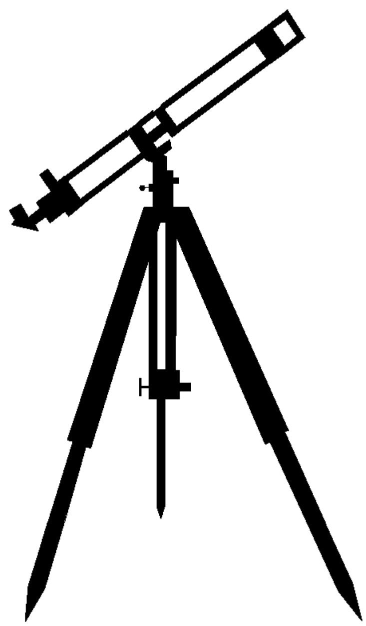
Universe Cycle

The Search for Our Beginnings

THIRD GRADE

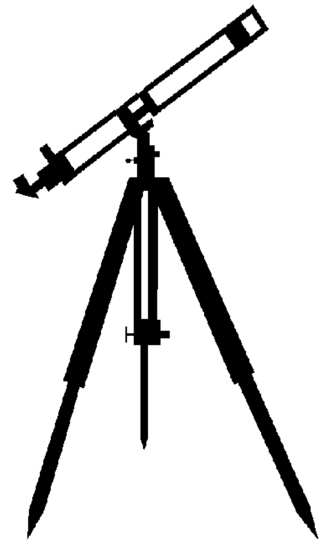
UNIVERSE



1 WEEK
LESSON PLANS AND
ACTIVITIES

UNIVERSE CYCLE

OVERVIEW OF THIRD GRADE



UNIVERSE

WEEK 1.
PRE: *Contrasting different components of the Universe.*
LAB: *Comparing and contrasting stars.*
POST: *Comparing relative and absolute brightness.*

SOLAR SYSTEM

WEEK 2.
PRE: *Distinguishing between revolution and rotation.*
LAB: *Discovering the terrestrial planets.*
POST: *Investigating the gas giants.*

EARTH

WEEK 3.
PRE: *Comparing lunar and solar eclipses.*
LAB: *Discovering how landforms are created on Earth.*
POST: *Exploring the reasons for seasons.*

GEOGRAPHY

WEEK 4.
PRE: *Describing different types of maps.*
LAB: *Exploring how to make a map.*
POST: *Comparing maps and globes.*

UNIVERSE CYCLE - UNIVERSE (3)

PRE LAB

Students observe a model of a comet throughout the day.

OBJECTIVES:

1. Contrasting different components of the Universe.
2. Comparing comets with stars.

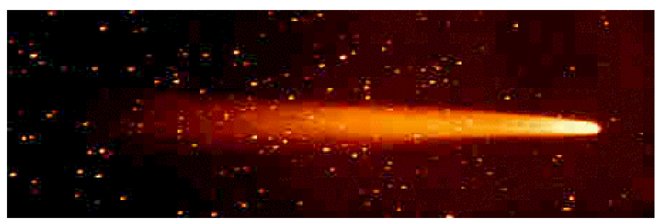
"Shooting stars" or meteorites

VOCABULARY:

comet
gravity
meteorite
shooting stars
Solar System
Universe

MATERIALS:

dry ice (buy at local ice company)
ammonia
corn syrup
bowl
plastic wrap
plastic gloves
soil
Internet



Halley's Comet

BACKGROUND:

The study of the Universe is still new and exciting to third grade students. They have been exposed to words like Universe and Solar System, but still might not know how they fit together.

The Universe was created over 15 billion years ago. The Big Bang theory is the most widely accepted explanation for the creation of the Universe. This theory states that Universe began with a tremendous explosion and expansion, which rapidly created matter and energy as we know them. Many details about the Big Bang have yet to be discovered.

The Universe is composed of objects that are "attracted" to each other by gravity. After the Big Bang, matter in the Universe was distributed irregularly. The areas where more matter was clumped together had higher gravitation attraction, which pulled the matter closer together. This process eventually formed stars, solar systems, and all the other components of the Universe. Galaxies, which are major clusters of stars, are a remnant of this original clumping of matter.

A fun way to begin the Universe Cycle is to make a model of a comet. Most comets reside in areas outside the Solar System proper. The comets that we see from Earth, orbit the Sun. Theoretically there should be other solar systems that have their own comets, but the only comets we can see are part of our Solar System.

The name “comet” comes from the Greek word for hair. It suggests an imagined resemblance between the tail of a comet and long hair streaming in the wind. Comets, many scientists think, are leftovers from the formation of the Solar System. The main part of a comet is its nucleus, which is composed of frozen gas, rocks, and sometimes small amounts of organic material (not biologically created, as far as we know). The ingredients in the comet recipe, dry ice, ammonia, water, corn syrup, and soil, simulate the real composition of comets.

When a comet is close to the Sun, solar radiation heats it up. The nucleus becomes surrounded by a glowing coma of vaporized gas. The solar wind blows parts of the coma away, forming the comet’s tail, which may be millions of kilometers in length. Comets are only visible to the naked eye when they have a coma and tail.

Students may confuse comets with "shooting stars". These are meteorites (rocks left over from the formation of the Solar System) that enter the Earth’s atmosphere and burn up leaving a trail of ionized gas behind. “Shooting stars” glow for a matter of seconds at most. Comets differ from meteorites in three ways. First, as above, they are “dirty snowballs”; they are composed of frozen gas and rock, and are much less dense than meteorites. Second, comets orbit the Sun, and rarely come close to the Earth, whereas shooting stars enter the Earth’s atmosphere. Third, comets may be visible in the sky for days to months as they orbit near the Sun.

PROCEDURE:

1. Make sure that students review what items are in the Universe. Quiz them on the meaning of the following words: stars, galaxy, planet, and nebula. It is important that by this grade that the students can distinguish that the Universe is the big picture, and that the Solar System is just a very small part of it.

2. Making a comet for the students gives them a fun introduction to the wonders of the Universe. You should make the comet in the morning so the students can see the “comet” change throughout the day. You may want to do this activity with all the third graders. If there is comet mixture left over, you can share with other grade levels.

3. We suggest that you mix the ingredients in front of students, so you can explain why you are putting them together. **Caution**: **Use Plastic Gloves when handling the dry ice**

Directions to make a comet:

1. Line mixing bowl with plastic wrap. Place 500 ml water in bowl.

2. Place 5 ml of soil, and stir well.
3. Add dash of ammonia and mix.
4. Add dash of corn syrup and mix.
5. Add 500 ml of crushed dry ice, and mix until mixture is almost frozen.

6. Lift the comet out of the bowl, using the plastic liner and shape it as you would a snowball. Make sure you have plastic or well insulated gloves to prevent burns.

This mixture will make a spooky mist. Do not let students touch the material, unless they have gloves on. In our experience, the students get very excited, so you may have to remind them to stay away from it.

4. Place the mixture in a tray and have the students observe the comet throughout the day. It may take up to 3 or 4 hours before the comet disappears. You may want to record the findings on the board. There will sometimes be little "pops" during the day. This is occurs when pockets of gas escape from the comet.

5. The Internet is full of wonderful information on the Universe. Below are a few sites that you might want the students to surf for information.

http://map.gsfc.nasa.gov/

A site from NASA that contains good scientific information on current research at the galaxy and universe level. Fundamental investigations on the large scale structure of the Universe, including the Big Bang and how galaxies may have formed.

http://oposite.stsci.edu/pubinfo/Anim.html

The Hubbles Space Telescope website, with animations of planets and galaxies. Links to the mother site, containing innumerable Hubble Space Telescope pictures.

http://www.damtp.cam.ac.uk/user/gr/public/

Cambridge Relativity of Cambridge University. Discusses Cosmology, Black Holes,Inflation, Cosmic stings, and more.... Good illustrations and graphics.

http://windows.ivv.nasa.gov/the_universe/AllStarTop.html

Pictures of stars and galaxies....all star line up.

http://www.nationalgeographic.com/features/97/stars/

“Star Journey” - a National Geographic site which includes star charts of the nighttime sky.

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

The Constellations and Their Stars - includes interactive sky charts and pictures of stars and galaxies.

UNIVERSE CYCLE - UNIVERSE (3)

LAB

Students study the stars using a celestial globe.

OBJECTIVES:

1. Exploring components of a galaxy.
2. Comparing and contrasting stars.

VOCABULARY:

absolute brightness
absolute magnitude
apparent brightness
apparent magnitude
helium
hydrogen
light
star

MATERIALS:

Inflatable Celestial Globe

BACKGROUND:

Stars are a fundamental component of galaxies. In the lower grades students learned a simple classification of objects in the Universe: those bodies in space that make light, and those that reflect light. A star is an object that makes light, because much energy released when hydrogen fuses, or "burns" to form helium.

There are many different types of stars. Stars are classified by their color, which corresponds to their temperature. Blue stars are extremely hot, 7,500° to over 25,000° Kelvin (273.16° Kelvin = 0° centigrade). White stars are cooler (6,000° - 7,500°K), yellow stars range from 5,000° to 6,000°K; orange stars range from is 3,500° to 5,000°K and red stars are less than 3,500°K.

When we look at stars in the night sky, we do not see them as they really appear, because they are at greatly varying distances from Earth. From Earth we see each star's relative brightness. For example, a dim nearby star might appear brighter and bigger than a faraway very bright star. In contrast, if the stars were all the same distance from Earth, we would see their absolute brightness. Bright stars would always look brighter than dim stars.

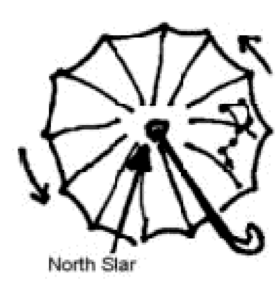
Astronomers call a star's brightness its magnitude. The brightness as we see it on Earth is termed apparent magnitude, while a star's actual light output is called absolute magnitude. For instance our Sun has an apparent magnitude of -26.8 (very bright) but an absolute of 4.8 (not bright). The derivation of these numbers is not important in the third grade. The main point is that from Earth, we see only the apparent brightness of the stars.

Astronomers group and name stars using their locations and brightness. We usually think of grouping stars in constellations, but these are artificial, historical associations which have little to do the real magnitude and locations of stars. The main stars in each constellation are labeled with a letter of the Greek alphabet, the brightest in the group is usually termed alpha. The rest of the Greek alphabet is usually used to label lesser brightness. Many stars are not even in constellations. These are named with numbers.

LETTERS OF THE GREEK ALPHABET					
α	alpha	ι	iota	ρ	rho
β	beta	κ	kappa	σ	sigma
γ	gamma	λ	lambda	τ	tau
δ	delta	μ	mu	υ	upsilon
ϵ	epsilon	ν	nu	ϕ	phi
ζ	zeta	ξ	xi	χ	chi
η	eta	ο	omicron	ψ	psi
θ	theta	π	pi	ω	omega

In this lab, students will use the inflatable celestial globes to find several constellations. This will help them develop a sense of star brightness and to learn how to locate stars in the sky. Many details on the globe are too difficult for this grade. The following information, however, is enough to allow the students to successfully use the globes.

The area where you blow air into the globe is the location of the North Star, commonly called Polaris. It was discovered early on that the night sky (only in the northern hemisphere) seems to revolve around at fixed northern point; the star closest to this location came to be called the North Star. Navigators used the North Star to guide ships and caravans while traveling at night. The height of the North Star above the horizon depends on the latitude at which you live. The North Star is 40° above the horizon for most of the continental United States.



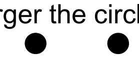
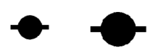
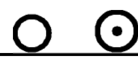
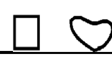
If your students have trouble understanding that we revolve around the North Star you can use an umbrella to illustrate this point. Open the umbrella and draw two constellations on it with a piece of chalk, or use glow-in-the dark stickers. Spin the umbrella. The spinning represents movement of the constellations around a central point which simulates the North Star.

The line labeled 0° on the globe is the celestial equator. This is a projection into space of the Earth's equator. The months of the year are written on the celestial equator. This indicates what celestial objects are visible each month. The northern part is for the northern hemisphere and the southern is for the people that live south of the equator. Remember they see stars at a different angle than the United States. For example, they do not see the North Star.

The 88 recognized constellations are enclosed within dotted lines on the celestial sphere. These constellations help astronomers create sectors, so they can locate other stars. Remember there are constellations that can only be seen in the northern hemisphere and only in the southern hemisphere.

PROCEDURE:

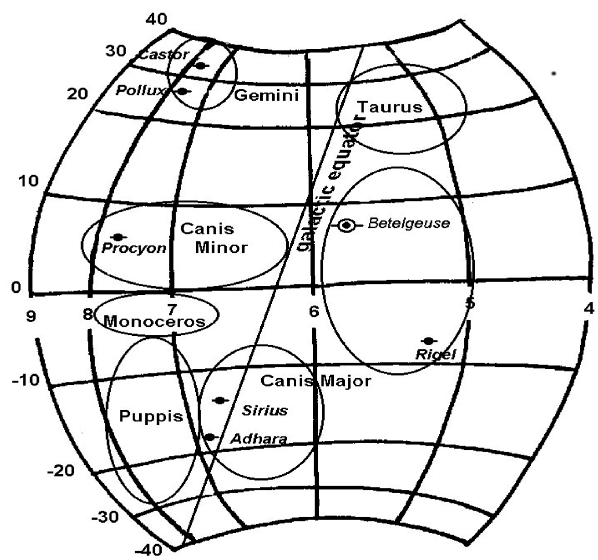
1. Give students a celestial globe. Point out the location of the North Star and the celestial equator (0°) to the students. Explain the different symbols on the celestial globe by using the information provided below.

magnitude	the larger the circle the brighter it appears to us on Earth 
double or multiple stars	
variable star	
open cluster	
globular cluster	
galaxy	
diffuse nebula	
planetary nebula	
letter and then numbers	galaxy names
east/west lines	represent the declination from the real equator
north/south lines	represent time during the year
dotted lines with names	boundaries of the constellations, total of 88
dotted lines without names	represent either galactic equator or ecliptic
Greek alphabet	helps identify a star, used like a first name
numbers	refer to stars

2. Students may ask how far away the stars are located. Explain that the distances are unimaginable. Astronomers invented their own unit to measure these distances called the light year. This is the distance a beam of light travels in one year, about 9.46 trillion kilometers.

3. Have the students look at the celestial globe to find the different star patterns and complete the worksheet. This exercise will take students a long time to complete individually, so you may want them to work in groups. The more the students look at the globe, the more it will make sense to them.

4. The illustration below shows the answers at which the students should arrive.



UNIVERSE CYCLE - UNIVERSE (3)LAB

PROBLEM: How you derive information from a celestial globe?
PREDICTION:____
MATERIALS: Inflatable Celestial Globe colored pencils

PROCEDURE:

1. Look at January and December (between the 4h and 9h) on your celestial globe (look at the Equator) and fill in the diagram below as you answer the questions on the next page. Use the Guide to the Celestial Globe to understand the symbols.

2. Draw and label the celestial equator in BLUE. Draw and label in the +10, +20, +30, +40, 0, -10, -20, -30, and -40 in pencil. Draw and label 4h, 5h, 6h, 7h, 8h and 9h.

3. The edge of the Milky Way Galaxy can be seen in the night sky as a belt across the skies. Color it in PURPLE. What is the Milky Way?
____
____
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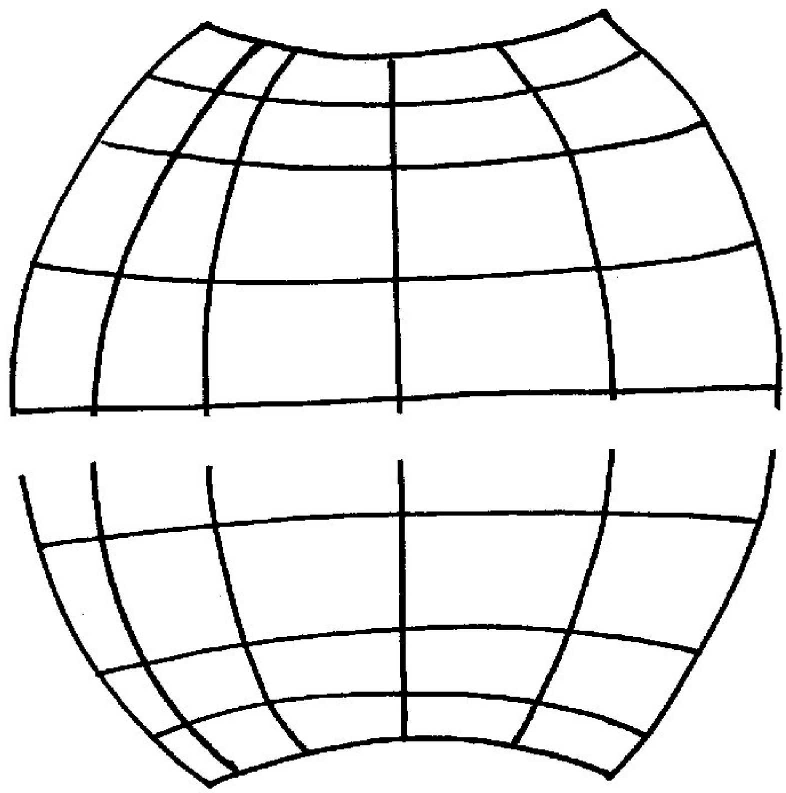
____
____
____



4. Find the following constellations, circle the general area, and label them on your diagram in ORANGE. Orion, Canis Minor, Canis Major, Puppis, Monoceros, Taurus, and Gemini. Make sure you include the major stars.

5. Find the Galactic Equator on the celestial globe and show it to your teacher.

6. Find the following stars and label them on your diagram in RED: Betelgeuse, Pollux, Adhara, Rigel, Sirius, Procyon, and Castor.

7. List 5 galaxies in this region.
____
____

CONCLUSION: What type of information can you derive from a celestial globe?
____

UNIVERSE CYCLE - UNIVERSE (3)

POST LAB

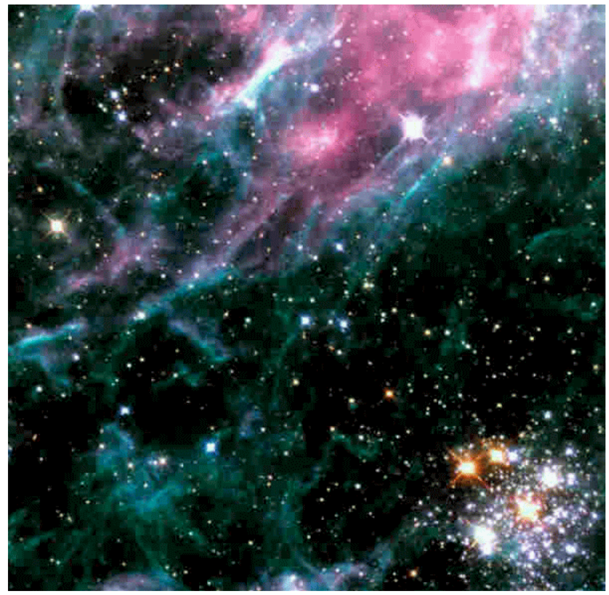
Students experiment with light.

OBJECTIVES:

1. Discovering how light moves.
2. Comparing absolute and relative brightness of stars.

VOCABULARY:

brightness
star



MATERIALS:

penlight flashlight
mirror

BACKGROUND:

Students have learned that stars emit light. Light, for all practical purposes, moves in a straight line in space, unless it hits an object and then the light is reflected from that object. Albert Einstein in his theory of relativity, state that light is "curved" by gravitational forces. This has been proven. For the purposes of this lab, light effectively travels in a straight line on a scale that humans can perceive.

Stars are different distances from the Earth. This means we see the relative brightness or magnitude of stars, not their real, or absolute magnitude. The light from stars travels to us in essentially straight lines. In contrast, within the Solar System, sunlight is also reflected from the surface of a moon, planet, or other objects. In this activity, students will experiment with absolute magnitudes, relative magnitudes, and reflection.

PROCEDURE:

1. Have the students work in pairs. Assign one student to hold the penlight. Have the second student gradually move away from the penlight, trying to find the distance at which the light appears significantly dimmer. Have them measure the distance in footsteps. If the students do this assignment as homework, have them record what kind of penlight they are using. This will allow for comparisons of different strengths of flashlights, which are analogous to the different magnitudes of stars.

2. Have the students devise an experiment with a flashlight that makes light" bend". Do not give the students too many hints, but suggest using a mirror or other reflective material. Discuss what groups did to make light bend.

3. Ask students the following after they finish the activities.

a. Are all stars the same distance from our planet? [Answer: No.]

b. How is apparent brightness different from real brightness? [Apparent is what we observe on Earth.]

4. Discuss the star classification chart with the students, so they realize that stars have different elements of color and temperature. This chart is not for students to memorize but to get a sense of the variety of stars. The absolute brightness data chart shows students that different stars like supergiants are very bright, emitting large amounts of light energy.

STAR CLASSIFICATION

	elements found	color	temperature range in centigrade	example
O	H, He,O,N	BLUE	40,000-25,000	Zeta Puppis
B	He, H	BLUE	25,000-11,000	Spica Regulus Rigel
A	H, Ca, metals	BLUE-WHITE	11,000-7,500	Vega Sirius Daneb
F	Ca, metals, Fe	WHITE	7,500-6,000	Canopus Procyon Polaris
G	Fe, Ca	YELLOW-WHITE	6,000-5,000	Sun Alpha Centauri
K	H	ORANGE	5,000-3,500	Arcturus
M	TiO	RED	3,500-3,000	faint stars
N,R,S,I (unknown)	TiO	not visible	1,000 (?)	unknown

ABSOLUTE BRIGHTNESS (LUMINOSITY)	
I	supergiant
II	bright giant
III	giant
IV	subgiant
V	main sequence (like our Sun)
VI	subdwarf
VII	white dwarf