# Group Activity: Lunar Crash Landing!



Picture credit: Pat Rawlings/NASA

### TO DO:

- 1. Form into groups of 4 or 5. Designate: a **team leader** to keep you on task, a **reader** to read the background story, and a **recorder** to write down the items you should/should not bring and the reasons for doing so. 4th and 5th team members should supply relevant facts about the Moon (from the "fact sheet" overleaf, from questions to the instructor, and from their own knowledge).
- 2. AS A GROUP, discuss the usefulness of each item on the "ship's manifest" of items recovered from the spacecraft (page 3). First decide by vote, if you like what to leave behind and what to bring. Then assign priorities to items you would bring with you. Unusual and imaginative uses are encouraged!
- **3.** Complete the item lists on the worksheet, provide any feedback on this activity, and hand the worksheet only back to the instructor. THANK YOU!

## BACKGROUND STORY:

Imagine a time in the not-so-distant future, when there are lunar bases and people are living and working on the Moon. On a routine trip from Earth to Tranquility Base, there is an accident on board the spacecraft and you crash land on the Moon's surface, 100km (about 60 miles) from your destination. The spacecraft has lost its seal against the vacuum of space, so you have to rely on your spacesuit for protection.

Fortunately for you, it is just after first quarter moon, and so dawn has just begun over your location. In the Moon's low gravity, 100km is not far to travel on foot. You *are* limited in what you can carry, though, so which items in the list should you choose to take with you, and how can you best use them?

#### MOON MISSION FAST FACTS

- Since the Moon rotates at the same rate as it orbits around Earth (about once every 28 Earth days), daylight on the Moon lasts 14 Earth days, followed by 14 days of darkness. As seen from the Moon, the Earth itself does not rise or set, but appears to "hang" in the sky.
- Daytime surface temperatures on the Moon can reach +110°C (230°F), while nighttime temperatures drop as low as -200°C (-328°F).
- With no atmosphere to scatter sunlight, you can see stars even during the daytime on the Moon, as long as you are in the shade and not looking in the direction of the Sun.
- Unlike the Earth, the Moon does not have a rapidly spinning molten iron core.
- Due to the Moon's smaller size, the lunar horizon is about half as far away as on Earth, so from level ground you can only see about 3 kilometers (1.8 miles) in any direction.
- Craters have steep walls, and entire lunar surface is covered with fine, powdery dust.
- NOT EVERYTHING YOU NEED TO KNOW IS HERE! So if you need help, please ask the instructor!

# Just FYI: The "Man in the Moon" Illusion (Northern hemisphere)

The "Man in the Moon" is one of many shapes which people have seen in different cultures. (From the Southern hemisphere of Earth, the Moon appears upside-down relative to the view below, so observers there see different figures).

The illusion goes away when we look through a telescope or at an enlarged image (e.g. page 5), but it does allow us to recognize some of the features on the Moon's near-side with the naked eye.



Eye on left: Mare Imbrium (Sea of Rains)

Eye on right: Mare Tranquilitatis (Sea of Tranquility)

**Nose: Appenine Mountains** 

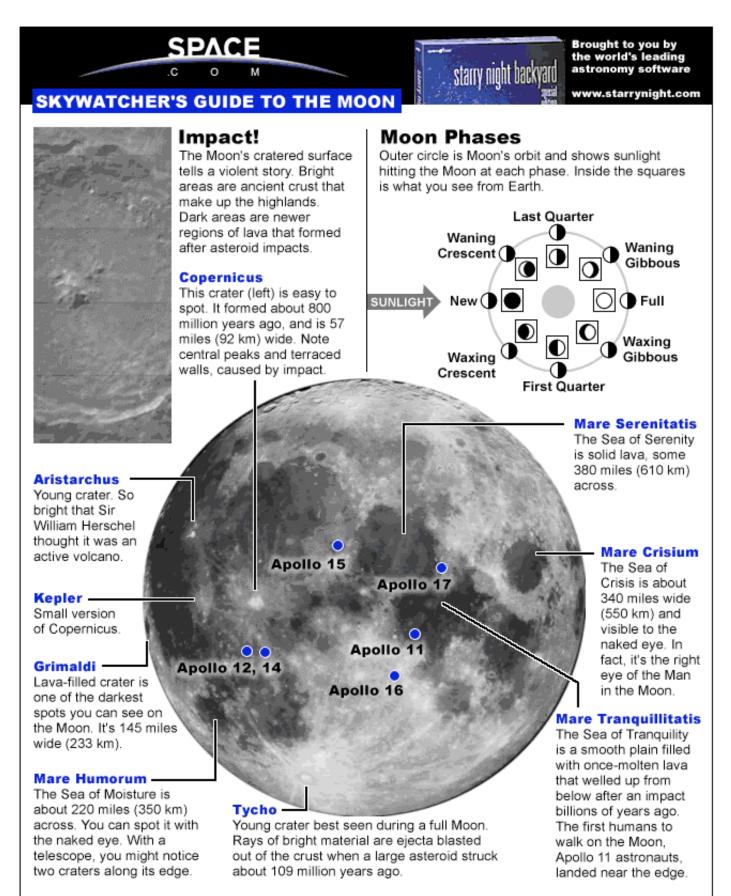
Mouth: Mare Nubium (Sea of Clouds)

The *maria* are not actual seas, of course, but plains of dark solidified lava. These ancient lava flows leaked out of cracks in the Moon's crust, which were caused by giant impacts billions of years ago. The older lunar highlands are made of more reflective (brighter) rocks. The bright marks on the maria are craters formed by later impact events.

### **LUNAR CRASH LANDING! RECOVERED ITEMS LIST**

Discuss which items to leave behind and which to bring (and why), then fill out the form on page 5.

- **1. Box of Matches:** These might be useful to make a signal fire or campfire on Earth. But would they be useful on the Moon?
- **2.** Two **50kg pressurized oxygen tanks**: You can refill your spacesuit supply from these. On Earth, these tanks weigh 110 pounds each. Could you carry them easily on the Moon?
- **3. Magnetic compass**: True North on Earth varies from magnetic north by as much as 20 degrees. How well could you navigate on the Moon with this?
- **4. Food concentrate**: After rehydration by injecting water, these food packs can be plugged in to a tube on your spacesuit's backpack, which leads to a feeding tube inside your helmet. Notoriously bland and similar in texture to baby food, but lightweight, non-perishable, and packed with calories, protein, fiber, and vitamins just like Mom and Dad wanted you to eat!
- **5. Self-igniting signal flare**: Originally designed to work underwater, these flares produce a brilliant flame without oxygen. They might be visible to a rescue craft in lunar orbit.
- **6. Solar-powered FM radio transmitter**: requires sunlight to function, but FM radio waves can only be received by someone with a clear, straight line-of-sight to the transmitter.
- 7. Nylon rope, 30 meters (about 100ft): it's rope not much else to say!
- **8.** Constellation chart: You learned to navigate by the stars during a training voyage across the Pacific, using this same chart. Could it still be useful so far from home?
- **9. Portable heat radiator**: This bulky heater at 30kg can produce 2kW of radiant power on its own batteries for about 12 hours. Perhaps you could all stand around it like a glowing campfire?
- **10. 100 liters (=100kg) of water**: About 30 U.S. gallons. The containers can be attached directly to the feeding tube on your spacesuit, or used to reconstitute the dried food concentrate.
- 11. First Aid Kit: including hypodermic needles that fit special openings in your spacesuit.
- **12. Self-inflating life raft**: This 60kg raft uses an integral CO<sub>2</sub> bottle to inflate. Standard issue on spacecraft in case of a water landing, the inflated raft is large enough for your team to sit comfortably inside.
- **13. 20kg helium tank and 600 party balloons, assorted colors**: Your spacecraft was supposed to deliver party supplies to the lunar base for the anniversary of Neil Armstrong's first steps on the Moon in 1969. Some party you'll be having now...but can you use them anyway?
- **14. Fire extinguishers**: 5kg each, standard issue in any spacecraft, one per person.



SOURCES: NASA; ADVANCED SKYWATCHING; CAMBRIDGE ATLAS OF ASTRONOMY; DK VISUAL ENCYCLOPEDIA

Robert Roy Britt / SPACE.com

Daily skywatching tips: www.space.com/spacewatch

# Lunar Crash Landing Worksheet – TO~BE~HANDED~IN

Item (from page 3)	Reason(s) for bringing it with you (be creative!)	PRIOR
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ITEMS TO LEAVE BI Item (from page 3)	EHIND:  Reason(s) for leaving it behind	
ITEMS TO LEAVE BI Item (from page 3)		

FEEDBACK CONTINUED		
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