

Science Activity 4: Choose a Landing Site and Science Showcase

Educator Preview

Activity Overview

Youth combine multiple data sets made possible by technologies that engineers designed to choose a safe and scientifically interesting landing site for a Mars rover. They then share their findings with the whole group and with invited guests.

Timing		Prep Snapshot	21st Century Skills Connection
Introduction	5 min	Prep Time 15 min (several days in advance)	<ul style="list-style-type: none"> • Communication
Choose a Landing Site	15 min		
Prepare for the Showcase	30 min	Send Science Showcase Invitations people from the community.	Science Practices <ul style="list-style-type: none"> • Interpreting Data • Constructing Explanations • Communicating Information
Science Showcase	30 min		
Reflect	5 min		
Total	85 min		

Guiding Question	Youth Will Do	Youth Will Know
Which landing site on Mars do we recommend, and why?	<ul style="list-style-type: none"> • Integrate their understanding of prior data sets to select where to land on Mars. • Justify their reasoning about landing site selection and communicate their explanation to others. 	<ul style="list-style-type: none"> • Using different types of remote sensing gives a more complete understanding of an area. • Choosing a site involves making tradeoffs.

Connecting Across Activities

In the previous three Activities, youth examined different kinds of remote sensing data from Mars. In this Activity, they apply what they have learned about landforms, topography, and minerals as they select landing sites.

Educator Guide

Educator Resources

Access Activity resources using link or QR code.

Activity Resources

QR code leads to resources available for this Activity.



<https://planets-stem.org/betars-activity-s4/>

Family Connection

If time permits, have youth ask the following question to their Elders, families, or mentors before the Activity:

Q: Can you tell me a story about how you made an important decision? Did you follow a process? Who did you talk to?

Educator Guide

Materials and Preparation

Materials

For the whole group

- Audio mineral data from Science Activity 3
- Tactile *Mineral Fingerprints Data Handout* from Science Activity 3 (optional)
- Tactile version of the *Science Activity 3 Data Packet* (optional)
- Devices for listening to audio
- *Landforms Chart* or shared document from Science Activity 1
- *Topography Chart* or shared document from Science Activity 2
- *Minerals Chart* or shared document from Science Activity 3

For each small group

- *Data Packets* from Science Activities 1 – 3
- *Landing Site Oval* from Science Activity 1

For each youth

- Science Notebook

For community members

- Science Showcase Invitations

Activity 4 Materials Preparation (15 min)

1. If you have not already, send out Science Showcase Invitations to invite people from the community, including families and friends of youth, to the Science Showcase.

2. For reference,
 - a. download the audio files for each spectrum and set up a listening station center for youth to refer to as they choose. Place one copy of the *Mineral Fingerprints Data Handout* and one copy of the *Science Activity 3 Data Packet* at the center.
 - b. place tactile *Mineral Fingerprints Data* and tactile *Science Activity 3 Data Packet* at a center that is accessible to all youth so they can refer to these as they choose.

3. Post the *Landforms Chart*, *Topography Chart*, and *Minerals Chart* in a location that is accessible to all youth.

Teaching Tip

If you think youth will need more time to plan for the Showcase, you can run this activity over two sessions.

Activity Guide

Guiding Question: Which landing site on Mars do we recommend, and why?

Post the question somewhere accessible, such as on chart paper or a shared document, so that youth can refer to it throughout the activity.

Introduction (5 min)

1. If you sent youth home with the Family Connection question, ask:

Q: Did anyone talk with their families about making important decisions? If so, is there anything you would like to share?

A: Accept all responses. Possible strategies for decision-making include thinking long and hard, making a pro/con list, and gathering information by getting advice, researching, or testing things out.

2. Explain that scientists also gather information to make decisions. NASA scientists use remote sensing data to make decisions about where to land rovers.
3. Have youth think back to the previous activities by asking one or more of the following questions:

Q: What decision are we trying to make?

A: We are choosing a landing site for a rover on Mars to search for evidence of past water.

Q: What kinds of data have we gathered to help us make this decision?

A: Responses will vary. Possible responses include images of the landforms on Mars, topographic maps of Mars, and spectra of minerals on Mars.

Q: How will the data help us make this decision?

A: Responses will vary. A possible response is that certain landforms and minerals provide evidence of past water, while topographic maps show where it is safe for a rover to land.

4. Share the Guiding Question:

Q: Which landing site on Mars do we recommend, and why?

Let youth know that today they will consider all the data they have collected and choose the landing site they decide is safest and most likely to have evidence of past water.

Supporting Learner Differences

If youth are engaged in the bonus challenge of searching for volcanic activity from Science Activity 1, they might also choose a landing site that they determine has the greatest chance of having evidence of past volcanic activity.

Choose a Landing Site (15 min)

1. Ask groups to review their data about (1) landforms, detected from images in Science Activity 1, (2) safety, based on topographic maps in Science Activity 2, and (3) minerals, detected from spectroscopy in Science Activity 3. As you mention each type of data, refer to the posted *Landforms*, *Topography*, and *Minerals Charts* or shared documents from Science Activities 1 – 3.
2. Have each group use *Putting the Data Together*, pages 27 – 29 in their Science Notebooks, to rank their top two sites and describe their reasoning for choosing each. If necessary, suggest roles that group members can fill, such as one member referring to observations from previous activities, another member tracing the landing oval on maps, and a third recording the group's choices. As they make their decision, youth should consider the tradeoff between site safety and interesting science.

Prepare for the Showcase (30 min)

1. Once each group chooses a site, have that group decide how they would like to share information about the landing site they have selected. Let them know that they will share their work with the whole group and any invited guests. If they want to, youth can use the sentence frames on *Make the Case for Your Site*, page 30 their Science Notebooks, to get started.
2. The Showcase is a chance for youth to explain their thinking and reflect on what they learned about remote sensing throughout the unit. As a group, agree upon a structure for the Showcase. Possible structures include the following:
 - Gallery Walk where different groups stand at their stations and explain posters, graphs, maps, writings, drawings, audio or videos on small devices, or other artistic depictions of the site they believe should be selected.
 - Screening of whole-group video or audio files.
 - Performance in which some people play scientists making recommendations and some are NASA professionals asking questions about the site. You can develop script cards to include adults in the play.
 - Discussion in which youth and community members share their knowledge. You can write discussion prompts to lead this discussion.
3. As groups are working, help guide their thinking by asking one or more of the following questions:

Q: What evidence from the data packet can you use to help you choose your landing site?

A: Responses will vary. Possible responses include that a site has river valleys or deltas, that it is flat, and that it has minerals that form in water.

Q: Which site do you think will be the most scientifically interesting? Why?

A: Accept all responses.

Q: Which is more important: site safety or interesting science? Why?

A: Accept all responses.

Science Showcase (30 min)

1. When youth are ready, invite guests into the room and explain how the Showcase will proceed. Carry out the steps of the Showcase as the group has planned.
2. As they experience the Showcase, invite families and other guests to think about their family, cultural, or other knowledge related to what they observe here today and share that knowledge with youth individually or the event as a whole.
3. After all groups have shared, ask youth to reflect on the sites selected:

Q: Did all groups agree on a site that has evidence of past water and is safe to land on? Why or why not?

A: Accept all responses.

Q: Would you have made the same recommendation if you were missing some of the data from the packets? For example, how would your recommendation be different if you had no data about landforms?

A: Responses will vary. A possible response is that we could not have chosen our site if we didn't know about its landforms, topography, and minerals. Using different kinds of remote sensing together gives a much more complete understanding of a site, much like how a person uses all their senses to understand the world, not just one.

4. Congratulate youth on their excellent scientific work. Let them know that they have just followed a process very similar to what NASA scientists do when choosing landing sites!

Reflect (5 min)

1. Restate the Guiding Question:

Q: Which landing site on Mars do we recommend, and why?

A: Youth should refer to their own work to answer the question. Help youth to accept that other groups may have made different choices, and that's fine as long as they can support their choice using the data they collected.

2. Discuss how landing at sites selected using data from spacecraft allows scientists to learn as much as possible about Mars to help answer their questions. Sometimes, many sites seem interesting, so the evidence scientists use to explain their reasoning is important. There is also the tradeoff aspect: a site may be "best" in terms of science but not good for safety. More broadly, important decision making requires looking at the problem in different ways, working as a group, and compromise.
3. Let youth know what really happened when scientists and engineers had to choose landing sites for prior Mars missions:
 - NASA chose Gale Crater as the landing site for its Curiosity rover, which landed on Mars in 2012 and has been exploring ever since.
 - Share an [exciting NASA video](#), *Curiosity's Seven Minutes of Terror*, about the challenges of landing Curiosity at Gale Crater.
 - [Learn more about the Curiosity rover and see pictures from inside Gale Crater](#).
 - NASA chose Jezero Crater for its [Perseverance rover](#). The rover launched in 2020 and landed in 2021.
 - NASA also considered Iani Chaos and Nili Fossae as landing sites for Perseverance but ruled out both. Iani Chaos is too rough, and although both sites have water-related minerals, they lack water-related landforms.

After the Activity

1. Take time to reflect on the following educator prompt:

Q: What methods did youth use to present their choices? How did you support multiple means of expression?

Remote Sensing Unit Resources

QR code leads to resources available for this unit.



<https://planets-stem.org/betars-unit-landing-page/>

