7.

Support Learner Differences

Group learners with different abilities and strengths in a way they can all contribute. Check out the Intentional Grouping Strategies, pg. xxii.

Get ready to adjust the activity or materials for any learner whose physical abilities mean they have different needs for using gloves. Ask learners in advance what they need to complete the activity. They are the experts knowing their physical capabilities. You can have alternative tools like tongs, oven mitts, plastic bags, or socks to test how wearing protective coverings affects their ability to handle objects in their usual way, but don't assume they cannot do the activity as written.

Adventure Guide

Get Ready & Team Up (10 min.)

1. Ask: **If you did the last activity, what did you do and why?** *(We told stories about hazards and how we have made them safer.)* Draw learners' attention to their work on the *Our Ideas* poster about the hazards they addressed.
2. Ask: **What are hazards?** Have learners decide on a definition of *hazard* as a whole group. Add *hazard* and the definition that you agree on to the *Our Ideas* poster, along with translations into learners' preferred languages and relevant images. (You may want to add a danger icon next to the term.)
3. Have learners read the *Engineering Comic*, pgs. 11-14 in their Notebooks, to set the context.
4. Say: **As engineers, we are going to try to answer the big question in the comic: How can we design space gloves that protect astronauts from space hazards on the Moon, Mars, or asteroids?** Write the question in a prominent spot at the top of the *Our Ideas* poster. **To start figuring this out, we're going to explore how easy–or hard–it is to do things while wearing gloves.** Share the Guiding Question with learners aloud and write it on the *Our Ideas* poster (using multiple languages as needed): **Which gloves work best for everyday tasks?**
5. Organize learners into pairs.

Support Learner Differences

If new learners are joining you, lead an inclusion activity (pgs. xx-xxi) and use other engagement strategies as necessary (pgs. viii–xviii).

Support Learner Differences

You can project a digital version of the comic or share it so learners using text-to-speech technology can access the comics.

- iOS or macOS users should enable text-to-speech or voice-over.
- Windows users should use JAWS or NVDA at NV Access.

Be sure to read carefully and leave a visual shortcut to exit the program, or have your learner restore settings when they are done.

Support Learner Differences

Pair learners in a way that lets each learner use their self-identified strengths. If you have learners who speak multiple languages, consider pairing learners with the same preferred language so they can share with each other in that language.

Depending on your learners, it may be useful to have two pairs work together in a group of four in order to allow more discussion and specialization. For example, at the "Find the Message" station, a learner who is good with their hands can turn over the washers, and a learner who is good at reading can read the message.

Which Glove Works Best? (50 min.)

6. Give one type of glove to each pair and allow them time to examine it. Have pairs discuss if they think it will be easier or harder to do things wearing these gloves.
7. Show learners the sheet at each station. Point out the directions and results chart. Give each pair a copy of Engineering Adventure 2 Glove Testing Directions Handout, pg. 42. Say:
   a. **First, you will read directions on how to test gloves.**
   b. **Next, you will complete the test with your gloves on.**
   c. **Then, you will record your results in the chart.**
   d. **Finally, you will reset the station.**
   e. **You must visit all three stations. When you finish one station, you can move to any available station.**
   f. **You and your partner need to decide how to take turns testing, recording, and resetting.**
8. Ask: **Do you have all the tools you need to do this activity? What other tools would help you?** (Have tongs, socks, or bags on hand.)
9. Have learners go to their first station and begin. Give learners a 3-minute limit warning and a 1-minute warning, then tell them when to switch.

Teaching Tips

- This activity uses six types of gloves. Each pair of learners tests one type. If you have more than six pairs, assign food-safe or vinyl gloves to more than one pair.
- Let learners know they can replace food-safe and vinyl gloves between stations, if they need to.

Reflect & Wrap Up (15 min.)

10. Gather learners and review the results. **Ask: What surprised you? Which tasks did your gloves do best and worst in? Why?** Have learners discuss in pairs and record their ideas on the *Our Ideas* poster. Guide learners to think about how the **materials** that the gloves are made from affected results. Add *materials* and a definition learners agree on to the *Our Ideas* poster, along with translations into learners' preferred languages and relevant images.
11. Revisit the Guiding Question on the *Our Ideas* poster: **Which gloves work best for everyday tasks?** Help learners make the connection that, just as different gloves work better for different tasks, different spacesuit materials are designed to work for the different goals of a mission. As needed, remind learners of the term *hazard*.
12. Say: **Next time, you will test materials to see how well they protect against cold. Later, you will use what you learn to design space gloves.**

Support Thinking

Hand out Engineering Adventure 2 Gloves in Action Handout (PDF) to review the function, materials, and features of each glove.

Level Up!

- Refer to the Engineering Design Process poster (PDF). Ask: **What phases of the Engineering Design Process did you use today?** *(The Ask phase. We asked which gloves are best for which uses.)* (5 min.)
- If you can, show the NASA video #AskNASA | What Are the Next Generation Spacesuits? (3:32) to help learners understand how NASA engineers design spacesuits to meet the needs of astronauts. The video mentions the testing of five spacesuit materials on Mars, happening now on the Perseverance rover. Learners will be testing materials in Adventures 3, 4, and 5. (5 min.)
- Ask this story prompt: **Can you tell me a story about another time when using the right tool or clothing made something way easier for you?** Tell learners, if anyone asks what they did today, they can say "we tried to do things wearing different types of gloves in the same way that NASA tests spacesuits for astronauts," and then ask them the above story prompt. Consider returning to learners' ideas at the start of the next adventure. (5 min.)
- Get families or a community member involved to share relevant stories of engineering. Download customizable flyers and get ideas on the Space Hazards Family and Community Connections (weblink). (45 min.)

After the Adventure

1. Clean up:
   - Keep the *Our Ideas* poster for Adventure 3.
   - Throw away disposable gloves and any materials that cannot be reused.
   - Dispose of water and rinse soapy materials and dry them.
   - Save reusable gloves, washers, and other materials.
2. Plan for Engineering Adventure 3. See the Adventure 3 Preparation on pg. 45. Note that you will need to prepare two Cold Testing Stations, requiring a total of 12 cups of ice. Set up will likely take at least 45 minutes.
3. Take time to reflect on the following educator prompt. **What strengths did your diverse learners bring to the adventure?**

Space Hazards Additional Resources

Resources include All Downloads, All Videos, Family Connections, and more.

weblink: https://hov.to/940428f7

Glove Test Setup Instructions

Arrange the glove test stations on separate tables by following the instructions below. Each station will have 4 setups so that 4 pairs of learners can test at a time. Arrange the setups per station as needed to meet your group's needs.

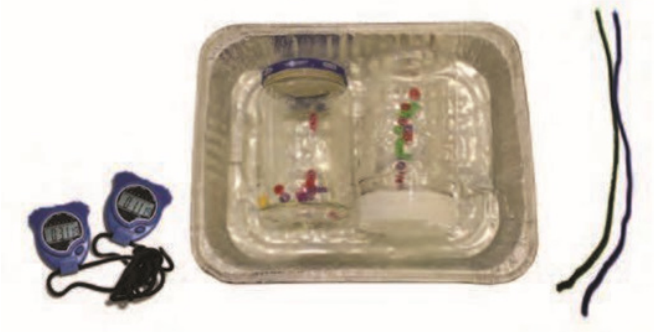
Station 1: Slippery Jar Setup

Materials

- Engineering Adventure 2 Station 1: Slippery Jar Directions Handout, pg. 36
- Engineering Adventure 2 Station 1 Results Handout, pg. 37
- access to water
- writing utensil
- 1 bottle of dish soap
- 1 roll of paper towels
- 1 tablespoon measure
- 2 aluminum trays, 12" × 10"
- 4 pipe cleaners / fuzzy sticks
- 4 plastic jars with twist lids
- 4 timers
- 60 beads

Instructions

1. Place the Engineering Adventure 2 Station 1: Slippery Jar Directions Handout, pg. 36 and Engineering Adventure 2 Station 1 Results Handout, pg. 37 at the station where learners can see them, along with a writing utensil.
2. Place 15 beads in each jar and tighten the lids.
3. Pour 1 cup of water into each aluminum tray and add 2 tablespoons of dish soap.
4. Roll the jars in the soapy water and leave them in the tray.
5. Place 2 fuzzy sticks, 2 timers, and a roll of paper towels near each tray.



Station 1: Slippery Jar

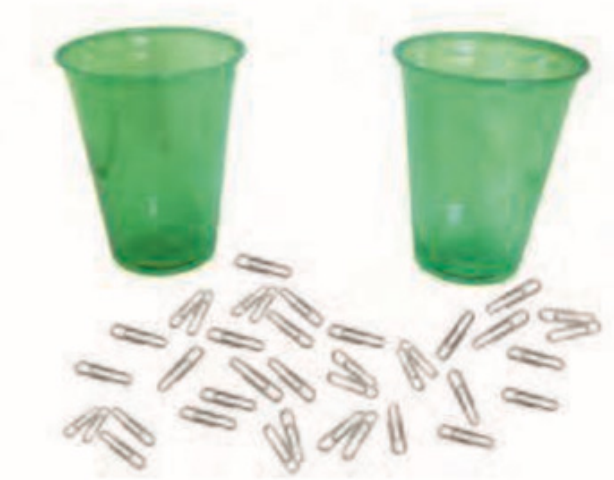
Station 2: Paper Clip Pickup Setup

Materials

- Engineering Adventure 2 Station 2: Paper Clip Pickup Directions Handout, pg. 38
- Engineering Adventure 2 Station 2 Results Handout, pg. 39
- writing utensil
- 4 plastic cups, 10 oz or larger
- 4 timers
- 160 paper clips

Instructions

1. Place the Engineering Adventure 2 Station 2: Paper Clip Pickup Directions Handout, pg. 38 and Engineering Adventure 2 Station 2 Results Handout, pg. 39 at the station where learners can see them, along with a writing utensil.
2. Spread the paper clips on the table in a single layer.
3. Place the plastic cups and timers around the paper clips.



Station 2: Paper Clip Pickup

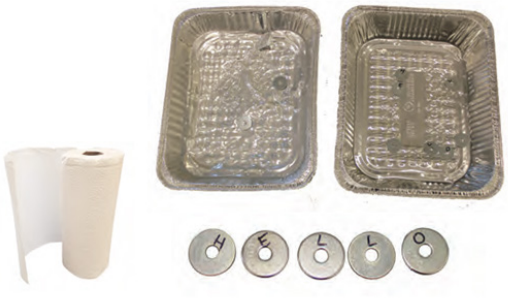
Station 3: Find the Message Setup

Materials

- Engineering Adventure 2 Station 3: Find the Message Directions Handout, pg. 40
- Engineering Adventure 2 Station 3 Results Handout, pg. 41
- access to water
- writing utensil
- 1 permanent marker (to write the message. It is not part of the station.)
- 1 roll of paper towels
- 4 aluminum trays, 12" × 10"
- 28 washers

Instructions

1. Place the Engineering Adventure 2 Station 3: Find the Message Directions Handout, pg. 40 and Engineering Adventure 2 Station 3 Results Handout, pg. 41 at the station where learners can see them, along with a writing utensil.
2. Fill each tray halfway with water.
3. Choose a word with 5 letters (e.g., "hello")—this will be the message learners need to find.
4. Use a permanent marker to write 1 letter of the message on each washer. Do this again so you have 4 sets of washers with the same 5 letters written on them.
5. Place 1 message in each tray. Add 2 additional washers to each tray and turn all the washers over to hide the letters.
6. Place a roll of paper towels at this station in case of spills.
7. Optional: Write the message on *Engineering Adventure 2 Station 3: Find the Message Directions Handout* so learners know what to look for as they complete the task.



Station 3: Find the Message

Station 1: Slippery Jar Directions

Note: These directions are also read aloud in a translatable online video.

1

2 hands and gloves

timer (max time = 3 min.)

jar and lid

fuzzy stick

stringing beads

2

Test directions

1. Start the timer.
2. Open the jar and take out 3 beads.
3. String each bead onto the fuzzy stick.
4. Twist the lid back on the jar.
5. Stop the timer.

3

How long did it take to do the task?

Record your results

Reset

1. Put the beads back in the jar and close the lid.
2. Roll the jar in the soapy water.
3. Use the paper towels to dry your gloves.
4. Move to the next station.

wash station

Station 1 Results

Glove Type	Time to Complete (seconds)
dish 	
food safe 	
garden 	
oven 	
vinyl 	
winter 	

Station 2: Paper Clip Pickup Directions

Note: These directions are also read aloud in a translatable online video.

1

1 hand and glove

+

timer (20 sec.)

+

empty cup

+

paper clips

2

Test directions

1. Set the timer for 20 seconds.
2. Pick up paper clips one at a time and drop them in the cup.
3. Stop the timer after 20 seconds.

3

How many paper clips are in the cup?

Record your results

Reset

1. Take the paper clips out of the cup.
2. Spread the paper clips on the table in a single layer.
3. Move to the next station.

Station 2 Results

Glove Type	Number of Paper Clips
dish 	
food safe 	
garden 	
oven 	
vinyl 	
winter 	

Station 3: Find the Message Directions

Note: These directions are also read aloud in a translatable online video.

1

2 hands and gloves

+

tub with water and washers

2

Test directions

no time limit

1. Turn over the washers in the water.
2. Arrange the washers to reveal the message.
3. Take the gloves off.

3

Record your results

Are your hands wet or dry?

Reset

1. Turn the washers over so the message is hidden.
2. Mix up the washers so the message is hard to find.
3. Use paper towels to dry your gloves.
4. Move to the next station.

Station 3 Results

Glove Type	Wet or Dry Hands?
dish 	
food safe 	
garden 	
oven 	
vinyl 	
winter 	

Glove Testing Directions

At each station...

1. Read directions on how to test gloves.
2. Complete the test with the gloves on.
3. Record your results in the chart.
4. Reset the station.

You must visit all three stations. When you finish one station, you can move to any available station.

You and your partner need to decide how to take turns testing, recording, and resetting.