

Activity 5: Designing a Lunar Colony

Lunar colonies must house people and all of the supplies that people need. This list tells what each person in your colony will need each day,

Material	Amount Needed for One Person
Oxygen	0.83 kg per person per day
Food preparation water	1.86 kg per person per day
Clothing wash water	12.47 kg per person per day
Hand wash water	1.81 kg per person per day.
Shower water	3.63 kg per person per day
Bathroom flush water	0.49 kg per person per day
Food solids	0.73 kg per person per day
Food water	0.45 kg per person per day
Food packaging	0.45 kg per person per day
EVA oxygen	0.55 kg per person for an 8-hour EVA
EVA water	4.39 kg per person per 8-hour EVA

How many people do you want to live in your lunar colony? _____

EVA means Extra Vehicular Activity.

How many people will work outside the colony each day? _____

How many kilograms of oxygen will you need each day? _____

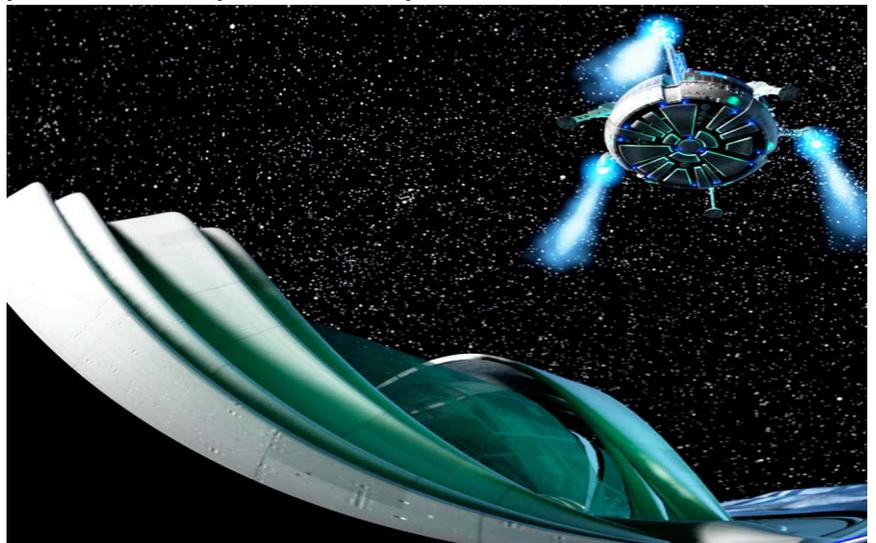
How many kilograms of food will you need (including packaging)? _____

How many kilograms of water does your lunar colony need each day? _____

How could you reduce the amount of water, food, and oxygen needed?

How would a greenhouse help? _____

What other needs will your colony have?



Activity 6: the Effects of a Blanket of Air

The Earth has a thick atmosphere. In this project, you will investigate the effect of an atmosphere on the surface below.

Materials;

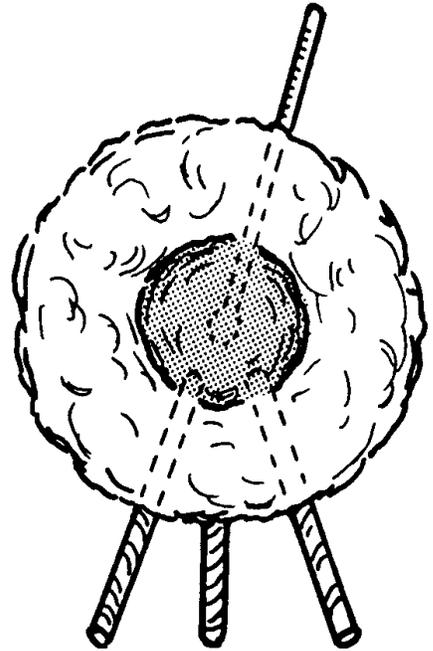
2 balls of clay
2 thermometers
a roll of cotton
straws

Form the clay balls around the bulbs of the thermometers. Wrap cotton around one of the balls (about an inch thick) Support both balls with three straws making a tripod Place both balls on their straw stands in a freezer for 5 minutes.

Remove both balls immediately and record their temperatures

Return the balls to the freezer and repeat the procedure, but leave the balls in for 10 minutes. Finally repeat the experiment by leaving the balls in the freezer for a whole hour.

Record your findings below.



Time	Temperature Of Uncovered Ball	Temperature Of Cotton-Covered Ball
5 minutes in freezer	_____	_____
10 minutes in freezer	_____	_____
60 minutes in freezer	_____	_____

How did the cotton affect the cooling rate of the clay? _____

Do the two balls eventually reach the same temperature? _____
Why?

Why don't the Earth and Moon reach the same temperature?

Repeat this experiment, but cover the moon ball with 10 times as much cotton as the Earth ball. Now it represents Venus. See what the effect of a thicker atmosphere is.

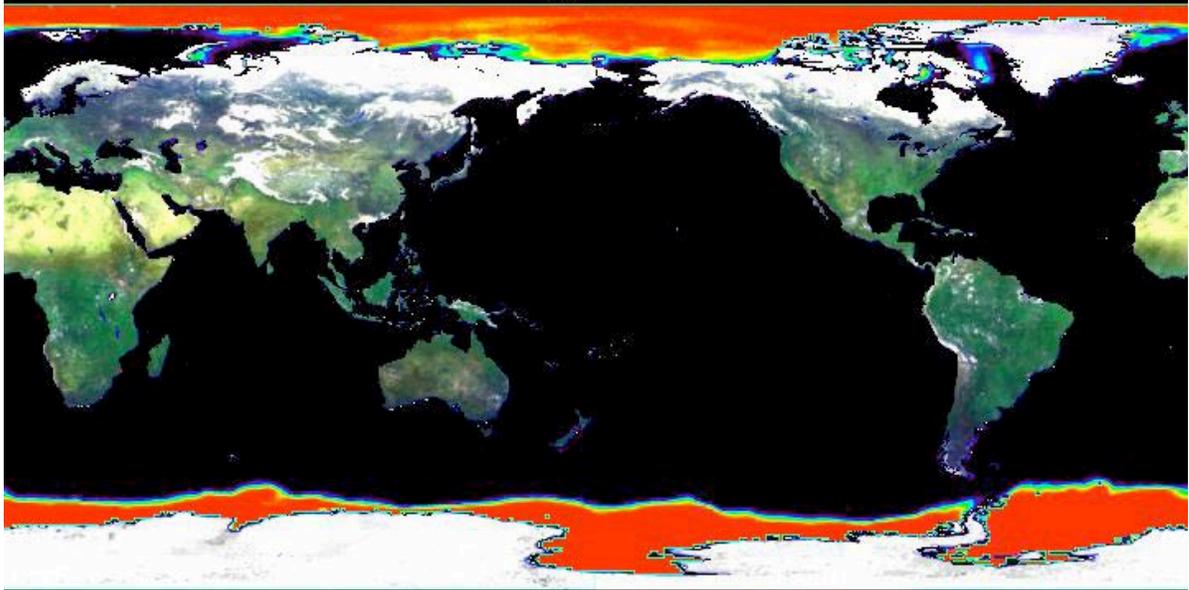
Activity 7: Ice Age – Keeping Warm

About 10,000 years ago, the Earth was in an Ice Age and ice covered much more of the planet.

Materials

Earth globe or map

Activity



The map above shows where ice is in July today. Only the white areas represent ice.

Using a globe for reference, list the European countries that were covered in ice during the ice age, but are ice-free in the summer now.



List the states in the United States and the provinces of Canada that were ice-covered in the last ice age, but are ice-free in the summer now.



Activity 8: Watching Mt. Etna

Astronauts can watch volcanoes erupt from space and will someday be able to watch the eruptions from the moon. See what you can discover in this photograph from the International Space Station.

Materials

Metric ruler

Activity

Italy is a country that looks like a boot. The boot is kicking a triangular island called Sicily. Label Italy and Sicily on the map.

Mt. Etna lies on the eastern side of Sicily. In this photo, it is releasing smoke. Label Mt. Etna.

From the smoke plume, which way is the wind blowing?

The Italian peninsula is about 1,145 km (about 710 miles) long from the Alps Mountains in the north to the tip, with a maximum width of about 240 km (about 150 miles).

Using these lengths for reference, estimate how far the smoke plume from Mt. Etna extends.



There is another famous volcano in Italy, called Mt. Vesuvius. This volcano erupted in 79 BCE and buried the towns of Herculaneum and Pompeii. Mt. Vesuvius is near the west coast of Italy -- about 2/3rds of the way down the Italian Peninsula. It is cloud covered -- see if you can find it.

Estimate how far it is from Mt. Vesuvius to Mt. Etna _____

Mt. Vesuvius and Etna are on a subduction zone. The African plate is moving northward at about one inch (2-3 cm) per year and is slowly closing the Mediterranean basin. As it moves to the north, the African plate is pushed beneath the Eurasian plate. Volcanoes are a result of this pressure below the surface.

Activity 9: IMPACT

About 10,000 tons of space particles fall to Earth every year. Most are very small and burn up high in the atmosphere. But a few particles are very large and can do tremendous damage.

Activity

The chart below describes how often an impact occurs. Use it to answer the questions below.

Size	Impact Frequency	Effect
1mm to 1 cm (sand grain/pebble)	every second (thousands per day)	bright “shooting star”, destroyed in the atmosphere
1 – 50 cm (rock)	every hour (over 10 per day)	fireball, most destroyed in the atmosphere
0.5 0 1 meter (microwave oven)	every day	bolide (brilliant fireball), most destroyed in the atmosphere
1-10 meters (car or truck)	once per decade	stony or icy boulders destroyed in the atmosphere, iron boulders can crash through a roof or damage a car
10 – 50 meters (house)	every hundred years	local disaster, equivalent to several Hiroshima-sized bombs
50-100 meters (football field)	1-2 every 1,000 years	regional disaster, equivalent to the Meteor Crater or Tunguska event (about 15 megatons of TNT)
100 m – 1 km (small village)	once in 50 to 100 thousand years	continent-size disaster, equivalent to thousands of megatons of TNT
1-10 km (small city)	once in 50 to 100 million years	mass extinction, threat to all life (millions of megatons of TNT)
over 10 km	less than once in a billion years	threat to the continued habitability of the present

How many sand grains fall to Earth each year? _____

How many oven-size objects fall each year? _____

In a hundred years, how many truck-size objects fall to Earth? _____

In a thousand years, how many house-size objects fall to Earth? _____

In a thousand years, how many football-field size objects fall to Earth? _____

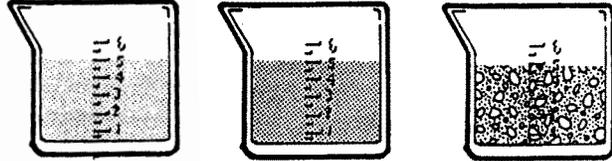
What are the chances that an object large enough to cause a disaster could fall this year?

Activity 10: World of Water

The Earth's surface is over 2/3rd oceans. All of this water affects Earth's weather in many ways – especially the temperature.

Materials

Three clear beakers of the same size
 Water, loose sand, and topsoil
 Thermometer
 Access to a freezer



Activity

In three beakers of the same size, place equal volumes of water, loose sand and moist topsoil. Allow the three beakers to sit in a warm room until all three substances are at the same temperature. Place all three beakers in a freezer for five minutes. Record the temperature of the contents of each beaker while still in the freezer. Leave the beakers in the freezer until they are at the same temperature. Then return them to room temperature and record their temperatures after five minutes. List your data below.

Beaker	Temperature in room	Temperature after 5 min. in freezer	Temperature after 5 min. in room
Water-filled	_____	_____	_____
Sand-filled	_____	_____	_____
Soil-filled	_____	_____	_____

Which substance cools off the most quickly? _____

Which substance cools off the most slowly? _____

Which substance warms up the most quickly? _____

Which substance warms up the most slowly? _____

Which parts of the Earth have very rapid changes in temperature? _____
 Why do you predict this?

Which parts of the Earth experience less daily temperature change? _____
 How do you know this?

Activity 11: Following the Grand Canyon

Over time, rivers create canyons. We can use photographs taken from the surface and from space to understand how canyons form and change.



Activity

This photograph shows the Grand Canyon of the Colorado River from its beginning at the upper right of the image. The photograph is rotated so that north is up on the page.

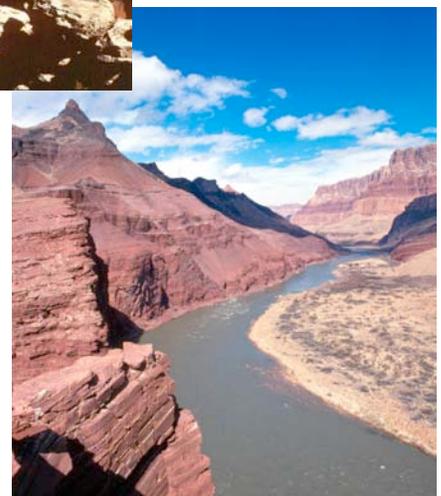
The Colorado River turns south, makes a bend and turns north. As the Colorado River turns, the northwest-flowing Little Colorado River joins it from the east. The dark forested, elevated land north of the bend in the Colorado River is the Kaibab Plateau. The North Rim is the southern tip of this plateau. Use a colored pencil to trace the Colorado River as it crosses the photograph from

east to north. Then label the Little Colorado River. Finally label the Kaibab Plateau and North Rim.



This image was made looking south from the North Rim. The Colorado River carved out this entire canyon over millions of years. Find the white rock

in the cliffs in the distance. It is at the same height from one plateau to the next. This was once one flat plane with the land carved away over time by the river. The photo to the right is the Colorado River today. Dams and irrigation have reduced it in size. Do you think it is still changing the canyon's shape?



Activity 12: Picnic on the Moon

What things would you pack for a picnic outside on the Moon? Think about how the moon is different from the Earth.

Activity

You can choose from these items in planning your picnic. Place the items on one of the two lists below.

- | | | | |
|------------------|-------------------|---------------------|--------|
| Baseball and bat | bathing suit | bicycle pump | drums |
| Yo-yo | telescope | fishing pole | fan |
| Flashlight | insect repellent | pitcher of lemonade | kite |
| Playground slide | playground swings | umbrella | shovel |
| Slingshot | sunglasses | | |

Things I Could Use on the Moon

Thing I Could Not Use on the Moon

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Think about what you would like to do outside on the Moon. Make a third list: "Other Things I Would Like to Have on a Picnic" Describe what you would do with each of these items.

Item

What I Would Do With It

_____	_____
_____	_____
_____	_____
_____	_____

