



# Lunar Landing Sites

## Purpose

To design a spacecraft for travel to and from the Moon and choose an interesting lunar landing site.

## Background [also see “Teacher's Guide” Pages 2-5]

The previous Unit 2 activities introduce the Moon's rocks, surface features, and the geologic processes that formed them. With this background, students are given the challenge to plan a mission to the Moon. In this activity, teams of students design a spacecraft, choose a suitable lunar landing site, and present their ideas before the entire class. Final presentations should include speeches and visual aides such as maps, diagrams, and 3-dimensional models.

## Preparation

Review and prepare materials listed on the student sheet. Schedule library time as needed.

## In Class

Lead a discussion on what the students need to know about the Moon in general and about potential landing sites *before* landing. A review of the Apollo sites may help initiate a discussion.

After presenting the scenario and tasks to the class, form cooperative teams of 3-4 students. Each student will have assigned duties, as described on the reproducible “Team Duty Sheet.”

For the presentations, either 3-D models or poster-size diagrams can be made, depending on resources and time. Any one or all team members may participate in the presentations.

**Scenario:** NASA has given you the assignment to develop a spacecraft that can fly people safely to the Moon, land, and return to Earth. You must select a safe yet interesting lunar landing site for the spacecraft.

Size, mass, propulsion, number of crew, life support systems, and methods of takeoff and landing should be considered for the spacecraft. Geology, terrain, safety, and length of stay should be considered for the lunar landing site.

# Lunar Landing Sites

## Wrap-up

1. How do the sites chosen by the class compare in location and geologic diversity with the Apollo sites?
2. What made some spacecraft designs and landing sites, in this activity, more risky than others?
3. Are these lunar landing sites good for short-term visits only, or could the sites be appropriate for lunar base development?  
See the “Lunar Land Use” activity on Page 101.

## Extensions

Spacecraft design could be conducted as a spin-off of the "egg drop" contest. Each spacecraft is constructed to hold and protect one raw egg. The egg must remain unbroken after landing from a high drop (perhaps a second-story balcony).

Some students may enjoy learning more details of Apollo site selections. A detailed discussion of how the sites were chosen is given in *To A Rocky Moon* by Don E. Wilhelms, Univ. of Arizona Press, 1993.

Use these lunar landing sites in the “Lunar Roving Vehicle” activity on Page 87, stipulating that the vehicle must be able to work on the terrains.

Use these lunar sites in the “Lunar Land Use” activity on Page 101.



# Lunar Landing Sites

## Purpose

To design a spacecraft for travel to and from the Moon and chose an interesting lunar landing site.

## Materials

Moon maps  
Apollo landing sites map  
“Moon ABCs Fact Sheet”  
Moon slides  
background literature,  
such as the “Teacher’s  
Guide”  
“Team Duty Sheet”  
art and construction  
supplies

## Scenario

NASA has given you the assignment to develop a spacecraft that can fly people safely to the Moon, land, and return to Earth. You must also select a safe yet interesting lunar landing site for the spacecraft.

Size, weight, propulsion, number of crew, life support systems, and methods of takeoff and landing should be considered for the spacecraft. Geology, terrain, safety, and length of stay should be considered for the lunar landing site.

## Procedure

1. Read the “Team Duty Sheet” given to your team.
2. Design a spacecraft with all necessary systems that can go to the Moon, land, and return to Earth. Build a model or draw a detailed diagram of the design.
3. Study maps of the lunar surface and use your knowledge of the Moon to determine a safe yet interesting lunar landing site.
4. Make a presentation to the class:
  - (a) about your spacecraft and its special features using diagrams and/or a model,
  - (b) describing, locating, and justifying the landing site.

Names: \_\_\_\_\_

Date: \_\_\_\_\_

## Lunar Landing Sites

### TEAM DUTY SHEET

Your team must design a spacecraft and determine a safe yet interesting place to land on the Moon.

Everyone on your team should be assigned one or more of the following duties:

*Chief Engineer* : oversees the entire project, helps to design spacecraft, makes critical decisions for the team.

*Scientist* : designs spacecraft, oversees the construction of the model or diagrams of the spacecraft.

*Lunar Geologist* : studies maps of the Moon and oversees the selection of a safe yet interesting place to land the spacecraft.

*Public Relations Manager* : helps scientist and geologist, oversees the presentation of the spacecraft and landing site before the class.

# Moon ABCs Fact Sheet

Property	Earth	Moon	Brain Busters
Equatorial diameter	12,756 km	3,476 km	How long would it take to drive around the Moon's equator at 80 km per hour?
Surface area	510 million square km	37.8 million square km	The Moon's surface area is similar to that of one of Earth's continents. Which one?
Mass	$5.98 \times 10^{24}$ kg	$7.35 \times 10^{22}$ kg	What percentage of Earth's mass is the Moon's mass?
Volume	---	---	Can you calculate the volumes of Earth and the Moon?
Density	5.52 grams per cubic cm	3.34 grams per cubic cm	Check this by calculating the density from the mass and volume.
Surface gravity	9.8 m/sec/sec	1.63 m/sec/sec	What fraction of Earth's gravity is the Moon's gravity?
Crust	Silicate rocks. Continents dominated by granites. Ocean crust dominated by basalt.	Silicate rocks. Highlands dominated by feldspar-rich rocks and maria by basalt.	What portion of each body is crust?
Mantle	Silicate rocks dominated by minerals containing iron and magnesium.	Similar to Earth.	Collect some silicate rocks and determine the density. Is the density greater or lesser than the Earth/Moon's density? Why?

# Moon ABCs Fact Sheet

Property	Earth	Moon	Brain Busters
Core	Iron, nickel metal	Same, but core is much smaller	What portion of each body is core?
Sediment or Regolith	Silicon and oxygen bound in minerals that contain water, plus organic materials.	Silicon and oxygen bound in minerals, glass produced by meteorite impacts, small amounts of gases (e.g., hydrogen) implanted by the solar wind. No water or organic materials.	Do you think life ever existed on the Moon? Why or why not?
Atmosphere (main constituents)	78 % nitrogen, 21 % oxygen	Basically none. Some carbon gases (CO <sub>2</sub> , CO, and methane), but very little of them. Pressure is about one-trillionth of Earth's atmospheric pressure.	Could you breathe the lunar atmosphere?
Length of day (sidereal rotation period)	23.93 hours	27.3 Earth days	How long does daylight last on the Moon?
Surface temperature	Air temperature ranges from -88°C (winter in polar regions) to 58°C (summer in tropical regions).	Surface temperature ranges from -193°C (night in polar regions) to 111°C (day in equatorial regions).	Why are the temperatures of Earth and the Moon so different?
Surface features	25 % land (seven continents) with varied terrain of mountains, plains, river valleys. Ocean floor characterized by mountains, plains.	84 % heavily-cratered highlands. 16 % basalt-covered maria. Impact craters-- some with bright rays, crater chains, and rilles.	Compare maps of Earth and the Moon. Is there any evidence that plate tectonics operated on the Moon?

# Nearside of the Moon

## Apollo Landing Sites

