

Home School Series: 6 & Up

December: Astronomy

Start Up: Astronomy related posters, pictures, & models
(5-10 min) Have students make the **Pocket Guide to the Universe** (*Ranger Rick*) as they arrive.

Welcome/ Staff/Volunteer Names
Introduction: **Today's Topic-Astronomy**
1 min. **Question: How does study of the stars and planets relate to nature?**

Opener: **Human Solar System (Astro-Drama, Sanborn)-**
10min. Various students take on the roles of the different planets in our solar system. Place them in order to scale for a visual representation of distances between our nearest planetary bodies (1' = 36 million miles). See below.

Background/ Ask the students to name some astronomic cycles and events.
Exploration: Do these events affect us? The environment?
45 min. We study Astronomy to learn about the seasons & cycles of nature. The shortening days in winter, the ocean's tides, the colors of the sunset are all affected by the planets and sun.

Why Winter? (Caduto)-Describe how the tilt of the Earth gives us the seasons as it travels its annual orbit.

Using a globe or poster of the earth, briefly show students how the sun's rays hit our part of the earth more directly in the spring/summer, and indirectly in the fall/winter. Explain how the abundance, then lack, of solar energy due to the tilt of the Earth's axis causes a change in seasons every year.

Explain the **Solstices** (summer/winter) and **Equinoxes** (spring/fall).

Astronomy basics-Ask the students to question each other and answer using the pocket guides students have made.

Activity: **Moon Walker** (Caduto)-Help students understand the phases of the moon and the distance to it by modeling its orbit around the earth.
15 min.

- ♣ Students sit in the center of the area by "Earth" on a post.
- ♣ Walk around the center with the moon on a string, letting it rotate as it travels.
- ♣ Help the students understand how the moon's rotation and orbit create its phases.

Activity: **Crater formation**-Let students take turns dropping different sizes and weights of marbles and balls into a container of sand or mud.
5 min. Study the shapes of the mini-craters that form. Share a picture of the Moon's surface and its craters.

Prepare to Restroom break.
go Outside: Bring: Water bottles, hats, jackets
5 min. **Trail Rules** (see The First Program).
What we will do-Learn about telescopes and look through one.

OUTDOOR EXPLORATION: We can observe and learn much about astronomy without a telescope, but it is useful to know what the instrument can help you see.
1 hour, 30 min. Explain the parts of a telescope and the basics of how it works.
Help students take turns practicing using it for faraway objects on land.

Activity: Look at the sun indirectly through a telescope with a sun-viewing attachment.
10 min. Look also at the moon and its craters if it is visible.

Game: Play **Asteroid Belt** (Sanborn)-
15 min. Set up a rectangular playing field.
♣ Ask students to stand randomly within the area. They are the asteroids.
♣ A blindfolded student is the spaceship trying to guide itself through the field of asteroids.
♣ The nearby asteroids must “beep” as the ship’s radar detects them (student gets close).
♣ If the student successfully navigates the asteroids, a new pilot is chosen.
♣ If an asteroid is hit, that student becomes the new pilot.
♣ Several pilots can fly simultaneously in a larger group.

Take a hike in the area to see what changes have occurred since the last program.

Send Off: Goodbye!
Next Month-Restoration Ecology

Take Home: Parent outline
Background

Vocabulary

Astronomy, planet, star, eclipse, solstice, equinox, zenith, meridian, ecliptic, orbit, ocular, universe, solar system, tide, crater, asteroid

Background and Activity References for Naturalists and Parents

- Caduto, M. J., and J. Bruchac. 1989. *Keepers of the Earth: Native American Stories and Environmental Activities for Children*. Fulcrum, Inc. Golden, CO.
Pp. 111-134 Sky information and activities; p. 114 Moonwalker
- Milord, Susan. 1989. *The Kid's Nature Book*. Williamson Publishing, Charlotte, VT.
P. 35 Moon flip book craft
- Project Bluestem: A Curriculum on Prairies and Savannas*. 1995. Walnut Creek National Wildlife Refuge and Prairie Learning Center. Pp. 150-152 Shooting the Moon-moon surface map
- Ranger Rick's Naturescope: Astronomy Adventures*. 1986. National Wildlife Federation, Washington, D.C.
Background, activities; Pp. 16-17 Pocket Guide to the Universe; p. 25, 32-33 Astro-Match
- Sanborn, Jane. 1984. *Bag of Tricks: 180 Great Games*. Search Publications, Florissant, CO.
P. 27 Asteroid Belt; p. Astro drama
- Whitney, Charles A. 1977. *Whitney's Star Finder*. Alfred A. Knopf, NY.
Star finder, good basic info.
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Extensions/Alternate Activities/Rainy Day

Ask an astronomy expert to visit the session to talk to students about career opportunities or current events.

Discuss other astronomy topics as time allows (see notes below).

Astro-Match (*Ranger Rick*)-Learn about the planets and their characteristics by filling in a chart as a group.

Discuss the difference between **astronomy** (observation and study of celestial bodies, the oldest science) and **astrology** (predicting the future by studying the position of the stars). Mention some famous astronomical artifacts aligned with celestial bodies-Stonehenge, Cahokia, Egyptian pyramids...

Explain and discuss eclipses of the sun and moon.

Hold a night session to view the moon, stars, etc. Use star finders to identify constellations.

Supplies:	100'+ measuring tape	Moon Walker-
	Blindfolds for Asteroid Belt	Ball for Earth
	Astronomy posters	Ball for Moon
	Astronomy pictures (moon surface)	Post
	Planet models	21' string
	Globe	String to tie moon
	Flashlight	Pencil
	Marbles, small balls of different sizes	

Advance Copy the Pocket Guide to the Universe.

Preparation:

Moon Walker-Paint $\frac{1}{2}$ the moon ball black. Stick a dowel or pencil through it. Tie string to the pencil above and below the moon to attach the long string to. Attach the Earth to the post, and the other end of the string.

Prepare a tub of sand for crater making.

Astro-Drama distances:

One student stands at one end of the activity area to represent the sun.

Mercury stands 1' from the sun.

Venus stands 2' from the sun.

Earth stands 2-1/2' from the sun.

Mars stands 4' from the sun.

Jupiter stands 13-1/2' from the sun.

Saturn stands 25' from the sun.

Uranus stands 50' from the sun.

Neptune stands 80' from the sun.

Pluto stands 120' from the sun.

On this scale (1' = 36 million miles), the closest star (Alpha Centauri) would stand 150 MILES away...

Astronomy Background Notes:

Moon

400X smaller than the Sun

No air pressure due to weak gravity; no air = no sound waves (can't hear someone yelling).

Only reflects sunlight, doesn't generate its own light. Surface doesn't change -no water/weather.

Craters (pits), Mares (flat plains), Mountains, and Rilles (~river like shapes) can be seen on the Moon's surface. Craters were formed from meteor collisions, features do not erode. Mares (~seas) may have formed from lava filling in large craters.

High temp. = 212°F; low temp. = -200°F

Orbit is 27 days, 7 hrs, 27 min.

29 1/2 days from one new moon to the next

Full moon occurs at halfway point during lunar month-when Sun is shining directly on it

The Earth's shadow gets in the way other times -1/2, quarter moons

Tides-higher at new and full moons; lower at quarter moons

The gravitational pull of the Sun, the Earth's rotation, and land features also influence tides

Rainfall peaks 20% more during a full moon; better to plan trips during quarter moons

Phases = D O C

D-Waxing/enlarging

O-Full

C-Waning/decreasing

Moon origins theories

Spun off from earth-Pacific Ocean

Formed when Earth was formed-stayed separate

Moon as a captured planet

Lunar Calendar

Used in agricultural communities

Farmer's Almanac

Plant potatoes during new moon before Easter

Used to set dates like Easter

Effects on animals-aquatic creatures spawn at full moon; growth and eating peaks at new & full moons

People-Moon affects our instinctual behavior/autonomic nervous system.

Biochemically imbalanced-Manic depression, dementia, alzheimer's patients worse at new/full moons.

Instinctual behavior can overcome rational control in people w/problems.

Some get more aggressive, like alcoholics/drug addicts; nursing homes have difficulties.

More police calls during full moons-arson, personal crimes hospital admissions, fights at sporting events

Migranes-Can occur more often during a full moon

We are conditioned to control our behavior, and living in air conditioning/inside dulls our sense of nature's cycles and seasons, so we aren't as affected as we might be.

We often respond to the full moon whether we're aware of it or not

Human gestation period is 9 lunar months.

You can chart your reactions by recording moon phases

Some think the body is better at healing & absorption during waxing moon.

Should detoxify/flush out during waning moon (smoking cessation easier).

Some begin new projects with the new moon (increasing)

Decrease (bad habits, pests) during full or last quarter phase

Lunar Eclipse

Moon is covered by round shadow of the Earth as it passes directly between the Sun and the Moon

Solar Eclipse

Sun is obscured by a round shadow of the moon as it passes between the Sun and the Earth

Zenith-the highest point in the sky, directly overhead

Meridian-imaginary line running from North to South through the zenith

Ecliptic-path of the Sun through a band of 12 constellations during the year (Zodiac)

Our **Galaxy**, the Milky Way, is a spiral galaxy. There are over 100 billion stars, planets, and other objects in the Milky way. Our solar system is 30,000 light years from the center of our galaxy. All the stars we can see are from our galaxy.

Stars

Large balls of gas under pressure in space which produce heat (in millions of degrees) and light from nuclear fusion, which travels a long way (sunlight).

Relative star brightness as we see it is called magnitude. Brighter stars have a lower magnitude.

Magnitude 1 means 2.5X brighter than magnitude 2. Extremely bright objects have negative magnitude.

Stars are born in nebulae, vast clouds of gas, and can look white, yellow, or reddish.

Groups of stars that look like certain shapes are called constellations.

There are 88 constellations, 41 of which we see.

The best known is Ursa Major (Great Bear), which contains the Big Dipper (looks like a saddle).

The Big Dipper was known as the drinking gourd to African American slaves.

The Big Dipper and certain other constellations move around the North Star as the other stars travel across the sky each night-Ursa Minor, Draco (Dragon), Cassiopeia (the Queen), Cepheus (the King). These are called circumpolar constellations.

Other constellations are more visible at certain times of the year, like Orion (Hunter) in the fall.

There are stories about many of the constellations dating back to ancient times that relate to Greek and Roman mythology. Native Americans and other cultures each have their own set of star stories.

Solar System

The Sun, nine planets and their moons, plus comets and asteroids orbiting the sun make our solar system.

Sun

A star 93,000,000 miles from the Earth, it is a fiery ball undergoing a continuous nuclear reaction which releases heat and light. Hydrogen converts into Helium during this reaction. Temperature is 10,000 F.

Corona-The large hot atmosphere around the sun, which extends hundreds of thousands of miles into space.

It has low density and a very hot temperature (almost 4,000,000 F)

Sunlight travels for 8 min., 20 sec. before it gets to Earth.

The sun is 850,000 miles in diameter, which is 107X larger than the Earth. It is a medium star.

Alpha Centauri is the the next closest star at is four light years away.

Planets

Planets can be seen to move in relation to the stars and each other. They shine, but don't twinkle like stars.

Planets show as discs in a telescope, stars as points.

The word Planet is Greek for "a wanderer". Planets travel around a star in an orbit held by gravity.

Mercury, the smallest planet, is only 1,000 miles in diameter larger than the moon.

Meteors

"Shooting Stars" or "Falling Stars". Solid particles or space objects pulled into Earth's gravity.

They leave a brief glowing streak as they burn up on entry into the atmosphere. (make a wish!)
