Rover Driving Academy
Académie de pilotage de rovers lunaires

Team Name: _____
Rover Color: _____

ROLES & OBJECTIVES

As part of the lunar exploration team, you'll rotate through the following five roles. Experience each unique responsibility and interface, creating a dynamic and collaborative lunar adventure!

ROVER DRIVER

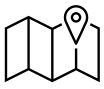
This is a real rover you're driving! Work with your team to drive your rover to the four lunar regions so the Rover Scientist can do their job. And work with Rover Safety to avoid the hazards! Remember that sending commands to the moon can take 1-2 seconds to cover the 384 400 km distance. Laggy controls is the cost of driving a vehicle so far away!

PAN TILT ZOOM (PTZ) OPERATOR

Operates the Pan Tilt Zoom (PTZ) camera, to figure out where you are, and find all the lunar features. You also steer the science instrument, so work with the Rover Scientist to analyze the things you find. You can click on features in the image to fine-tune your aim. Zoom in to get the best images for your scientist!

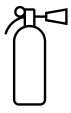
ROVER SCIENTIST

Analyzes rocks, minerals, and geological formations, contributing to a better understanding of the Moon's history. Work with the PTZ operator to analyze the samples you find, and when you get your results, use the Science sheet to match the minerals to the spectrums. Will you be able to find all the minerals?



ROVER NAVIGATOR

Work with the driver and PTZ operator to figure out where you are, and where you need to go to visit all four of the different lunar regions. The map holds important clues to help you find the minerals, rocks and achieve all the objectives.



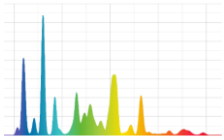
ROVER SAFETY

Your display has the tools to find the hazards, and help the driver avoid them. Use the different views to help plot a course that keeps you out of trouble! Can you work with your driver to safely descend into the volcanic region?

SCIENCE

When using your science instrument to sample the minerals and rocks on the moon, compare to the graphs below to decipher what you have found. Spectrums are like fingerprints; each mineral has its own unique set!

Mark the boxes below each time you find a feature

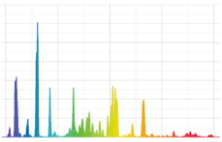


Vesicular Basalt

Vesicular basalt is a type of volcanic rock characterized by its numerous small cavities or vesicles, which are formed by gas bubbles trapped within the molten lava during the volcanic eruption. This type of basalt is commonly found on the Moon's surface.

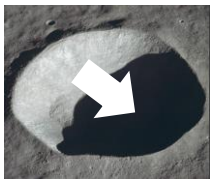
Anorthosite

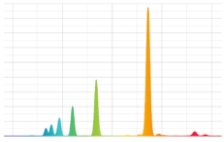
Scientists speculate that long ago, the Moon had an ocean of hot melted rock. As this molten rock cooled down, the plagioclase feldspar crystals settled and formed anorthosite. That's why we find a lot of anorthosite in the highlands of the Moon, which are the bumpy and cratered areas.



Basalt

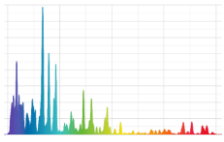
Millions of years after the giant impact basins formed, lava flowed up through cracks in the lunar crust and poured over the surface. The lava filled the circular basins and cooled, forming dark-colored, flat plains. Basalt is a fine-grained, dark-colored volcanic rock and can be found in the dark plains on the Moon.





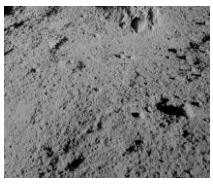
Water

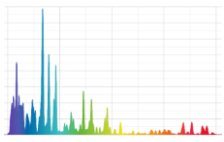
Water on the Moon exists in the form of ice, but only in areas that are permanently shaded from the heat of sunlight. The Moon's poles have regions that never receive direct sunlight, and they act like cold traps where temperatures stay as low as -200 °C. Look in the **shadows** of craters to find this key resource.



Breccia

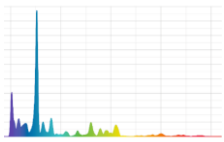
Lunar breccia is a mixture of various rock fragments and mineral grains that have been cemented together over time. These fragments can range in size from small pebbles to larger boulders, and they come from different types of rocks that have been shattered and broken apart through impact events from meteorites.





Regolith

Regolith is the Moon's "soil" or "dirt." It's the layer of loose material that covers the Moon's surface. But unlike the soil on Earth, the Moon's regolith is made up of tiny pieces of rocks, dust, and even small fragments from meteorite impacts. It has the same spectrum as breccia so don't confuse the two!



Ilmenite

Ilmenite is composed of iron and titanium oxide, and it appears in the form of dark, black-grey mineral. Within the Apollo samples brought back by the astronauts, vast/substantial amounts of sample were found within the rocks and regolith. This mineral is particularly exciting because it can be mined for its useful resources.

MOON FEATURES

To find all the minerals and rocks on the scientist's checklist, you'll need to explore all the areas on the Moon Yard. The Rover Navigator's map will show you where to find these lunar features, and the minerals and rocks associated with them.

Mark the boxes below each time you find a feature

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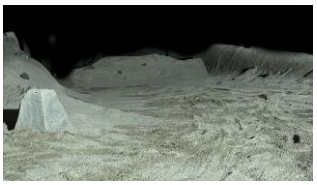
Zone 1 Basalt Boulders in the Mare Region

In the Mare Region, basalt boulders on the lunar surface provide valuable clues about the Moon's volcanic history, indicating past lava flows and volcanic activity. These boulders are important targets for scientific exploration as they can reveal information about the composition and age of lunar rocks, shedding light on the Moon's geological evolution.

☐ 

Zone 2 Descend the Canyon of a Collapsed Lava Tube

Collapsed lava tubes on the lunar surface are evidence of ancient volcanic activity and lava flow dynamics. These structures inform future lunar exploration efforts, as these features may provide natural shelters for human habitats or resources for sustainable lunar missions. Can you plot a safe course down and find the vesicular basalt scattered around?

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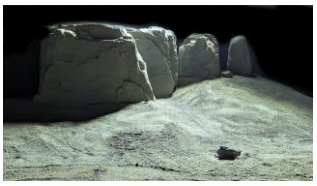
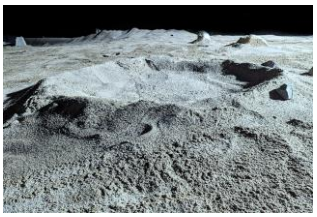
Zone 3 Large Crater

Large craters are essential for understanding the Moon's geological history, offering evidence of past impacts and the processes that have shaped its surface. Look for ilmenite at the crater's edge.

☐ 

Zone 4 Highland Outcrop

Inspect the outcrop in the Lunar highlands, offering insights into the ancient history and geological processes of the Moon. Studying these outcrops helps scientists understand the composition, structure, and evolution of the lunar crust, providing valuable information about the Moon's formation and early geological activity.

☐☐ 

Medium Crater

Medium-sized lunar craters typically represent more recent geological activity compared to larger ones, as they are often formed by relatively recent impacts. Studying these craters provides insights into the frequency and intensity of meteorite bombardment over time, contributing to our understanding of lunar surface dynamics and evolution. Look into the permanently shadowed regions for water!

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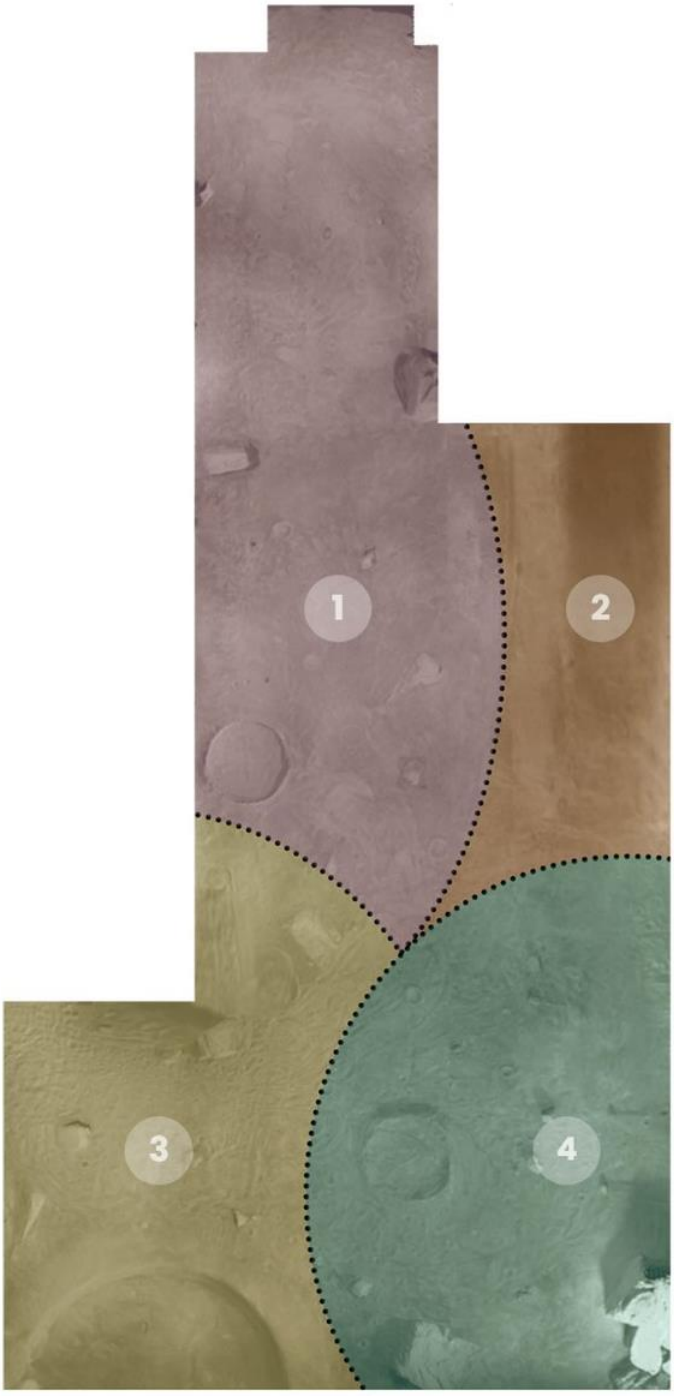
Small Crater

Small lunar craters are often formed by micrometeorite impacts, tiny particles that collide with the Moon's surface at high speeds. These craters play a crucial role in understanding ongoing processes such as space weathering and erosion on the lunar surface through micrometeorite bombardment, since they erode more quickly than the larger craters. How many can you find?

THE MOON YARD

Welcome to the Moon Yard! Below is the Moon Yard map (the Rover Navigator has access to the map) divided into 4 zones, each containing unique lunar features. Work together as a team to navigate through all 4 zones and discover everything you can about the Moon and its intriguing features.



Zone 1

Mare

Mare (MAR-ay) is Latin for “Sea” and these dark-coloured lowlands on the Moon look a bit like oceans. They are vast plains of solidified lava. Look for dark coloured basalt in this region.

Zone 2

Volcanic

Lava tubes, formed by ancient volcanic activity, create underground tunnels on the Moon. Collapses over time expose hidden channels and potentially expose some vesicular basalt.

Zone 3

Impact Crater

This region contains a large crater formed by an ancient asteroid hitting the surface of the Moon. Look for a dark granular ilmenite that has been thrown out from the violent collision.

Zone 4

Highlands

This hilly region is full of bumpy light-coloured terrain formed from early plutonic activity. Look in this region for the light coloured anorthosites, as these were the first among the minerals and rocks to form here.