

**SPACE JOURNEYS**  
**Science  
Carnival**

# Outreach Guide



In appreciation of:

**Institute of Museum  
and Library Services**

# Introduction

Sci-Port Discovery Center's **Space Journeys Science Carnival** provides 16 portable, hands-on exhibits and guided activities addressing a number of Louisiana, Texas, and Arkansas science and math curriculum objectives. The primary audience is 1st - 12th grade students and their families. A strong component of the Space Journeys Science Carnival is teacher orientation through resource materials and a professional development workshop given by Sci-Port's educators that travel with Science Carnival.





## BACKGROUND INFORMATION

Our skies at night are glittered with thousands of stars and other celestial objects. Despite their apparent limitless numbers, the stars seen with the naked eye comprise less than one-hundredth of one percent of the stars in our galaxy! The stars of our galaxy, the Milky Way, make up an even smaller proportion of our Universe, which contains billions of other galaxies.

### CURRICULUM STANDARD

LOUISIANA	ARKANSAS	TEXAS
SCIENCE	SCIENCE	SCIENCE
PS-E-B1	ES.1.1 (K-4)	3.6.A
PS-M-B1	ES.3.1 (5-8)	7.8.A
PS-H-F1	ES.1.3 (9-12)	47.4.C

For thousands of years, people have made shapes out of these stars. These shapes, known as constellations, have been the source for mythological stories from many cultures throughout history. The International Astronomers Union now recognizes 88 official constellations. In addition to stimulating the imagination, the constellations are also used as reference points to guide astronomers through the night sky.

Most of the constellations, just like the Sun, rise in the East, travel an arc across the sky, and set in the West. This is caused not by the movement of the stars, but by the daily rotation of the Earth about its axis. Polaris, the only star that does not appear to move throughout the Earth's daily rotation, sits motionless in the Northern sky. As a result Polaris points due North no matter what time of night or year and is appropriately named the North Star. The other stars in the Northern sky seem to circle around Polaris throughout the night. These stars and the constellations they comprise are circumpolar, meaning they circle around Polaris without ever falling below the horizon.

One glance at our skies at night reveals many different stars that vary in brightness. The brightness of a star as viewed from Earth is referred to as its apparent magnitude. This is not to be confused with luminosity, the amount of light and heat energy generated by the star. A very luminous star that is far away (such as Rigel in Orion) may not be as bright as a much less luminous star that is very close (like Sirius in Canis Major).

## SPACE LINGO

**Constellation:** Shape of stars in the night sky officially recognized by the International Astronomers Union (IAU)

**Apparent Magnitude:** Brightness of a star as viewed from Earth

**Luminosity:** Energy output of a star

**Circumpolar:** Referring to stars and constellations in the Northern sky that seem to circle around Polaris, the North Star, without ever going below the horizon

**Galaxy:** Very large gravitationally bound collection of millions stars

# Instructions

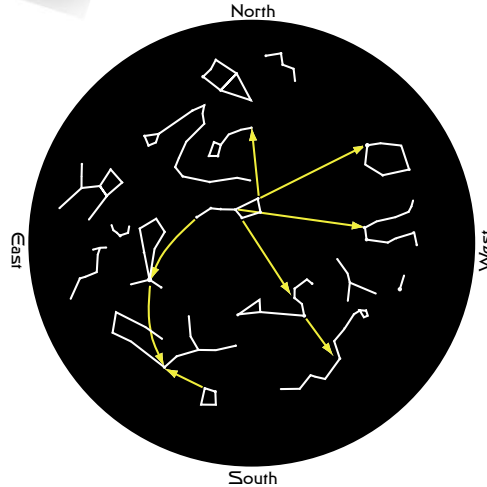


Our Skies

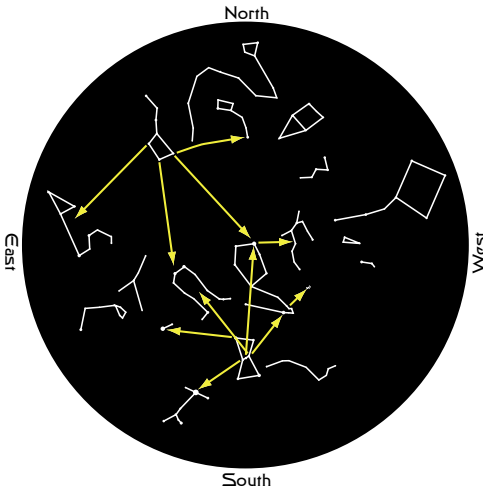
**MISSION:** To learn the names of the constellations.

**PROCEDURE:** Press the buttons to see the constellations light up. Learn the shape and name of the constellations. Press the quiz button. A timer will count how long it takes to identify the constellation and press the corresponding button.

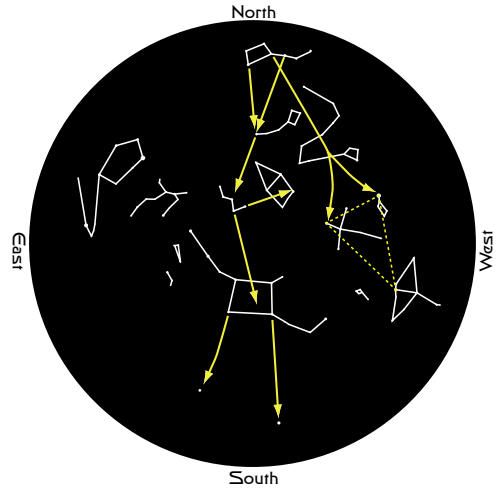
## SPRING CONSTELLATIONS



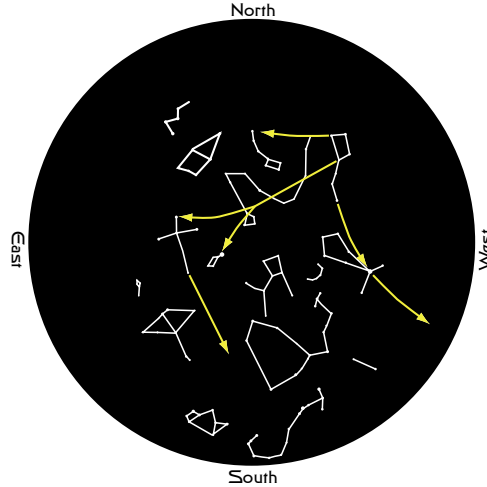
## WINTER CONSTELLATIONS



## AUTUMN CONSTELLATIONS



## SUMMER CONSTELLATIONS



## OBJECTIVE

To identify constellations and learn their stories

# Constellation Tubes

## MATERIALS

- scissors
- black construction paper
- constellation patterns
- push pin
- small piece of foam board the diameter of the cardboard tube
- cardboard toilet paper tube

## CURRICULUM STANDARD

LOUISIANA	ARKANSAS	TEXAS
SCIENCE	SCIENCE	SCIENCE
EES-E-B1	ES.2.8 (K-4)	4.6.A
EES-E-B4	ES.1.6 (5-8)	
EES-M-C2	ES.2.9 (5-8)	

## PROCEDURE

1. **Teacher Note:** The star patterns will need to be reduced on a Xerox machine to fit inside a cardboard toilet paper tube. You may want to discuss the legends associated with the patterns provided. They are Cassiopeia, Bootes, Ursa Major, The Little Dipper.
2. Give the students the following instructions for making their constellation tubes:
  - a. Turn your cardboard tube up and make a circle outlining the end on black construction paper. Cut it out.
  - b. Choose the constellation you want to make from the patterns.
  - c. Lay your black circle on the piece of foam board with your pattern on top. Punch a hole where each star is found in your constellation. Tape the black circle to the end of the cardboard tube.
  - d. Put one light in the center of a darken room and look through the open end of the tube to see your constellation.

## EXTENSIONS

Choose constellations currently visible in the night sky. Have the students look up the time they can best be seen. Assign the constellation chosen by the student to be observed for homework.

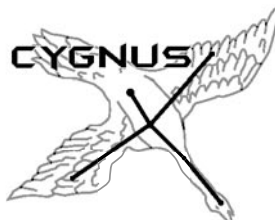
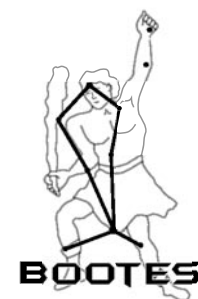
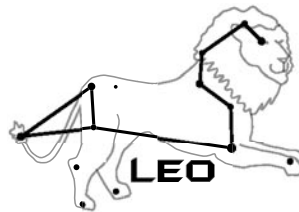
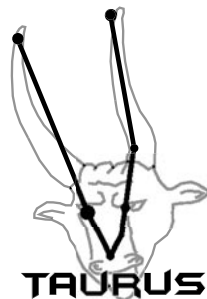
## RESOURCES

Constellations and their stars-list of constellations and stars alphabetically, magnitudes of stars etc.

<http://www.astro.wisc.edu/Adolan/constellations/>

Constellations

<http://nasaexplores.nasa.gov/extras/constellations/index.html>



## OBJECTIVE

To identify constellations that are found in a particular month

# Star Finder

## MATERIALS

- scissors
- Star Finder  
(use the appropriate month; these are found at the Space Place website in PDF format)
- Star Finder directions

## CURRICULUM STANDARD

LOUISIANA	ARKANSAS	TEXAS
SCIENCE	SCIENCE	SCIENCE
ESS-E-B1	ES.2.8 (K-4)	2.7.A
ESS-E-B4	ES.1.6 (5-8)	4.6.A
ESS-M-C2	ES.2.9 (5-8)	4B.9.A
ESS-M-C5		

## PROCEDURE

1. Talk about constellations and their history. You may even want to tell the story of a few of the constellations like Pegasus, Leo, Virgo, Taurus, Scorpius, The Big Bear, The Little Bear, Cygnus, and Lyra.
2. Pass out the Star Finders and directions. Have the student trim the Star Finder to the solid black lines. Have the students highlight in red the constellations that have the solid black lines.
3. Fold the Star Finder following the directions.
4. Now give the following directions to use the Star Finder:
  - a. Stick your thumbs and index fingers into the four pockets on the bottom of the Star Finder.
  - b. Ask someone to choose one of the four top squares. Use the number in the square to open and close your Star Finder that many times.
  - c. Then ask the person to look inside the star finder and name a constellation like Taurus. You then move the Star Finder one time for each letter, T-A-U-R-U-S.
  - d. Now have the person choose a constellation they can see as they look down into the Star Finder. Open the panel to see the name of the constellation they will try to find in the sky for this month.

## RESOURCES

Constellation Stories

<http://einstein.stcloudstate.edu/Dome/clicks/constlist.html>

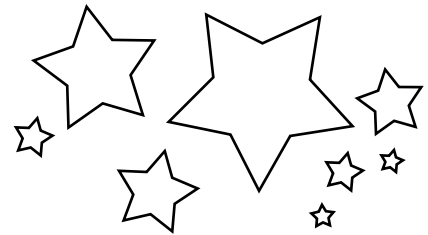
[http://www.windows.ucar.edu/cgi-bin/tour\\_def/mythology/stars.html](http://www.windows.ucar.edu/cgi-bin/tour_def/mythology/stars.html)

Constellations

<http://nasaexplores.nasa.gov/extras/constellations/index.html>

Space Place

<http://spaceplace.jpl.nasa.gov/st6starfinder/st6starfinder.html>



# Planets



## BACKGROUND INFORMATION

**Mercury's** combination of a fast orbit around the Sun (88 Earth days) and slow rotation about its axis (59 days) combine to make a day on Mercury as long as two Mercury years. Temperature variations on Mercury are very extreme, ranging from -300 °F at night to over 1100 °F during the day.

**Venus** is the third brightest object in the entire sky. It is known as the Earth's sister planet because of similar size, density, and composition. But, Venus' atmosphere is 96.5% carbon dioxide, creating a greenhouse effect which makes the temperature a sweltering 850 °F.

**Earth** is the only planet known to sustain life. The environment contains substances essential for diversity of life, such as liquid water, carbon, and oxygen. Life first formed 3.5 billion years ago and then proliferated into 1.7 million species of animals, plants, fungi, and microorganisms, including five billion people. Earth is the third planet from the Sun, which lies in the outer third of the Milky Way. Our galaxy is one of about 35 galaxies in the Local Group of Galaxies, within the Virgo galaxy supercluster, in the very middle of our Universe.

**Mars** varies in brightness more than any planet when viewed from Earth. The surface contains vast deserts of iron oxides, or rust, which give it the familiar red color. There is a volcano larger than the state of Texas and a canyon so big that the Grand Canyon in Arizona would easily fit into one of its tributary cracks.

**Jupiter**, the largest planet, has a mass 318 times more than Earth and a volume 1400 times more than Earth. It is a gaseous giant with the familiar Great Red Spot, a wind storm twice the size of Earth caused by hurricane force winds.

**Saturn**, a gaseous giant like Jupiter, has the familiar rings made of ice crystals ranging from fractions of a millimeter to tens of meters in size. With a very low density, Saturn is the only planet that could theoretically float in water.

**Uranus** and **Neptune** are gaseous giants of similar size. Uranus' rotational axis is almost parallel to the ecliptic plane, therefore it rotates practically on its side. Neptune has a Great Dark Spot similar to Jupiter's Red Spot.

**Pluto** is the smallest (0.2% of Earth's mass) and most distant (40 times further from the Sun than Earth) planet. Pluto's orbit is so large that it takes almost 250 years to complete one revolution around the Sun. Pluto remains the only planet that has not been observed by close spacecraft.

## CURRICULUM STANDARD

LOUISIANA	ARKANSAS	TEXAS
SCIENCE	SCIENCE	SCIENCE
PS-E-B2	3.11.C.D	PS.2.8 (k-4)
PS-M-B2	8.13.A	PS.2.8 (5-8)
PS-H-E1	48.4.A	PS.2.8 (9-12)



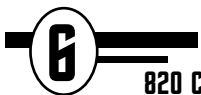
Gaseous Giant: one of the planets Jupiter, Saturn, Uranus, and Neptune composed mainly of hydrogen and helium with a very deep rocky core and a ring system composed of ice crystals

Rotational Axis: the North-South axis about which the planet rotates, or spins

Ecliptic Plane: the plane in which the planets travel around the Sun

Galaxy: large collection of millions of gravitationally bound stars

Galaxy Supercluster: large collection of small galaxy clusters containing as many as tens of thousands of galaxies



# Instructions

**MISSION:** To discover your weight on each of the planets, the Sun, and the Moon.

**PROCEDURE:** Step on the scale to read your Earth weight in kilograms. Press the buttons for each of the nine planets, Sun, and Moon to read your weight on each of these objects.



Planetary Weight



Space Puzzle

**MISSION:** To put together a double-sided puzzle of the Earth and/or the Andromeda galaxy.

**PROCEDURE:** Connect the multi-color pieces of the Earth puzzle together. Flip it over and put the darker pieces of the Andromeda puzzle together.



Starry Night

**MISSION:** To visualize the objects in the night sky from any location at any time through a computer program.

**PROCEDURE:** See the sky on the night of your birth, see earth from outerspace.

## OBJECTIVE

Discover the planets' relative distance from the sun and their approximate size in relation to the Earth.

# Classroom Planetarium

## CURRICULUM STANDARD

LOUISIANA		ARKANSAS		TEXAS	
SCIENCE	MATH	SCIENCE	MATH	SCIENCE	MATH
ESS-E-B1	N-3-E	ES.2.8 (K-4)	NPO.1.1 (K-4)	5.12.C	5.3.A
ESS-M-C2	N-4-M	ES.2.11 (5-8)	NPO.1.1 (5-8)	8.13.A	8.1.B
ESS-H-D2	A-2-H	ES.2.15 (9-12)	NPO.1.2 (9-12)	48.4.A	32.B.1.C

## MATERIALS

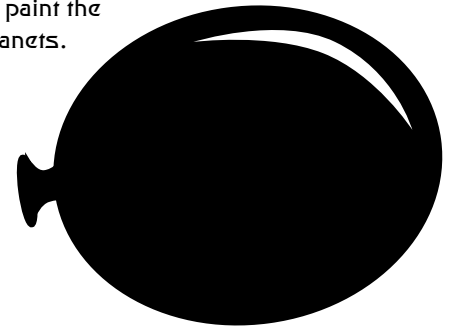
- round balloons, different sizes
- tempera paints and paint brushes
- fishing line (or strong string)
- construction paper
- newspaper torn into strips about one inch wide
- space paste
- s-clips to suspend models from ceiling tile frames (large paper clips)

## PROCEDURE

Teacher note: Divide your students into nine groups. Assign each group a planet. Student will gather information from library books, their science books and the Internet. Students will then record their information. Make a space paste by mixing together one part flour to three parts water.

1. Give each group a balloon. Explain that all the balloons should not be blown up to the same size, but should represent the comparative size of the planets.
2. Provide each group with a supply of space paste and newspaper. Instruct them to dip each strip into the paste; gently pull it through their fingers to wipe off extra clumps, and then paste it onto the balloon. Encourage them to apply extra layers to make their balloons seem round as possible.
3. Allow the balloons to dry. While they are drying, students should discuss how they will paint the surface of their balloons to enhance the surface of their balloons. Students paint their planets.
4. Once dry, use a class discussion to decide where to hang the planets.
5. Discuss the planets' distance in relation to the sun image.

Mercury	58.9 million km
Venus	108.2 million km
Earth	149.6 million km
Mars	206 million km
Jupiter	778 million km
Saturn	1,427 million km
Uranus	2,870 million km
Neptune	4,500 million km
Pluto	5,900 million km



6. Once planets are hung with fishing line and paper clip, attach the planet's student researched information sheet with it.

## RESOURCES

NASA Spacelink's Our Solar system web page

<http://spacelink.nasa.gov/Instructional.Materials/Curriculum.Support/Space.Science/Our.Sol>

StarChild-A Learning Center for Young Astronomers

[http://starchild.gsfc.nasa.gov/docs/StarcChild/solar\\_system\\_level/planets.html](http://starchild.gsfc.nasa.gov/docs/StarcChild/solar_system_level/planets.html)

## OBJECTIVE

To discover the distances between the Sun, planets, and small objects in the Solar System.

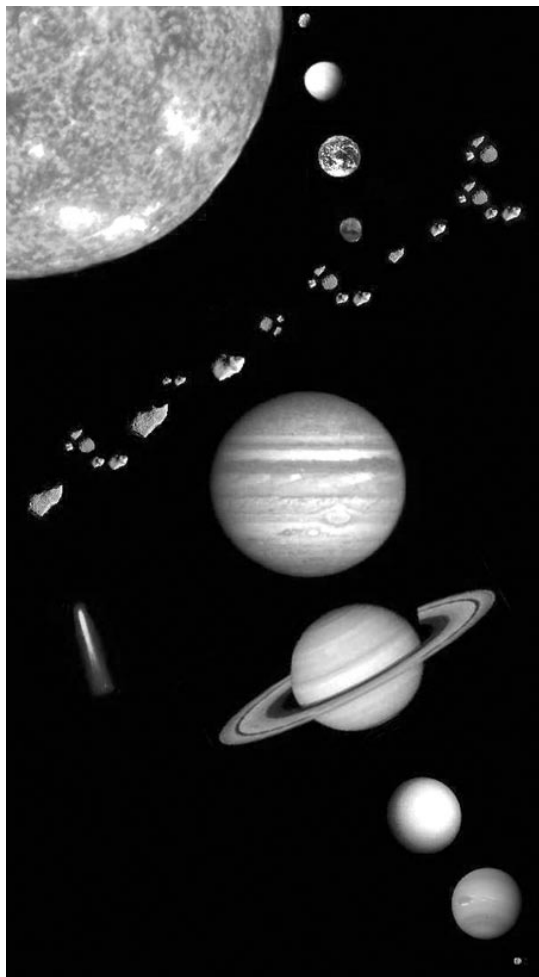
# Solar System Bead Distance

## CURRICULUM STANDARD

LOUISIANA		ARKANSAS		TEXAS	
SCIENCE	MATH	SCIENCE	MATH	SCIENCE	MATH
PS-E-B2	N-3-E	PS.2.8 (K-4)	NPO.1.1 (K-4)	3.12.C,D	3.11.A
PS-M-B2	N-4-M	PS.2.6 (5-8)	NPO.1.1 (5-8)	8.13.A	7.9.A
PS-H-E1	A-2-H	PS.2.17 (9-12)	NPO.1.2 (9-12)	48.4.A	34.E.1.D

## MATERIALS

- planet beads (large craft pony beads in 11 colors):
  - 0.00 AU/Sun-yellow
  - 0.40 AU/Mercury-solid red
  - 0.70 AU/Venus-cream
  - 1.00 AU/Earth-clear blue
  - 1.50 AU/Mars-clear red
  - 2.80 AU/Asteroid belt-black
  - 5.00 AU/Jupiter-orange
  - 10.00 AU/Saturn-clear gold
  - 19.00 AU/Uranus-dark blue
  - 30.00 AU/Neptune-light blue
  - 39.00 AU/Pluto-brown
- 4.5 meters of string for each student
- small pieces of cardboard to wrap Solar System string around (10 cm x 10 cm)
- meter sticks or measuring device



## PROCEDURE

- Convert the various astronomical units to centimeters. To do this, multiply each AU by the scale factor of 10 cm per astronomical unit.
- Measure and cut a piece of string 4.5 m long.
- Using the calculated cm distances of the planets, measure the appropriate distance and place the bead on to the string. Tie the bead onto the string using a double knot.
- Wrap the Solar system string (with beads) around the cardboard holder.
- Using their models, ask students to consider that if you were traveling at the speed of light, it would take 8 minutes to travel from the Sun to the Earth (1 AU). It would take 4.3 years (traveling at the speed of light – 300,000 kilometers per second) to reach the next nearest star, Alpha Centauri.
- Allow students to show models to the class.

## RESOURCES

Solar System Simulator  
<http://space.jpl.nasa.gov>

Astronomy Picture of the Day  
<http://antwrp.gsfc.nasa.gov/apod/stropix.html>

Planets  
<http://pds.jpl.nasa.gov/planets>

# Living in Space



## BACKGROUND INFORMATION

NASA's mission is to understand and protect our home planet, explore the universe, search for life, and inspire the next generation of explorers. In order to do this they must be able to launch men and women into space, and keep them there over periods of time ranging from a few days to several months. Simple earthly tasks like what to wear, what to eat, and how to sleep can be quite challenging in space and require thoughtful solutions.

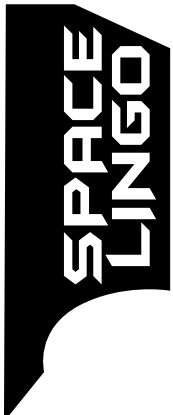
Astronauts wear normal clothing while in the shuttle or space station, but a protective suit is needed during launch, entry, and on space walks. The space suit is a full pressure suit made of flame-retardant material. This suit protects crewmembers from the cold temperature, the vacuum, and micrometeoroids that occur in space.

Even though astronauts are scheduled to sleep eight out of every twenty-four hours, their sleep schedules are often disrupted due to the sheer excitement of space travel. However, astronauts invariably get tired and they can sleep in the commander's seat, pilot's seat, or in bunk beds on the space shuttle. But, on missions with five or more astronauts, some crewmembers must sleep in sleeping bags attached to the walls. In the microgravity of space, there is no up or down. Therefore, astronauts sleep in any orientation. However, they have to attach themselves to something so they don't float around while they sleep.

Space food is surprisingly similar to food eaten on Earth. The nutritional requirements are essentially the same as on Earth. One difference is that space food is packaged in light, flexible containers for storage. Another difference is that astronauts need less iron, a mineral essential for oxygen transport in red blood cells. Fewer red blood cells are produced in space, so astronauts need less meats and green leafy vegetables that are high in iron.

## CURRICULUM STANDARD

LOUISIANA	ARKANSAS	TEXAS
SCIENCE	SCIENCE	SCIENCE
PS-E-B2	3.11.C.D	PS.2.8 (k-4)
PS-M-B2	8.13.A	PS.2.8 (5-8)
PS-H-E1	48.4.A	PS.2.8 (9-12)



Microgravity: Condition of apparent weightlessness that results from an object such as a spacecraft in orbit around a large body such as the Earth; the term zero gravity is technically incorrect because the force of gravity from the large body is what keeps the object in orbit.

Micrometeoroids: Solar System debris with masses ranging from a few micrograms to one gram

# Instructions



Astronaut Suit

**MISSION:** To see and feel what it's like to wear a space suit

**PROCEDURE:** One or more of the students will be able to put on a space suit while the classmates assist with gloves, helmet, and boots (Sci-Port staff will be needed)

**MISSION:** To understand the challenges of sleeping in space

**PROCEDURE:** Zip yourself up in the space bed, lean your head against the pillow, pull the head strap across your forehead



Space Bed



Space Food

**MISSION:** To find the best nutrition selection for astronauts

**PROCEDURE:** Become a "Space Chef" and design a gourmet, nutritious meal for an astronaut in outer space

## OBJECTIVE

1. To identify types of space foods.
2. To understand nutrition and how a diet based upon the daily guidelines from the food groups relates to good health.

# Umm, Good in Space a Lesson in Space Food

## CURRICULUM STANDARD

LOUISIANA	ARKANSAS	TEXAS
<b>SCIENCE</b>	<b>SCIENCE</b>	<b>SCIENCE</b>
LS-E-A1	LS.2.10 (K-4)	1.8.A
LS-E-A6	LS.2.4 (5-8)	43.11.C
EES-E-B6	ES.3.7 (5-8)	
LS-M-C4	LS.2.2 (9-12)	
LS-H-G1		
SE-H-C4		

## MATERIALS

- collection of magazines, food newspaper ads, etc.
- sheet of construction paper
- markers
- scissors
- tape or glue
- chart of the food pyramid

## PROCEDURE

1. Discuss with your students the daily guidelines from each food groups.
2. Discuss the foods that are available in space.
3. Take a piece of construction paper and divide it into breakfast, lunch, dinner, and a daily snack. With smaller children, have them make their piece of construction paper look like a food tray.
4. Cut out pictures of food that can be used in space and will meet the requirements for a balanced diet for a day or one meal (for younger children). Tape or glue the pictures in the appropriate places.
5. Talk about the children's food choices and display their space food.

\*For older students

Give them a menu chart and plan a 3 day space flight menu including all of the daily guidelines for the 4 food groups.

## RESOURCES

Information about USDA guidelines for a balanced diet

<http://www.nal.usda.gov:8001/py/pmap.html>

Information about foods in space

<http://spaceflight.nasa.gov/shuttle/reference/factsheets/food.html>

Information about foods on the ISS Daily Menu

<http://spacelinknasa.gov/products/Space.Food.andNutrition/appendix-b.html>



This picture came from

<http://www.nal.usda.gov:8001/py/pmap.htm>

## OBJECTIVE

To learn how sleep patterns vary in animals.

# Sleep is a Many Splendorous Thing

## MATERIALS

- scissors
- tape
- paper
- data sheet from website

## PROCEDURE

1. Talk about astronauts and how they sleep.
2. Ask if all animals need sleep.
3. Make a bar graph using the animal data about sleep.

## CURRICULUM STANDARD

LOUISIANA		ARKANSAS		TEXAS	
SCIENCE	MATH	SCIENCE	MATH	SCIENCE	MATH
LS-E-A1	N-5-E	LS.1.3 (K-4)	NPO.1.2 (K-4)	1.8.A	3.10.A
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ESS-M-C8	N-5-M	LS.2.5 (5-8)			6.13.B
	A-3-M				7.13.A
	P-2-M				8.15.A
	A-3-M				32.B.1.C
	P-2-H				34.B.4

ANIMAL	Hamster	Human	Giraffe	Bat	Owl	Elephant	Beaver
AMOUNT OF SLEEP	14 hours	8 hours	2 hours	20 hours	17 hours	4 hours	11 hours

3. Have the students cut out the pictures and match them to the animal's bed by taping them together on a sheet of paper.



SQUIRREL



FISH



TIGER



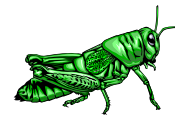
BABY



BEAR



DOG



GRASS HOPPER



BOY



TREE



WATER



GRASS LAND



CRIB



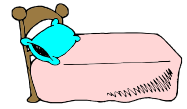
CAVE



DOG HOUSE



GRASS



BED

## RESOURCES

Article about sleeping in space

[http://nasaexplores.com/show2\\_article.php?id-03-057](http://nasaexplores.com/show2_article.php?id-03-057)

Sleep from A to Z<sup>zzzz</sup>

<http://library.thinkquest.org/25553/english/animals/when/index.html>

# Working in Space



## BACKGROUND INFORMATION

Working in space has many challenges that are not present on Earth. For example, the microgravity of space makes operating tools more difficult. A hammer has essentially zero weight, or the force due to gravity, so it is easier to swing. But a hammer still has mass, the amount of matter of an object, as well as inertia, the resistance to changes in motion of an object. The microgravity environment would cause a normal hammer to bounce back and possibly injure the astronaut. So crewmembers use a dead-blow hammer with a pocket of shot in the head to absorb force and avoid injury.

## CURRICULUM STANDARD

LOUISIANA	ARKANSAS	TEXAS
SCIENCE	SCIENCE	SCIENCE
PS-E-B1	ES.1.1 (K-4)	3.6.A
PS-M-B1	ES.3.1 (5-8)	7.8.A
PS-H-F1	ES.1.3 (9-12)	47.4.C

An important part of an astronaut's work equipment is his gloves. An intravehicular (IV) glove is used while inside the spacecraft. The IV is a flexible glove that locks to the sleeve of the space suit. It is used to hold air while outside the spacecraft. But astronauts need more protection from the severe cold and micrometeoroids while outside the spacecraft. So, a multi-layered extravehicular (EV) glove was designed to fit over the IV. The pressurized IV and thick EV reduce dexterity a great deal. To increase mobility, the wrist was given a movable joint, and fabric joints at the knuckles allow thumb and finger movement. Future space gloves will include a robotic aid built inside the glove to provide additional force for augmenting human grasping. It contains a motor and cable system that improves dexterity and lessens hand fatigue from bending the stiff material of the glove.

The robotic glove aid is a design of the future. But robots are currently in use in many facets of the space program, such as robotic land rovers to explore the surface of Mars. The Shuttle Remote Manipulator System or Canadarm2, is a large robotic arm on the International Space Station (ISS). It has performed more than 50 missions and 7,000 orbits without a malfunction and was instrumental in fixing problems with the Hubble Space Telescope. NASA now has plans to develop a humanoid robot named Robonaut. This robot will perform extravehicular activity in place of an astronaut.



Humanoid: Having human characteristics or form

Extravehicular: Outside the spacecraft

Intravehicular: Inside the spacecraft

Micrometeoroids: Solar System debris with masses ranging from a few micrograms to one gram

Weight: The force of gravity on an object

Mass: The amount of matter of an object

Microgravity: Condition of apparent weightlessness that results from an object such as a spacecraft in orbit around a large body such as the Earth

# Instructions

**MISSION:** To use a robot to dunk a basketball into the goal.

**PROCEDURE:** Learn how the joysticks control the robot from the diagrams, maneuver the robot so that it can grab the ball, position it over the goal, let go of the ball, and dunk.



Robodunk

**MISSION:** To turn a wrench in a simulated microgravity environment

**PROCEDURE:** Step up carefully on the “lazy Susan”, turn the bolt with a wrench using one hand, try it again this time by holding on to the handle with the free hand



Tooling Around

**MISSION:** To simulate the difficulty of using space gloves.

**PROCEDURE:** Put on the large bulky gloves, press the timer, see how long it takes to put the Oreos cookies back together.



Space Gloves

# Think Like a Robot

## OBJECTIVE

To demonstrate how hard it is to accurately guide a robot through simple tasks.

## MATERIALS

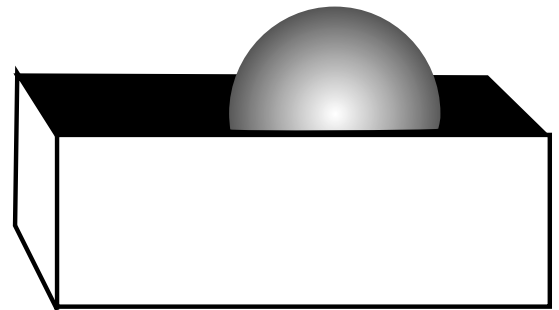
- blindfolds
- ball
- desks
- container

## PROCEDURE

1. Working with a partner, one student will take on the role of a robot, the other the controller. The person playing the robot should be securely blindfolded and given the ball.
2. The robot, following the verbal instructions from the controller, must move along a prescribed course (down an aisle and around a desk, for example) and then deposit the ball in the container. The robot can't talk during the first attempt and must follow directions given to it exactly ("turn right" doesn't necessarily mean all parts of the body). After the robot has successfully put the ball in the container, the robot and controller switches roles and tries again.
3. Discuss how effective partners were with commands. Work out commands that are very specific to follow.
4. Repeat the mission again using a different route, taking a turn in each role. Were the commands clearer this time?
5. For discussion: What problems might you face if the robot wasn't as smart as you or your partner? What activities or problems can you think of that a robot could solve or at least help with?

## CURRICULUM STANDARD

LOUISIANA	ARKANSAS	TEXAS
SCIENCE	SCIENCE	SCIENCE
SI-E-A6	ES.1.1 (K-4)	4.2.A.B.C.D.E
SI-M-A2	ES.3.1 (5-8)	7.2.A.B.C.D.E
SI-H-B3	ES.1.3 (9-12)	47.2.A.B.C.D
		47.4.C



## OBJECTIVE

To create a model of a robotic probe, and to practice research skills using the Internet.

# Mars Rover

## MATERIALS

- computers with Internet access
- book for referencing robots

## PROCEDURE

1. Discuss the robotic probe missions.
2. Have students or groups sign up for one of the robotic probe missions listed below, or allow them to research a mission not mentioned in the article.  
Lunar Prospector                      Pioneer 10                      Stardust  
Pathfinder                                  Sojourner                      Genesis  
Messenger
3. Students can use the Internet to research robotic probes. Students should type in their probe's name in the search block. Have students list information to include the following:
  - Date of mission
  - Purpose of the robotic mission
  - Estimated time of mission
  - What the probe is doing at this time
4. Have student type (or write neatly in ink) the information on a 5" X 7" index card to be attached to their robotic probe models.
5. Using miscellaneous materials from home, the students will create a model of their probe to be completed in 5 days.
6. Have students share their information and robotic probe models with the class.
7. Display projects in the classroom, hallway, or library.

## EXTENSION

Have students pick one of the nine planets and design a robotic probe to explore it and to gather information.

## RESOURCES

Mars Team Online

<http://quest.arc.nasa.gov/mars>

Spacelink Search

<http://search.spacelink.nasa.gov/index.html>

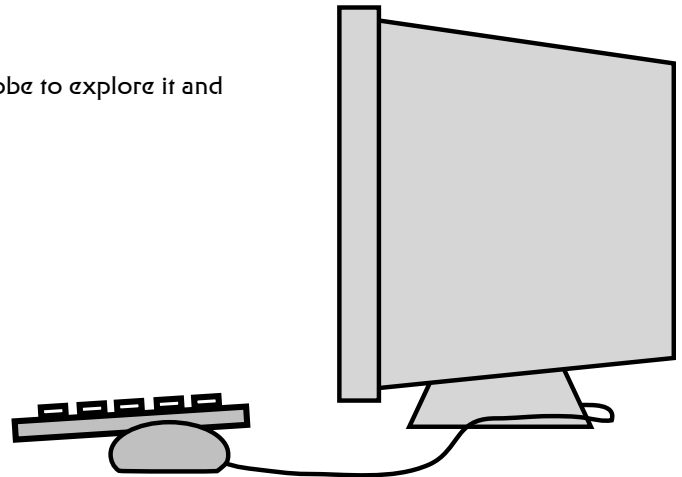
NASAexplores article, "Where No Man Has Gone Before..."

Information about Mars

<http://quest.arc.nasagov/mars>

## CURRICULUM STANDARD

LOUISIANA	ARKANSAS	TEXAS
SCIENCE	SCIENCE	SCIENCE
SI-E-A6	ES.1.1 (K-4)	4.2.A.B.C.D.E
SI-M-A2	ES.3.1 (5-8)	7.2.A.B.C.D.E
SI-H-B3	ES.1.3 (9-12)	47.2.A.B.C.D
		47.4.C



## Websites



### GENERAL RESOURCES

Spacelink- Official home to the NASA Education Division's electronic publications and NASA Television's education schedule plus NASA's Internet resources with hundreds of subject oriented pages and the ability search all of NASA.

<http://spacelink.nasa.gov/NASA.Overview/.index.html>

The Space Place-Where you make, learn, and do spacey things

<http://spaceplace.jpl.nasa.gov/index.shtml>

### OUR SKIES

Chris Dolan's Constellations and their stars- List of 88 constellations and stars alphabetically, magnitudes of stars etc.

<http://www.astro.wisc.edu/~dolan/constellations/>

Constellation List-St. Cloud State- Good mythological descriptions of the constellations, information about their brightest stars, and pictures of the constellations

<http://einstein.stcloudstate.edu/Dome/constellns/constlist.html>

The Mythology of Constellations- Short descriptions of the myths surrounding some of the prominent constellations

<http://www.emufarm.org/~cmbell/myth/myth.html>

Windows to the Universe- University Corporation of Atmospheric Research-Has a wealth of information about the earth, solar system, universe, myths about space, space missions, etc.

<http://www.windows.ucar.edu/>

### WORKING IN SPACE

NASA Space Telerobotics Program- Compilation of space robotics-related and general purpose robotics-related resources

[http://ranier.oact.hq.nasa.gov/telerobotics\\_page/internetrobots.html](http://ranier.oact.hq.nasa.gov/telerobotics_page/internetrobots.html)

Space Robotics- The Space Educators Handbook

<http://www.jsc.nasa.gov/er/seh/robotard.html>

Space Systems Laboratory University of Maryland- List of current and completed projects involving tools, gloves, space suits, robots, vehicles, etc.

<http://www.ssl.umd.edu/projects/projects.html>

### PLANETS

The Nine Planets: A Multimedia Tour of the Solar System- An overview of the history, mythology, and current scientific knowledge of each of the planets and moons in our solar system.

<http://seds.lpl.arizona.edu/nineplanets/nineplanets/nineplanets.html>

Solar Folklore

<http://solar-center.stanford.edu/folklore/folklore.html>

Solar System Exploration- Where you can find out about the history of exploration, why study the solar system, the people of the solar system, and the planets

<http://sse.jpl.nasa.gov/index.cfm>

Views of the Solar System- A vivid multimedia adventure unfolding the magic of the Sun, planets, moons, and more

<http://www.solarviews.com/eng/homepage.htm>

### LIVING IN SPACE

Living and Working in Space- Activities, articles, and information about breathing, water usage, food in space

<http://education.nasa.gov/IEW2001/living.html>

Space Food- With menus and food lists in PDF format, plus instructional materials about working and living in space

<http://spacelink.nasa.gov/NASA.Projects/Human.Exploration.and.Development.of.Space/Living.and.Working.In.Space/.index.html>

## Books

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*Astronomy For All Ages* by Philip Harrington and Edward Pascuzzi - Activities for families or the classroom that involve topics like the naked-sky eye, the moons, the sun, the solar system and more. Published in Guilford, CN by The Globe Pequot Press

*Collins Pocket Guide Stars and Planets* by Ian Ridpath - Field guide to the stars. Published in Toronto, Canada by HarperCollinsPublishers

*NightWatch: A Practical Guide to Viewing the Universe* by Terence Dickinson - A great resource guide with information about everything from viewing from your backyard to comets, meteors, and auroras. Published in Buffalo, New York by Firefly Books Inc.

*Star Myths of the Greeks and Romans: A Sourcebook* by Theony Condos -An in-depth compilation of mythological stories of 48 constellations. Published in Grand Rapids, MI by Phanes Press

## Software

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Starry Night Pro-Allows you to see the night sky at any time from any astronomical position, easy to learn and use. Information on purchasing the software is at [www.space.com](http://www.space.com) or [www.starrynight.com](http://www.starrynight.com).

Deep Sky-The Basic Program 2.75-Freeware software with star maps containing bright stars Cat (9096 stars to magnitude 6.5), 10'000 nebulae from SAC 7.2, elements of planets, comets and asteroids.  
Download at <http://www.stargazing.net/astropc/download.html>.

## FACTS ABOUT THE PLANETS

MERCURY	VENUS	EARTH	MARS	JUPITER	SATURN	NEPTUNE	URANUS	PLUTO
Only planet smaller is Pluto	Closest planet to Earth	Perfect for people	Has ice caps at its poles	Is an outer planet	Large gas planet	Rotates on its side	Has a moon called Triton	Smallest planet
Can be seen from Earth in early morning or late evening	Rotates in opposite direction from other planets	Has oceans and land	Its moons are Phobos and Deimos	Has a large red spot thought to be a hurricane	Surrounded by 1000 rings of ice and dust	Has 11 known rings	Sometimes is further away than Pluto	Coldest planet
Named for the messenger of the gods	Covered with clouds	Atmosphere is just right for kids	Iron in its soil makes it red	So large all the other planets will fit inside	Has at least 18 moons	Has a blue green color	Atmosphere has very strong winds	Some astronomers do not think it is a planet

## PLANETARY DATA

	MERCURY	VENUS	EARTH	MARS	JUPITER	SATURN	URANUS	NEPTUNE	PLUTO
Distance from the Sun (AU)	0.387	0.723	1.000	1.524	5.203	9.537	19.191	30.069	39.481
Approx. Distance from the Sun (10 <sup>3</sup> km)	57,910	108,200	149,600	227,940	778,400	1,429,725	2,870,980	4,498,250	5,906,370
Radius	2,439.7	6,051.8	6,378.14	3,397.2	71,492	60,268	25,559	24,764	1,194
Mass (Earth =1)	0.054	0.88	1	0.149	1,136	755	52	44	0.005
Density (gm/cm <sup>3</sup> )	5.43	5.24	5.515	3.94	1.33	0.70	1.30	1.76	1.1
Rotation Period (Day Length)	58.65	-243.02	0.99	1.03	0.41	0.44	-0.72	0.67	-6.39
Orbital Period (Year in Days)	88	225	365	687	4,333	10,760	30,685	60,190	90,800
Sidereal Period (Year Length in Earth Years)	0.24	0.62	1	1.88	11.86	29.42	83.75	163.72	248.02
Orbital Tilt (Degrees)	0	177.3	23.45	25.19	3.12	26.73	97.86	29.58	119.61
Satellites	0	0	1	2	16	18	15	8	1

### PLANETARY DATA GLOSSARY

AU - astronomical unit, the distance between Earth and Sun (~1.495 x 10<sup>8</sup>)

Rotation Period - the length of the day

Orbital Period - the length of the year in Earth days

Retrograde - when a celestial body rotates in the opposite direction of the Earth or clockwise

Satellite - another name for a moon

Sidereal Period - the length of a planet's year in Earth years

Tilt - how far a planet is tilted sideways on its axis, measured in degrees

## OBJECTIVE

To compare a circle to an ellipse

# Circles & Ellipses

## MATERIALS

- In groups of 2
- one foot square foam board
- 12 inch string tied into a 6 inch loop
- 2 thumbtacks
- metric ruler
- white paper
- 12 x 17 construction paper
- glue
- scissors
- markers

## CURRICULUM STANDARD

LOUISIANA		ARKANSAS		TEXAS	
SCIENCE	MATH	SCIENCE	MATH	SCIENCE	MATH
ESS-E-B1	G-2-E	ES.2.8 (K-4)	GS.2.1 (K-4)	5.12.D	2.7.A
ESS-M-C3	G-6-E	ES.2.6 (5-8)	GS.2.2 (K-4)	48.9.D	3.14.A
PS-H-E2	G-2-M	ES.2.12 (5-8)	GS.1.1 (5-8)	43.9.C	6.6.C
	G-6-M	ES.3.1 (5-8)	GS.2.2 (5-8)		34.B.2.A
	G-1-H				33.C.12.A
	G-2-H				

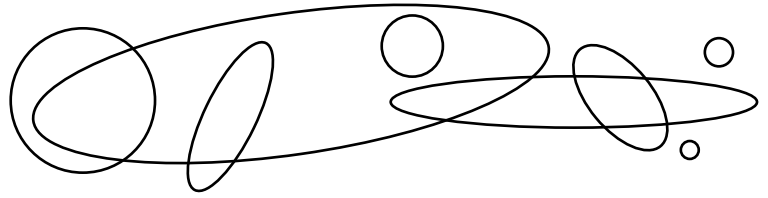
## PROCEDURE

1. Discuss orbits, satellites, and planets orbits.
2. Divide the students into groups and have them find the center of their copy paper by folding it in half vertically, then horizontally. Unfold the paper. Where the two lines intersect is the center of the paper.
3. Put the paper on the foam board and put a thumb tack in the center. Place the sting loop under the tack head and place the pen inside the loop. Move the pen outward to stretch the sting. Hold the pen firmly against the string, and move it around in an orbit. Remove the circle-shaped orbit from the foam board, and set it aside.
4. Repeat the same activity, except have students place a thumb tack 6 cm from the center on each side. Use the pen-and-string loop to draw the shape. Remove the ellipse-shaped orbit from the foam board.
5. Discuss the figures. The students can add a sun to the center of the ellipse and their favorite planet. They also need to think of something that has a circular orbit and draw it on their circle. These can be cut out and mounted on the construction paper for display.
6. For older students they can actually calculate the perimeter of the circle and the ellipse and discuss the mathematical relationships between the two. They can also make ellipses of different sizes and discuss the relationship between them.

## RESOURCES

Article on Orbits

[http://nasaexplores.com/show2\\_k\\_4a.php?id=01-079&gl=k4](http://nasaexplores.com/show2_k_4a.php?id=01-079&gl=k4)



## OBJECTIVE

To examine the relationship of distance to speed of an object in orbit

# Orbit Ways

## MATERIALS

- In groups of 2 or 3
- tennis ball anchored to a string (need 2 washers, 2 nuts, an eyebolt - see Teacher Note)
- markers
- stopwatches
- ruler

## CURRICULUM STANDARD

LOUISIANA		ARKANSAS		TEXAS	
SCIENCE	MATH	SCIENCE	MATH	SCIENCE	MATH
SI-E-A5	G-2-E	PS.1.1 (K-4)	NPO.1.2 (K-4)	3.1.2	1.12.A
PS-E-B2	G-2-M	PS.2.8 (K-4)	M.3.3 (K-4)	4.2.2	5.7.B
PS-E-B3	G-3-M	ES.2.6 (K-4)	DSP.4.1 (K-4)	4.2.7.C	B.2.A
SI-M-C3	G-1-H	PS.1.1 (5-8)	DSP.4.3 (K-4)	5.3.2	
ESS-M-C3	G-2-H	PS.1.3 (5-8)	GS.2.2 (5-8)	5.3.5.C	
SI-H-A4		PS.2.6 (5-8)	DSP.1.1 (9-12)	6.4.2	
PS-H-E2		ES.2.6 (5-8)		7.5.2	
		ES.2.12 (5-8)		7.5.12.D	
				47.4.B	
				47.6.A	

## PROCEDURE

1. Teacher Note: Drill a hole smaller than the eyebolt. Put the nuts and the washers on the end of the eyebolt. Force one nut and washer through the hole. Tighten the other nut down to secure the bolt. Tie the string to the eye of the bolt.
2. Discuss orbits, momentum, and gravity.
3. Explain the following procedure and then have the students construct a data sheet.
4. Divide the students into groups and have them measure out 30 cm of string from the ball to the ball handler's hand. Put a mark with the marker. Have the handler swing the ball perpendicular to the ground. Once it is at a steady speed, have a timer measure the time it takes to make one revolution. Repeat 3 times and average the results.
5. Repeat step 3 with a string distance of 40 and 60 cm.
6. Have the students explain their results using the concepts of gravity, momentum and the diameter of the orbit.

## RESOURCES

Article about orbits

[http://nasaexplores.com/show2\\_k\\_4a.php?id=01-079&gl=k4](http://nasaexplores.com/show2_k_4a.php?id=01-079&gl=k4)

Observatorium

<http://observe.ivy.nasa.gov/nasa/core.html.html>

Orbit Simulator

<http://observe.ivy.nasa.gov/nasa/education/reference/orbits/orbit2.html>

