Fireball Planetarium

Cosmos Tour Grade 6

Planetarium Program Guide

Fireball Planetarium
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What is a Portable Planetarium?

A portable planetarium is a theatre of the Universe. It can surround you with an accurate image of the sparkling night sky. It can show all the motions and cycles of the sky. It can create a multi-media experience with slides, video, visual effects, computer animations, narration, and music that reveal the wonders of the cosmos to you and your class. It can interpret the Universe in a way that appeals to both the mind and eye. The Planetarium will introduce your students to a lifelong acquaintance with the sky and the Universe.

Who Should Use the Planetarium?

Classes studying astronomy should visit the Planetarium. Ideally, a student should make several visits over the years to experience a broad range of programs. We also encourage students and parents to attend our public shows in the evening. Many of our programs are interdisciplinary in nature and can enrich classes not only in the other sciences.

Using the Planetarium Effectively

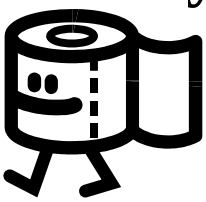
We see the planetarium as a resource to help you teach astronomy and as a means to convey the excitement of astronomy and the sciences and to attract student interest in these topics. We want the visit of your class to be a stimulating and educational experience. When you call to arrange a visit, please let us know any questions you have. This will help us assure the best possible program for your class.

Some helpful pointers include:

* A planetarium visit is most valuable when it is integrated with the regular classroom syllabus. The visit should generally be made after students have studied the related material in class, especially for the younger grades.
* The planetarium visit can be used to extend the classroom unit. Don't necessarily choose the program that most completely overlaps your curriculum. Consider also a program that expands on just part of your unit or that extends the unit in a new direction.

Solar System

Activity: Toilet Paper Solar System



LEVEL
Ages: general audiences

RATIONALE
A graphic demonstration of the varied and enormous distances in space.

LENGTH
Half an hour, in advance, to prepare the roll.
10-15 minutes for demonstration.

OBJECTIVES
Describe the relative distances of planets from our sun.

MATERIALS

- One roll of toilet paper, 201 sheets.
- Gel marker(s) or fluid writing utensil(s), preferably 10 colors.
- Clear tape for repairs.

PREPARATION

1. On a flat, protected surface, unroll the first sheet or so of the roll. Test the marker(s) for clarity and bleed through. Use gel or fluid pens rather than felt-tip. Pens that are very pointy or wet can tear the paper. You will be making X's and writing the names of planets.

2. Draw a small dot, about half the diameter of a standard pencil eraser, near the perforations between the (new) first and second sheet. This is the size of the Sun, approximately to scale. The other objects in our solar system are too small to draw on this scale; we will use large X's to represent their placement.
3. Write "SUN" near the dot.
4. Using the perforations between sheets as a ruler (the first is zero), mark the placement and names of the planets as listed in the table below. Re-roll the toilet paper. If it tears, repair with tape.

PROCEDURE

Starting at one end of a long hallway, unroll the toilet paper until you reach the end. Note the varying distances. Have one student represent the Sun and give out the distance and diameter of the next planet and asked which planet it is, the student with the right answer stand next to that distance. Repeat for all eight major planet as a bonus you can add Pluto and explain why it is a dwarf planet, showing how the scientific method works.

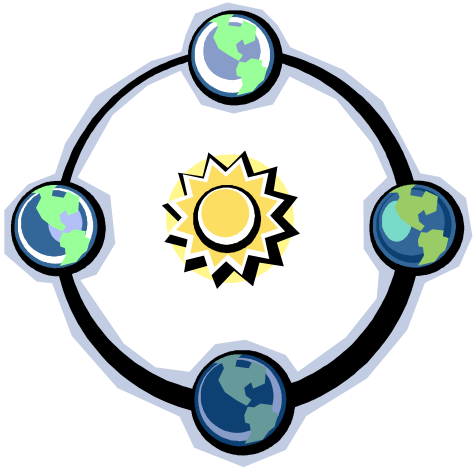
SPACING

Planetary Data Distance Table

Planet	Distance (from Sun)	Diameter	Toilet Paper
Mercury	57,910,000 km 0.387 A.U.	4,800 km	2.0
Venus	108,200,000 km 0.723 A.U.	12,100 km	3.7
Earth	149,600,000 km 1.000 A.U.	12,750 km	5.1
Mars	227,940,000 km 1.524 A.U.	6,800 km	7.7
Jupiter	778,330,000 km 5.203 A.U.	142,800 km	26.4
Saturn	1,424,600,000 km 9.523 A.U.	120,660 km	48.4
Uranus	2,873,550,000 km 19.208 A.U.	51,800 km	97.3
Neptune	4,501,000,000 km 30.087 A.U.	49,500 km	152.4
Pluto	5,945,900,000 km 39.746 A.U.	3,300 km	200.0

Cheap, flat toilet paper generally works best.

The reason for the seasons



During northern summer, the Earth‘s northern hemisphere is tipped towards the Sun, the Sun is high in the sky and up for longer hours. The Sun’s rays strike the Earth from a perpendicular position, and this direct radiation heats the Earth’s surface, thus making it hot in the summer. Six month later the Earth has moved half way around the Sun in it’s yearly orbit and the Earth is tilted away from the Sun and the Sun’s rays strike the surface from a very low angle. There are also fewer daylight hours in winter. This reduced winter hours and oblique sun angle making it colder in winter. Remember seasons are not caused by the ellipticity of the Earth’s orbit the Sun. Earth is marginally closer to the Sun in winter in the north.

Summary

The students will discuss, define, and demonstrate the Earth's rotation and revolution around the sun. The students work as a whole class and in small groups to determine Newfoundland &Labrador’s seasons in relationship to its revolution around the sun. Each group will write a paragraph explaining their reasoning (prediction). After whole group discussion, each student will reflect on his or her prediction (correct or incorrect and why).

Learning Goals

-The students will be able to define rotation and revolution.
-The students will be able to demonstrate how the Earth rotates and revolves around the sun in a counterclockwise position.
-The students will be able to predict which season each piece of tape represents based on the amount of light that hits the Earth.

Context for Use

The student will recognize the difference between rotation and revolution and their connection to day, night, seasons, and the year. The length of the lesson is 1 hour. The

lesson includes whole group and small group discussion and demonstration. Materials needed include a lamp, a globe, masking tape, a paper star (the North Star), and student journals (optional

Description and Teaching Materials

Introduction:
Ask the students to describe the word rotation (spinning). Have a student show rotation using his or her body. Have another student show rotation with the globe. Tell the students that the Earth rotates counterclockwise on it axis and demonstrate with the globe. Ask students to describe revolution or revolve (to move around something). Have two students demonstrate. Ask a student to show the revolution of the Earth around the sun using the globe and lamp. Tell the students that the Earth also moves around the sun counterclockwise and demonstrate.

Demonstration:
Have a student put a piece of tape on Newfoundland/Labrador. Tell the students to watch this location and the light it receives.

Place one piece of tape on the floor on each side of the lamp. Tell the students that each piece of tape represents one season. They will not know which is which. Tape a paper star on the wall nearest to the lamp.

Ask the students if the Earth sits straight up and down on its axis (No. It is always tilted at 23.5 degrees with the North Pole always facing the North Star).

Choose one student to slowly walk around the lamp to show the Earth's revolution while spinning the globe quickly. Ask what each spin or rotation represents (one day passing). Ask what each revolution or full circle around the lamp represents (one year passing).

Have one student stand at one of the pieces of tape and rotate the earth to show two days coming and going. Have another student take the globe and move counterclockwise to the next piece of tape and do the same. Repeat for the last two seasons. Always keep the North Pole pointing to the North Star. Tell the students to watch the sun's relationship to Newfoundland/Labrador during each season.

Conclusion:
Divide the students into groups. Have them talk about which pieces of tape are which season and why and make a prediction in their science journals. Have each group write a label for each of the four seasons and put them face down on each spot. Turn over the labels, one by one, and ask each group to explain their decisions. Students should recognize that winter would be on the spot where Newfoundland/Labrador sees the shortest amount of light and summer should be when Newfoundland/Labrador receives the most amount of light. Spring and fall receive the same amount of light (equinox = equal).

Teaching Notes and Tips

Some students may need more than one demonstration. It is helpful to show the whole class twice and then again with small groups, if needed. Take each group one at a time and have them demonstrate and explain their answers before bringing the whole class back together.

Assessment

The students will describe and explain their predictions of the seasons in relation to the revolution of the earth around the sun in their science journals. The students will reflect on their predictions (correct or incorrect and why) after the whole class discussion in their science journals.

Stars

Measuring the Sky

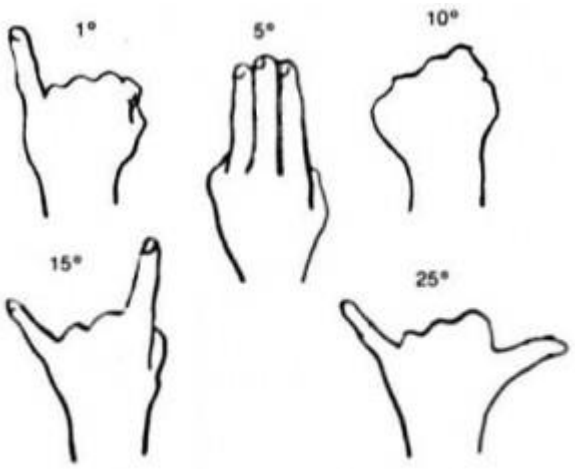


Fig E.
The Common Sky Measurements

Have students familiarize themselves with the common sky measurements. Download a star map from http://www.skymaps.com/ for your month. Have your student go out in their backyards and find the big dipper. Have them measure the distance from between the pointer stars, the pointer star to the end handle star. As they become familiar with angular measure. Have them measure the angular height of the big dipper's bowl above the horizon over a 3 hour period. Measure the height of the north star about the horizon.

While outside have the students take notes on the following thing.

- Are the stars all the same brightness?

- Are they the same color?
- Do they see any that appear grouped closely together?
- Can they is the band called the milkyway.
- What's the angular measurement of the moon?

Vocabulary List

Astronomer - A person who studies and contributes to the science of astronomy.
Atmosphere - A layer of gases that surround a body such as a planet.
Axis - An imaginary straight line around which an object rotates.
Black Hole - A cosmic body of extremely intense gravity from which nothing, not even light, can escape.
Comet Frozen - masses of gas and dust which have a orbit through the solar system.
Constellation - A grouping of stars, considered by humans to form a picture in the sky. Often related to mythology.
Day - The time it take for a planet to make one full rotation (on Earth, 24 hours).
Electromagnetic Radiation - A series of electromagnetic waves.
Galaxy - A cluster of stars, dust, and gas held together by gravity.
Gravity - The force of attraction between two objects which is influenced by the mass of two objects and the distance between the two objects.
Light Year - The distance that light travels in one year, approximately 6 trillion miles.
Milky Way - galaxy large spiral galaxy consisting of several billion stars, one of which is the Sun.
Moon - A natural satellite orbiting a planet.
Orbit - A specific path followed by a planet, satellite, etc.
Planet - A massive object orbiting a star.
Revolution - The circling of a smaller object around a larger object.
Rotation - The spinning of an object on its axis.
Solar System - The system of planets, moons, and other objects revolving around a star (in our case, the Sun).
Star - a massive, self-luminous celestial body of gas that shines by radiation derived from its internal energy sources.
Sun Sol, - the star that is closest to Earth and from which we get heat and light energy.
Time – The measured or measurable period during which an action, event, process, or condition exists, occurs or continues.
Time Dilation - In the theory of special relativity, the "slowing down" of a clock as determined by an observer who is in relative motion with respect to that clock.
Universe - The vast expanse of space which contains all of the matter and energy in existence.
Wormhole - A hypothetical structure of space-time envisioned as a long thin tunnel connecting

Word Search

E S T B B K Y N R A L O S M E
W L R E J M Q O N Q B E I C L
B E E O N S T W K Y S L X Z Y
X N M C L A E P K G Y P A C L
L N O I T A L L E T S N O C I
S N N I T R I P O O T M E C K
V U O A T M O S P H E R E E T
S N R I K U Z M Y T M M G P U
I I T K T A L O A X H R B V M
A V S N I A T O D G A W O L V
Y E A R B H I N V V N L R W E
G R N E R A J D I E I E A K E
G S D X O K R T A G R Y T G Z
L E W D Z D Y O H R Z E S I V
I M K D O T G T B O S P O Q C

ASTRONOMER
ATMOSPHERE
AXIS
BLACK
COMET
CONSTELLATION
DAY
ELECTROMAGNETIC
GALAXY
GRAVITY
HOLE
LIGHT
MILKY
MOON
ORBIT
PLANET
RADIATION
REVOLUTION
ROTATION
SOLAR
STAR
SUN
SYSTEM
TIME
UNIVERSE
WAY
WORMHOLE
YEAR

28 of 28 words were placed into the puzzle.

Solution

E + T + + + + + R A L O S + +
+ L R E + + + O + + B + I + +
+ E E + N + T + + Y S L X + +
+ N M C + A E + K + Y + A C +
+ N O I T A L L E T S N O C +
+ N N I T R I P O + T M + + K
+ U O A T M O S P H E R E + +
S N R I + U + M Y T M + G + +
+ I T + T + L O A X + R + + +
+ V S + I A + O D G A + O + +
Y E A R B + I N V V N L R W +
+ R + + R + + D I E I E A + +
+ S + + O + + T A G R Y T G +
+ E + + + + Y + H R + + S I +
+ + + + + + + T + + + + + + C

(Over,Down,Direction)
ASTRONOMER(3,11,N)
ATMOSPHERE(4,7,E)
AXIS(13,4,N)
BLACK(11,2,SE)
COMET(14,4,SW)
CONSTELLATION(14,5,W)
DAY(9,10,N)
ELECTROMAGNETIC(1,1,SE)
GALAXY(14,13,NW)
GRAVITY(13,8,SW)
HOLE(10,7,NW)
LIGHT(12,11,SW)
MILKY(6,7,NE)
MOON(8,8,S)
ORBIT(5,13,N)
PLANET(8,6,NW)
RADIATION(10,14,NW)
REVOLUTION(11,13,NW)
ROTATION(9,1,SW)
SOLAR(13,1,W)
STAR(13,14,N)
SUN(1,8,NE)
SYSTEM(11,3,S)
TIME(5,6,NW)
UNIVERSE(2,7,S)
WAY(14,11,SW)
WORMHOLE(14,11,NW)
YEAR(1,11,E)

sites. *http://www.rasc.ca/education/teachers/curriculum.shtml*
• **CASCA (Canadian Astronomical Society)** has ideas for astronomy lessons and complete unit plans at
http://www.cascaeducation.ca/files/teachers_secondary.html, and the home page has other relevant links at
http://www.cascaeducation.ca
• **Local Astronomy Clubs/Societies:** a parent directory for clubs throughout Canada and further information about local clubs can be found at SkyNews Magazine website
http://www.skynews.ca/pages/clubs.html
• **NASA (National Aeronautics and Space Administration)**
http://www.nasa.gov/audience/foreducators/9-12/programs/index.html
• **CSA (Canadian Space Agency)** lists resources by topic.
http://www.asc-csa.gc.ca/eng/educators/resources/highschool.asp
• **Canadian Images** (curated) from IYA2009. *http://www.galaxydynamics.org/iya2009/*
• **Photographic Tour of the Universe** from the CASCA Education website.
http://www.cascaeducation.ca/files/tourUniverse/tourUniverse.html

• **SkyNews Magazine** (Canadian astronomy magazine) also has images from their Photo of the Week
contest. *http://www.skynews.ca/pages/pow_winners.html*
• **Ken Tapping**'s weekly article, Skygazing, can be found at:
http://www.nrc-cnrc.gc.ca/eng/education/astronomy/tapping/index.html

. **NASA's Imagine the Universe**
This site is intended for middle and high school students, and for anyone interested in learning about our universe. Imagine the Universe lesson plans are available at this link
http://imagine.gsfc.nasa.gov/docs/teachers/lesson_plans.html

. **Star Child: A learning Center for Young Astronomers**
The information and activities found in StarChild can be used to engage, excite, and educate students in elementary school. It contains easy-to-understand information about the solar system, the Universe, and other "space stuff" as well as activities, movies, puzzles, etc. Each topic has a short quiz at the end. This site, written by middle school teachers, is a great educational resource with lots of fun! The StarChild site is a service of NASA and the Goddard Space Flight Center
http://starchild.gsfc.nasa.gov/docs/StarChild/StarChild.html
Teachers Center lesson plans
http://starchild.gsfc.nasa.gov/docs/StarChild/teachers/teachers.html

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Planetarium Program Evaluation

After the Fireball Planetarium has visited your class, please take a moment to fill out this evaluation. Your suggestions are very valuable to us!

Mail the completed evaluation to :.....
Fireball Planetarium
38 Pearson St.,Suite #117
St. John's, NL
A1A 3R1

Or Email To :.....gdymond@fireballplanetarium,ca

1. Show Name:
_____

2.Group grade/age
level:_____

3. Was the material presented at an appropriate level for your class?
_____
_____

4. Was the amount of material discussed: Enough __ Overwhelming __ Not Enough __

5. Should any parts of the presentation be developed further? _____. If so, which parts?

6. Was there sufficient time for questions and answers? Yes___ No __

7. Were you studying astronomy or another related subject at the time of the planetarium's visit?
Yes__ No__
If so, was the planetarium visit helpful?
_____

8. Was the Teacher's Guide helpful in preparing your class for the planetarium visit?
Yes__ No__

Which parts were most helpful?
_____
Which parts were least helpful?
_____

9. Did the presenter present the material in a clear and understandable fashion?
_____

10. How would you rate the overall program given to your class in the planetarium?
_____
_____
_____

11. (Optional) Your name &
school:_____

Please feel free to write any *further comments* on the back.

Thank you for your time! Your Comments Make a Difference