Emera Astronomy Center
and M. F. Jordan Planetarium

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Cosmic Classroom Guide

Astronaut

COMPILED AND EDITED BY LEISA PREBLE

THE UNIVERSITY OF MAINE

A Member of the University of Maine System

Astronaut

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Mission Statement:
The mission of the Maynard F. Jordan Planetarium of the University of Maine is to provide the University and the public with educational multi-media programs and observational activities in astronomy and related subjects.

Cosmic Classroom

Looking for fun and interesting space activities? The planetarium staff has prepared a collection of materials we call the Cosmic Classroom for you to use before and/or after your visit. These materials are entirely for use at your own discretion and are not intended to be required curricula or a prerequisite to any planetarium visit. The Cosmic Classroom is one more way that the Jordan Planetarium extends its resources to help the front line teacher and support the teaching of astronomy and space science in Maine schools.

The lessons in this Cosmic Classroom have been edited and selected for the range of ages/grades that might attend a showing of this program at the Jordan Planetarium. Those activities that are not focused at your students may be adapted up or down in level. Our staff has invested the time to key these materials to the State of Maine Learning Results in order to save you time.

The State of Maine Learning Results performance indicators have been identified and listed for the program, the Cosmic Classroom as a package, and each individual activity within the package. The guide also includes related vocabulary and a list of other available resources including links to the virtual universe. We intend to support educators, so if there are additions or changes that you think would improve, PLEASE let us know.

Thank you, and may the stars light your way.

The Maynard F. Jordan Planetarium Staff

The Program – *Astronaut*

The exploration of space is the greatest endeavor that humankind has ever undertaken. What does it take to be part of this incredible journey? What does it take to become an astronaut?

Experience a rocket launch from inside the body of an astronaut. Explore the amazing worlds of inner and outer space, from floating around the International Space Station to maneuvering through microscopic regions of the human body. Discover the perils that lurk in space as we subject 'Chad', our test astronaut, to everything that space has to throw at him.

We are very glad that you have chosen to visit our planetarium with your group. We hope that this guide either will help you prepare your group or help you review their experience at the University of Maine's sky theater.

State of Maine Learning Results Guiding Principles

The lessons in this guide, in combination with *Astronaut*, will help students to work towards some of the Guiding Principles set forth by the State of Maine Learning Results. By the simple act of visiting the planetarium, students of all ages open an avenue for self-directed lifelong learning. A field trip encourages students to think about learning from all environments including those beyond the schoolyard. A Jordan Planetarium visit also introduces visitors to the campus of the largest post-secondary school in Maine and encourages them to think of this as a place which holds opportunities for their future education, enjoyment and success.

Other sites on the University campus, including three museums, explore a variety of subjects, and the Visitors Center is always willing to arrange tours of the campus. A field trip can contribute to many different disciplines of the school curriculum and demonstrate that science is not separate from art, from mathematics, from history, etc. The world is not segregated into neat little boxes with labels such as social studies and science.

A field trip is an opportunity for learning in an interdisciplinary setting, to bring it all together and to start the process of thinking. For a more complete discussion of field trips, please visit the Emera Astronomy Center web site at http://astro.umaine.edu/.

If used in its entirety and accompanied by the Planetarium visit this guide will help students to:

Become **a clear and effective communicator** through
A. oral expression such as class discussions, and written presentations
B. listening to classmates while doing group work, cooperation, and record keeping.

Become **a self-directed and life long learner** by
A. introducing students to career and educational opportunities at the University of Maine and the Maynard F. Jordan Planetarium.
B. encouraging students to go further into the study of the subject at hand, and explore the question of "what if?"
C. giving students a chance to use a variety of resources for gathering information

Become **a creative and practical problem solver** by
A. asking students to observe phenomena and problems, and present solutions
B. urging students to ask extending questions and find answers to those questions
C. developing and applying problem solving techniques
D. encouraging alternative outcomes and solutions to presented problems

Become **a collaborative and quality worker** through
A. an understanding of the teamwork necessary to complete tasks
B. applying that understanding and working effectively in assigned groups
C. demonstrating a concern for the quality and accuracy needed to complete an activity

Become **an integrative and informed thinker** by
A. applying concepts learned in one subject area to solve problems and answer questions in another
B. participating in class discussion

State of Maine Learning Results Performance Indicators

In conjunction with the Maynard F. Jordan Planetarium show *Astronaut,* this guide will help you meet the following State of Maine Learning Results Performance Indicators in your classroom. This guide has been indexed to the 2007 State of Maine Learning Results.

Grades 3-5

Science and Technology –

A2. Models

a. Students will be able to use models to represent a real process of an object and note ways in which these representations match features of the original.

A4. Scale

b. Students will be able to use mathematics to describe scale for natural things, using measurements to compare sizes.

B1. Skills and Traits of Scientific Inquiry

a. Students will be able to pose investigable questions and seek answers from reliable sources of scientific information and from their own investigations.

b. Students will plan and safely conduct simple experiments that involve a fair test.

c. Students will plan, conduct, analyze data from, and communicate results of investigations using simple equipment, tools and appropriate units of measurement.

B2. Skills and Traits of Technological Design

a. Students will be able to use a design process to propose a solution to a design problem that recognizes constraints including cost, materials, time, space, or safety.

C3. Science, Technology and Society

b. Students will be able to give examples of changes in the environment caused by natural or man-made influences.

D1. Universe and Solar System

a. Students will be able to show the locations of the sun, Earth, moon, and planets and their orbits.

D2. Earth

c. Students will be able to explain how wind, waves, water, and ice reshape the surface of Earth.
d. Students will be able to describe the kinds of materials that form rocks and soil.

D3. Matter and Energy

c. Students will be able to describe properties of original materials, and the new material(s) formed, to demonstrate that a change has occurred.

D4. Force and Motion

b. Students will be able to describe how fast things move by how long it takes them to go a certain distance.
c. Students will be able to describe the path of an object.

E2. Ecosystems

a. Students will be able to explain how changes in an organism's habitat can influence its survival.

E5. Evolution

a. Students will be able to explain advantages and disadvantages gained when some individuals of the same kind are different in their characteristics and behavior.

Mathematics –

B1. Measurement and Approximation

c. Students will be able to understand and use measures of mass and weight.
b. Students will be able to solve and justify problems using these measures.

Grades 6-8

Science and Technology –

A1. Systems

b. Students will use scale to describe objects within a space system using proportions to describe small and large extremes of scale.

B1. Skills and Traits of Scientific Inquiry

b. Students will design and safely conduct scientific investigations including experiments with controlled variables.

c. Students will plan, conduct, analyze data from, and communicate results of simple experiments using appropriate tools and techniques.

g. Students will be able to communicate their design concepts and ideas with other students.

C1. Understandings of Inquiry

b. Students will be able to explain why it is important to identify and control variables and replicate trials in experiments.

C3. Science, Technology and Society

b. Students will be able to identify personal choices that can either positively or negatively impact society including population, ecosystem sustainability, personal health, and environmental quality.

c. Students will be able to explain that natural resources are limited, and that reusing, recycling, and reducing materials and using renewable resources is important.

C4. History and Nature of Science

c. Students will be able to describe and provide examples that illustrate that science is a human endeavor that generates explanations based on verifiable evidence that are subject to change when new evidence does not match existing explanations.

D1. Universe and Solar System

b. Students will be able to explain the motions that cause days, years, phases of the moon, and eclipses.

D2. Earth

b. Students will be able to describe Earth Systems – biosphere, atmosphere, hydrosphere and lithosphere – and cycles and interactions within them.

c. Students will be able to give several reasons why the climate is different in different regions of the Earth.

e. Students will be able to describe the effect of gravity on objects on Earth.

f. Students will be able to give examples of abrupt changes and slow changes in Earth Systems.

D4. Force and Motion

c. Students will be able to describe and apply an understanding of how the gravitational force between any two objects would change if their mass or the distance between them changed.

E5. Evolution

a. Students will be able to explain how the layers of sedimentary rock and their contained fossils provide evidence for the long history of Earth and for the long history of changing life.

b. Students will be able to describe how small differences between parents and offspring can lead to descendants who are very different from their ancestors.

Mathematics –

B1. Measurement and Approximation

a. Students will be able to understand and use measures of mass and weight.

b. Students will be able to understand and use measurements of time, volume, and temperature to solve and justify problems.

Performance Indicators Snapshot

The Show

Grades 3-5.

Science and Technology

B1.b; C3.b, c; D1.a; D2.c, d; D3.c; D4.b,c; E2.a; E5.a

Grades 6-8.

Science and Technology

B1.b; C3.b, c; C4.c; D1.b; D2.b, c, e, f; D4.c; E5.a, b.

The Guide

Grades 3-5.

Mathematics

B1.a1, a2

Science and Technology

A2.a; A4.b; B1.a,b,c; B2.a

Grades 6-8.

Mathematics

B1. a1, a2

Science and Technology

A4.b; B1.c,g; C1.b; C3.b

Designing a Lunar Colony

Producer and Script: Carolyn Sumners, Ed.D., Houston Museum of Natural Science

Objectives and State of Maine Learning Results Performance Indicators:

1. Learners will be able to recognize (brainstorm) needs for human survival in space. (6-8. Science and Technology. C3.b)
2. Learners will be able to design and build a model lunar settlement. (3-5. Science and Technology. B2. a.) (6-8. Science and Technology. B1.c)
3. Learners will be able to communicate their design concepts and ideas with other students. (6-8. Science and Technology. B1. g)
4. Learners will be able to understand and use measures of mass and weight. (3-5 ; 6-8. Mathematics. B1. a)

NGSS:

Engineering Design -

1. 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
2. MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

The General Idea:

Here is a chance for you to use up some of those interesting scraps and snips of things that most people throw away, but could make perfect components for a model lunar settlement. In this activity, students first think of everything they would need to survive for years on a lunar settlement, and then design and build a model of such a settlement from various easy-to-find parts.

This activity can take on different meanings with different age groups. For older students, the question of what is necessary to survive in space can have special significance, since they soon may be candidates for space missions themselves. For younger students, this activity is more of an open ended creative process of building a home on the moon.

Getting Ready:

- Gather supplies listed below.
- Arrange all building materials on a large table and in boxes beside the table.

What You Need:

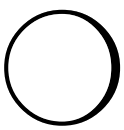
Board of 1/8" plywood or poster board, about 1' x 1- 1/2'
Cardboard
Poster board
Straws
Cardboard tubes
Pins
Corks
Tape
Glue
Plastic cups
Paper cups
Styrofoam cups
Plastic wrap
Aluminum foil

Plastic bags
Wire
Filter material
Styrofoam or Dylite balls (various sizes)
Styrofoam packing blocks (cut to interesting shapes)
Scissors
Doodads, whatever else you can think of.

What To Do:

1. Tell students that they are going to build a model moon settlement.
2. Pretend that they are going to live on the moon for at least a year, possibly 5 to 10 years! What will they need to have on their space settlement on the moon in order to survive and be happy? Have students record the needs on paper.
3. You can record a summary of student responses on a large sheet of flipchart paper or on the blackboard. Individual student's lists of needs do not have to be identical, but they should all include provisions for basics such as food, air, communication, bathrooms, etc.
4. The settlement will be built on a piece of poster board or plywood representing the moon's surface. If you wish, you may opt to build a free standing or orbiting settlement, in which case you probably will not need the board on which to build.

What To Discuss:



1. What things will you NEED to have on the moon?
2. Are there things that you would WANT to have? Are those things feasible to take along?

Continuations/Extensions:

1. Watch part of the NOVA video "To the Moon" and discover what the Apollo astronauts carried along and why.

Part 2:

http://earth.rice.edu/shows/EWR/activities.htm

The General Idea:

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

What To Discuss:

1. How many people do you want to live in your lunar colony?
   (EVA means Extra Vehicular Activity)

2. How many people will work outside the colony each day?

3. How many kilograms of oxygen will you need each day?

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

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

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

7. How would a greenhouse help?

8. What other needs will your colony have?

How Big, How Far: The Earth and Moon

http://earth.rice.edu/shows/EWR/activities.htm

Objectives and State of Maine Learning Results Performance Indicators:

1. Learners will be able to represent the relative size of the Earth and moon. (3-5. Science & Technology. A2.a.)
2. Learners will be able to use proportions and averages to describe the difference between the size of the Earth and the moon. (3-5; 6-8. Science & Technology. A4.b.)
3. Learners will be able to use appropriate tools to interpret data. (6-8. Science & Technology. B1.c.)

NGSS:

1. MS-ESS1-1. Learners will be able to develop and use a model of the Earth-moon system to describe the differences between the Earth and the moon.

The General Idea:

The Earth and Moon have been called a "double planet". In this activity you will discover how big (or small) and how close (or far away) the moon really is.

Getting Ready:

- Gather supplies listed.
- Arrange all building materials on a large table and in boxes beside the table.

What You Need:

- Earth globe – as large as you have available
- Ball of string – with individual strings about 5 times the diameter of the globe for each student
- Balloons (round) – can be inflated to at least a fourth of the diameter of the globe that you have chosen.
- Measuring tape or meter stick for each group of students

What To Do:

1. Inflate your balloon until you think it is the size that the Moon would be if the Earth were only as big as the globe in the classroom. Do not tie your balloon, but hold onto it tightly.

2. Watch as your teacher stretches a string around the equator of the Earth globe. The length of this string equals the globe's circumference.

3. The moon's diameter is a fourth of the diameter of the Earth. So the moon's circumference is also a fourth of the Earth's circumference. Watch as your teacher folds the Earth circumference string in fourths. The result is the circumference of the moon balloon. Your teacher will measure the length of the folded string to find the circumference of the moon balloon.

4. Use your string to measure the circumferences of your balloon. Use a measuring tape or meter stick to determine how long your circumference is. Then calculate the difference between your

circumference and the correct answer. Record your answers below.

5. Adjust the size of your balloon until it is the correct size compared to the Earth globe.

6. Now place your balloon at the correct scale distance from the Earth globe. Make your best guess about how far away the moon should be. Using a measuring tape, measure how far away your balloon is from the Earth globe. Record it below.

7. The moon balloon should be at a distance that it 9.5 times the circumference of the Earth globe. Multiply the Earth circumference string length by 9.5. Now use a measuring tape to measure how far your balloon is from the Earth globe. Subtract to find the difference between your distance and the correct distance. Record it on the table below.

Your balloon circumference: ______ The correct circumference: _____ Difference: _________

Your balloon distance: ____________ The correct distance: ___________ Difference: _________

8. Make a drawing on notebook paper showing the Earth and moon at the correct relative sizes and distances.

<u>Extension</u>

Look at moons of other planets and compare how far or near they are to each other. Are there any other planets that could be considered as "double planets"? Why?

Keeping Cool on the Moon

http://earth.rice.edu/shows/EWR/activities.htm

Objectives and State of Maine Learning Results Performance Indicators:

1. Learners will be able to use objects to represent the process of warming and cooling that goes on in a space suit. (3-5. Science and Technology. A2.a.)
2. Learners will be able to conduct a simple investigation involving everyday objects, and communicate results of those investigations. (3-5. Science and Technology. B1.b.)
3. Learners will be able to solve the problem of how to stay cool on the moon. (3-5. Science and Technology. B2.a.)

NGSS:

1. 3-5-ETS1.A. Possible solutions to a problem are limited by available materials and resources (constraints).

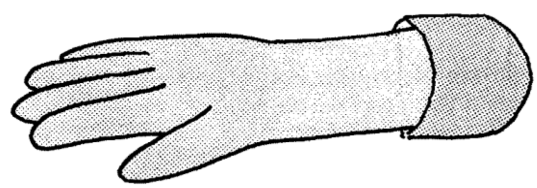
The General Idea:

The moon has no atmosphere. The human body must be surrounded by air. To explore the Moon, astronauts must have a spacesuit that is like a balloon. The suit is inflated with air and does not leak. Even the gloves must be pressurized.

What You Need:

rubber glove
nylon glove

What To Do:



Wear a rubber glove for at least five minutes.
Keep you hand moving the whole time by picking up objects or just opening and closing your fist. How does your hand feel after five minutes?

Why?

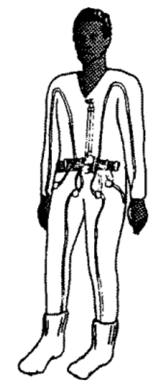
Take your hand out of the glove and wave it around in the air.
How does it feel?

Why?

Put a nylon glove on and then add the rubber glove. Exercise the hand again for five minutes. What effect does the nylon glove have?

Astronauts wear nylon gloves under their pressurized gloves when they leave their spacecraft or moon bases. Astronauts also wear a nylon undergarment with little tubes in it. Cool water is pumped through the tubes. Why is this suit needed?

Part 2: **Designing a liquid cooling garment (LCG)**



Outside of their spacecraft on the Moon, astronauts must wear a pressurized spacecraft, which protects the whole body from vacuum conditions. This suit contains several layers: a liquid cooling garment, a pressure garment, and a thermal micrometeoroid garment. The thermal micrometeoroid garment keeps in the astronaut's body heats and protects the pressure garment from any rips. The pressure garment is inflated to about four pounds per square inch (psi). (Sea level atmospheric pressure on Earth is 14 psi). Like a balloon, this garment does not leak air. Beneath the pressure garment is a Liquid Cooling Garment. The Liquid Cooling Garment is made of nylon with little tubes sewn into it. These tubes are worn next to the body. Water is circulated through the tubes.

Materials

Thin plastic aquarium tubing
Funnel
Pan
ice water
thermometer

1. To simulate this effect, wrap thin plastic tubing around a student's skin many times, as the drawing shows. The tubing must be worn next to the skin at all times, but be sure that it doesn't hinder circulation.

2. Another students places a funnel into the top of the tube and pours ice water through the tubing very slowly. The water is caught in a pan at the elbow.

3. Record the water temperature at the funnel and at the elbow.

   Water temperature at the funnel: _________

   Water temperature at the elbow: ___________

   What causes the water to change temperature?

4. Disconnect the funnel and beaker from the tubing, but leave the tubing in place around the student's arm. Tape the ends of the tubing so that the tubing will not move.

5. Ask the student to run as fast as possible in place for five minutes. Then repeat the first part of the experiment – dripping the water slowly through the tubing. Record temperature readings again.

   Water temperature at funnel: ___________

   Water temperature at elbow: _________________

6. Compare the change in water temperature with the first experience. Explain the difference.

7. Why would an astronaut want to regulate the temperature or speed of the water flowing through the tubes of the Liquid Cooling Garment?

The Effects of a Blanket of Air

http://earth.rice.edu/shows/EWR/activities.htm

Objectives and State of Maine Learning Result Performance Indicators:

1. Learners will be able to plan and conduct an investigation and analyze data using simple equipment. (3-5. Science and Technology. B1.c.)
2. Learners will understand and use measurements of time and temperature. (3-5. Mathematics. B1.a)

NGSS:

1. Learners will be able to plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects or a model or prototype that can be improved.

General Idea

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
drinking straws

What to Do:

1. Form the clay balls around the bulbs of the thermometers.
2. Wrap cotton around one of the balls (about an inch thick).
3. Support both balls with three straws making a tripod.
4. Place both balls on their straw stands in a freezer for 5 minutes.
5. Remove both balls immediately and record their temperatures.
6. Return the balls to the freezer and repeat the procedure, but leave the balls in for 10 minutes.
7. 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	_________________	_________________

What to Discuss:

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?

Extensions

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

World of Water

http://earth.rice.edu/shows/EWR/activities.htm

Objectives and State of Maine Learning Results Performance Indicators:

1. Learner will be able to plan, conduct, analyze data from, and communicate results of investigations using simple experiments. (3-5. Science and Technology. B1.a.)
2. Learner will be able to explain why it is important to identify and control variables and replicate trials in experiments. (6-8. Science and Technology. C1.b.)
3. Learners will be able to understand and use measurements of time, volume, and temperature to solve and justify problems. (3-5. Mathematics. B1. a2)

NGSS:

1.

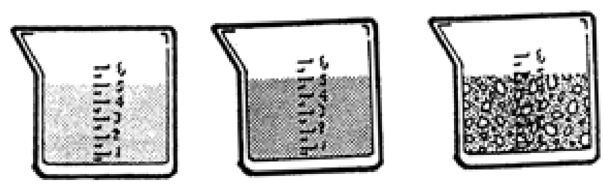
The General Idea:

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

What You Need:

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

What To Do:



1. In three beakers of the same size, place equal volumes of water, loose sand and moist topsoil.
2. Allow the three beakers to sit in a warm room until all three substances are at the same temperature.
3. Place all three beakers in a freezer for five minutes.
4. Record the temperature of the contents of each beaker while still in the freezer.
5. 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	______________	______________	_________________

What To Discuss:

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?

Vocabulary List

Astronaut	A person who pilots a spacecraft or works on one. "Astronaut" is the name used in the United States; "Cosmonaut" is the name used in Russia.
Atmosphere	The mixture of gases that surround a planet, moon, or star, and are held near it by gravity.
Cardiovascular System	The circulatory system of the heart and blood vessels.
Electromagnetic Radiation	The word "radiation" has to do with energy or matter moving through space. Any heated body produces electromagnetic radiation.
Experiment	A test or tests used to find out or prove something , or to see whether an idea is correct
Gravity	A physical force attracting one object to another object.
Light	Radiation that can be detected by the human eye.
Meteor	A bright streak of light caused by a meteoroid as it burns up in Earth's atmosphere.
Meteoroid	A small body in orbit about the Sun which may fall to Earth or to another planet.
Moon	A natural satellite orbiting a planet.
NASA	National Aeronautics and Space Administration. It was started in 1958 as a part of the United States government. NASA is in charge of U.S. Science and technology that has to do with airplanes or space.
Navigation	A method used to learn exactly where airplanes, ships, or spacecraft are in the sky, on the ocean, or in space.
Planet	A body that orbits a star in a solar system and which shines only by reflected light.
Red blood cells	Cells that carry oxygen to all parts of the body.
Robot	Machines controlled by computers
Shooting star	See "Meteor".
Space exploration	Travel into space to gather information about the planets, their moons, stars, and other space objects.
Space junk	This "junk" circling the Earth is also called orbital debris. It can be as small as tiny flecks of paint that have come off spacecraft, and as large as satellites that are no longer working.
Spacesuit	A specially designed garment that protects astronauts from the dangers of space.
Weather	The condition of the air at a certain place and time.
Weightlessness	Weight is the measure of the pull of gravity on an object. NASA astronauts do not feel the effect of gravity in space, which makes them seem like they have no weight, or feel weightless.

Some good books to use with *Astronaut*

Science project ideas about the moon.

Gardner, Robert. 1997, Enslow Publishers.

Introduces the phases and other characteristics of the moon.

Home on the Moon

Dyson, Marion. 2003, National Geographic Children's Books.

Describes the resources on the Moon and walks students through what it would take to establish a lunar settlement, while adeptly providing young readers the technical information required in real-life terms they can easily understand.

Some good web sites to use with *Astronaut*

tycho.usno.navy.mil/vphase.html

View the phases of the moon at any time on any date, site maintained by the U. S. Navy Observatory.

Lessons From The World Wide Web

Also, a wide variety of lesson plans and activities can be found on the World Wide Web. These sites are dedicated to lesson planning in a variety of subjects.

cse.ssl.berkeley.edu

The Center for Science Education at U. C. Berkeley Space Science Laboratory home page with a link to the Science Education Gateway, Lesson Plans

btc.montana.edu/ceres

Maintained by the Burns Telecommunications Center, this page links to educational activities and classroom resources.

www.clearsail.net/students.htm

School/Student links from the ClearSail student fun and research site

spaceplace.jpl.nasa.gov/spacepl.htm

This California Institute of Technology and NASA Jet Propulsion Laboratory site for kids offers information and activities .

school.discoveryeducation.com/

This Discovery Channel education site allows teachers to search for lesson plans by grade and subjects.

Astronomy Web Sites Worth a Visit

Astro.umaine.edu

The Emera Astronomy Center and Maynard F. Jordan Planetarium & Observatory home page

space.jpl.nasa.gov
NASA's Jet Propulsion Laboratory web site

ssd.jpl.nasa.gov
A site about our solar system maintained by the Solar System Dynamics Group of the Jet Propulsion Laboratory.

hawastsoc.org
The Hawaiian Astronomical Society's home page

www.nss.org/
The National Space Society webpage

stardate.org
Learn what's going on TODAY in astronomy on the "Star Date" web page, maintained by the University of Texas' McDonald Observatory

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Emera Astronomy Center

The Maynard F. Jordan Planetarium does not guarantee that the information given on the above web sites to be accurate, accessible, or appropriate for students.

ASTRONAUT DISCUSSION QUESTIONS

1. If you lived near the Moon's south pole, where would the Earth be in the sky?
   a. overhead
   b. below the horizon
   c. near the horizon
   d. depends on the time of day.

2. If you lived on the Moon, what color would the sky be?
   a. yellow
   b. reddish
   c. blue
   d. black

3. If the Moon has ice, it probably came from
   a. comets landing in valleys near the poles
   b. volcanoes covering the surface
   c. formation of the moon's mountains
   d. the Earth

4. What is easier to do outside on the Moon than on the Earth?
   a. bounce up and down
   b. go swimming
   c. grow flowers
   d. fly a kite

5. What color is the Moon's surface at midnight?
   a. yellow from the light of lunar colonies
   b. black because there's no light at night
   c. blue because of Earthshine from the "full Earth"
   d. white from the light of spaceships

6. When people on Earth see a solar eclipse, the Earth, Sun, and Moon are all in a straight line. What is the order of the Earth, Sun, and Moon?
   a. Sun, Earth, Moon
   b. Earth, Sun, Moon
   c. Moon, Earth, Sun
   d. Sun, Moon, Earth

7. When people on Earth see a total solar eclipse, what are people on the Moon seeing?
   a. the Sun disappearing behind the Earth
   b. the Earth disappearing behind the Sun
   c. the Moon casting a shadow on the Earth
   d. the Earth casting a shadow on the Moon

8. During an ice age, ice
   a. is found only at the North and South poles.
   b. covers most of Europe.
   c. covers the whole Earth.
   d. covers all the land areas of Earth.

9. During the last ice age, people drew pictures on
   a. cave walls.
   b. rice paper.
   c. clay tablets.
   d. pulp wood.

10. Which of these is an adaptation of mammoths to their environment?
   a. thick fur.
   b. meat diets.
   c. small feet.
   d. long necks.

11. The mammoth is most like
   a. a leopard.
   b. a tiger.
   c. a gorilla.
   d. an elephant.

12. During the last ice age, people used caves for
   a. killing mammoths.
   b. growing food.
   c. shelter.
   d. protecting their sheep.

13. Name the country that looks like a boot.
   a. Texas
   b. China
   c. Italy
   d. Mexico

14. Why don't the stars twinkle on the Moon?
   a. because the moon doesn't have any air.
   b. because there are no clouds on the Moon.
   c. because stars are closer from the Moon.
   d. They do, the astronauts just can't see it.

15. Which of these causes craters on Earth, but NOT on the Moon?
   a. comets.
   b. asteroids.
   c. volcanoes.
   d. meteoroids.

16. Why does the moon have more craters than the Earth?
   a. It has been hit more often.
   b. Asteroids reach the moon first.
   c. Earth doesn't crater as easily.
   d. Earth craters are wiped away by wind and water.

17. What was the climate like at the time of the dinosaurs?
   a. an ice age
   b. warm and wet like the tropics
   c. dry like a desert
   d. we don't know.

18. A large asteroid impact can kill animals around the world because it
   a. produces clouds covering the entire planet.
   b. floods the entire earth.
   c. causes fires that burn for days.
   d. produces earthquakes around the world.

19. An asteroid impact could not destroy all humans if we
    a. acted like the dinosaurs.
    b. built shelters in caves.
    c. lived both on the Earth and the Moon.
    d. lived in underwater colonies.

20. Are there rivers on the Moon?
    a. only in the mountains.
    b. only at the poles.
    c. only at night.
    d. no.

21. Clouds in the Earth's sky are made of
    a. water droplets.
    b. carbon dioxide.
    c. oxygen.
    d. water vapor.

22. Melted rock is called
    a. obsidian
    b. sedimentary
    c. lava when it's underground and magma when it's flowing on the surface
    d. magma when it's underground and lava when it's flowing on the surface

23. A river flows through a canyon. It is probably true that
    a. the canyon made the river.
    b. the river made the canyon.
    c. an earthquake made the canyon.
    d. wind produced the canyon and the river.

24. Which of these features do you expect to see on the Moon?
    a. canyons cut by ancient rivers.
    b. craters from a recent volcano.
    c. geysers.
    d. craters caused by asteroids.

25. Why is living on the Moon good for an old person?
    a. The rocks are safer.
    b. Lunar spring water is very healthy.
    c. Lower gravity is easier on the heart.
    d. The sunlight is less bright.