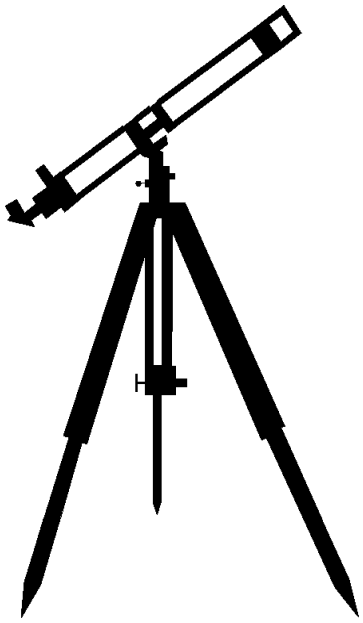
Universe Cycle

The Search for Our Beginnings

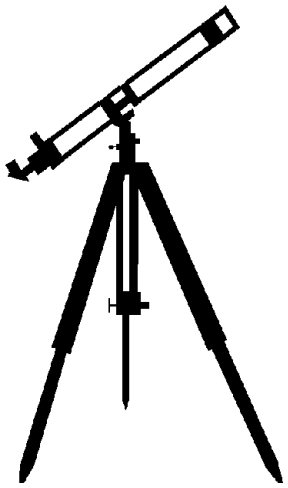
SECOND GRADE

SOLAR SYSTEM



1 WEEK
LESSON PLANS AND
ACTIVITIES

UNIVERSE CYCLE
OVERVIEW OF SECOND GRADE



UNIVERSE

WEEK 1.
PRE: *Discovering stars.*
LAB: *Analyzing the geometric pattern of constellations.*
POST: *Exploring myths about the constellations.*

SOLAR SYSTEM

WEEK 2.
PRE: *Comparing the 9 planets of our Solar System.*
LAB: *Comparing the distance between planets.*
POST: *Exploring terrestrial and gas planets.*

EARTH

WEEK 3.
PRE: *Comparing the Earth and the Moon.*
LAB: *Exploring the characteristics of the Earth's surface.*
POST: *Exploring the features of the Moon.*

GEOGRAPHY

WEEK 4.
PRE: *Contrasting different types of maps.*
LAB: *Exploring longitude and latitude.*
POST: *Comparing maps and globes.*

UNIVERSE CYCLE - SOLAR SYSTEM (2)

PRE LAB

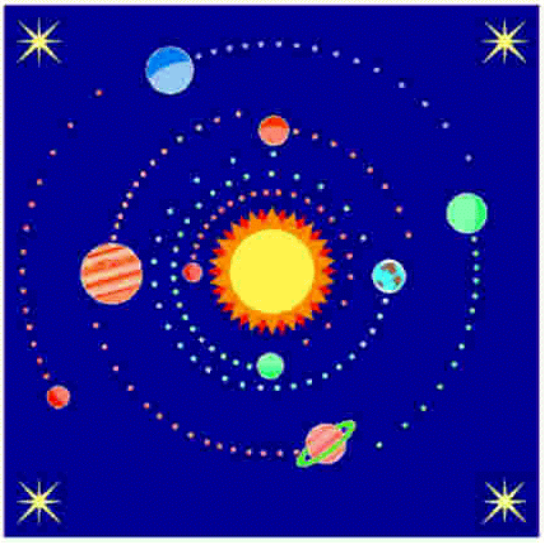
Creating silly sentence to remember the planets.

OBJECTIVE:

1. Comparing the nine planets of our Solar System.
2. Developing a method to remember the order of planets.

VOCABULARY:

atmosphere
orbit
revolution
rotation
satellite



MATERIALS:

worksheet
Solar System Placemats

BACKGROUND:

The planets are a wonderful example of how scientists slowly accumulate new information and make new conclusions. With each new space probe, much is learned about the planets. We really do not know all there is about the planets. As your students grow, they should be accustomed to the changing of planetary information.

There is more to learn about the planets than just their position and name. The following paragraphs give detailed information about each planet. You may wish to share some of these key characteristics with students. Constantly repeating and questioning students, will help them retain planetary information.

Mercury is the closest planet to the Sun. It orbits the Sun quickly, once every 88 days. It rotates slowly, however, only once every 59 days. Mercury is small, about 4850 kilometers (~3000 miles) in diameter. Because Mercury is so close to the Sun, the side of its surface that faces the Sun is very hot, ~700^{o}K. The surface of Mercury is gray to orange in color, and is covered with craters. Mercury is named for a mythical god who ran very fast.

Venus, the second planet away from the Sun, is Earth's closest neighbor. It is about the same size as the Earth, a little over 12,000 kilometers (7300 miles) in diameter. Venus has a very thick atmosphere, composed largely of sulphuric acid and CO_2. We could not breathe on Venus, because the atmosphere would be very toxic to humans. This atmosphere gives Venus a brownish-yellow color. It also traps heat (the greenhouse

effect) making the surface of Venus the hottest in the Solar System, about 750^{o}K. Venus rotates very slowly, taking 243 days to complete one turn. It is named for the Roman goddess of love.

Earth is a little more than 12,000 kilometers in diameter. It differs from the other planets because it has liquid water on its surface, maintains life, and has active plate movement. It rotates on its axis every 24 hours (a day) and revolves around the Sun every 365 days (a year). The Earth has one moon.

Mars is a little more than half the size of the Earth, having a diameter of 6,790 kilometers. It takes Mars 687 days to revolve once around the Sun. It rotates at about the same speed as the Earth, taking 24.6 hours. Mars has a very thin atmosphere which is composed largely of CO_2. Its surface is very cold, and is covered with craters, volcanoes, and large canyons. Mars is reddish in color. Mars has two small moons. It is named for the Roman god of war.

Jupiter is the largest planet in the Solar System, with a diameter of 142,980 kilometers, more than 11 times wider than the Earth. Jupiter orbits the Sun once every 12 years. It rotates very fast, in only 10 hours. Its surface is made up of gas (mostly hydrogen), so that if you landed on the surface you would sink into it. Jupiter probably has a core of metallic hydrogen and rock, although evidence for this is theoretical. The outer gaseous part of Jupiter is broken into bands of white, yellow, red, and brown clouds. Huge oval-shaped storms also occur on the surface. Jupiter has at least 16 moons. Jupiter is named for the Roman supreme god of heaven.

Saturn is well known for its system of three rings. It is a large planet: at 120,536 kilometers it is only a little smaller than Jupiter. It revolves around the Sun in 12 years, and rotates a little more than 10 hours. Like Jupiter, Saturn is composed of mostly gas, and has a core composed of rock and metallic hydrogen. The surface of Saturn looks banded, and has a brown-yellow, butterscotch color. Saturn's rings are probably composed of small particles of ice and rock. Saturn has at least 20 moons. It is named for the Roman god of agriculture.

Uranus is 51,118 kilometers in diameter, about 4.4 times the size of the Earth. It revolves around the Sun slowly, taking 84 years to complete one orbit. It rotates in about 17 hours. It is covered by a thick layer of gas, and has a fairly uniform blue-green color. Uranus has both at least 15 satellites, and is surrounded by a system of nine rings. It is named for another Roman god, the grandfather of Jupiter

Neptune is slightly smaller than Uranus, with a diameter of 49,500 kilometers. It circles the Sun once every 165 years, and rotates in 16 hours. Its atmosphere appears blue , and is marked by large dark blue storm systems. It is surrounded by a system of five rings and at least 8 moons. Neptune is named for the Roman god of the ocean.

Pluto is the most distant planet from the Sun. It has an eccentric, oval-shaped orbit, which is tilted with respect to the rest of the Solar System. Pluto revolves around the Sun in 248 years, and rotates in a period of 6.4 days. Pluto is probably composed of rock. Its surface and color are unknown. It has one large moon. Pluto is named for the Roman god of outer darkness.

PROCEDURE:

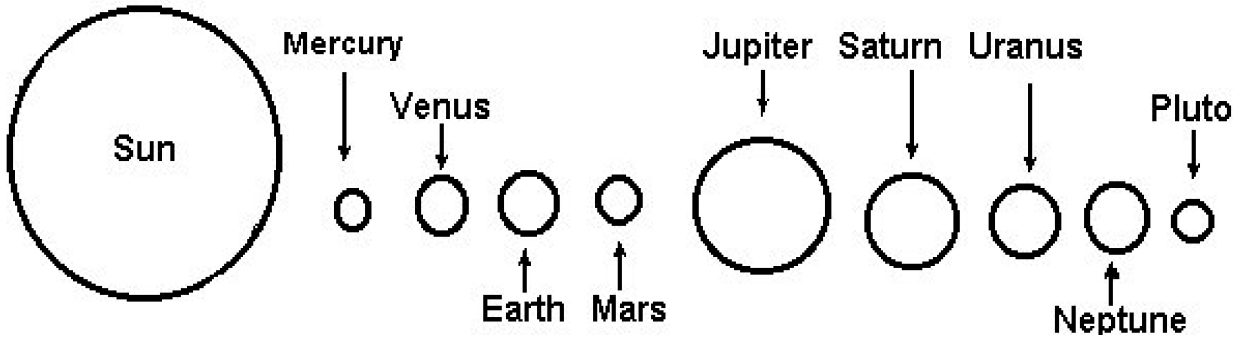
1. Instruct the students to memorize the names and positions of the planets. To make this easier, teach them a mnemonic device. Creating a silly sentence using the first letter of the planets that you are trying to remember is very helpful to children. For example “MY VERY EARTHLY MOTHER JUST SERVED US NEW PICKLES” helps students remember that the order of the planets. The lab sheet has students make their own silly sentences.

2. Discuss the different planets, and have your students develop a way of distinguishing the planets from each other. Use the key characteristics listed in the Background information. If you have pictures of the planets, hang them around the room. Remember, you are just exposing the students to the different planets and emphasizing the need to compare and contrast their key characteristics.

UNIVERSE CYCLE - SOLAR SYSTEM (2) PRE LAB

HOW CAN YOU REMEMBER THE ORDER OF THE PLANETS?

USE A MEMORY DEVICE. MAKE A "SILLY" SENTENCE, USING THE FIRST LETTER OF EACH PLANET.



M _____
V _____
E _____
M _____
J _____
S _____
U _____
N _____
P _____

UNIVERSE CYCLE - SOLAR SYSTEM (2)

LAB

Students compete to measure the distances of the planets from each

OBJECTIVE:

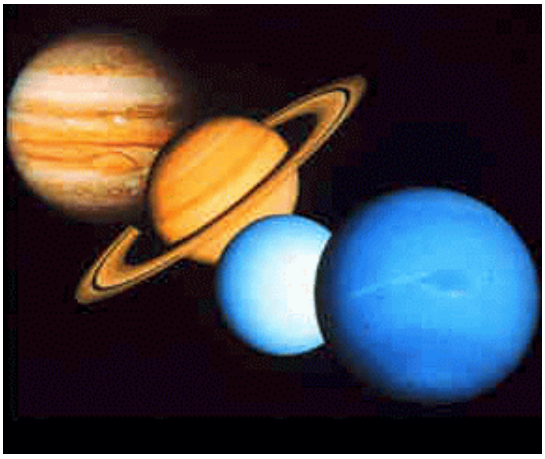
1. Demonstrating how far the planets are from each other.
2. Comparing the distance between planets.

VOCABULARY:

distance
planet
position

MATERIALS:

Meter tapes
chalk
Planet names



Gas planets

BACKGROUND:

The planets revolve around the Sun, forming the Solar System. The orbits of all the planets are elliptical in shape, although on the scale of the Solar System they may seem circular. Measuring the distances from the Sun to the various planets was not an easy task. For early astronomers, this required making may difficult, often inaccurate observations through the Earth's atmosphere. Today, using very sensitive ground- and space-based equipment we can measure these distances more precisely.

An accurate portrayal of the Solar System shows that the orbits of the planets are spaced further apart as distance from the Sun increases. For example, the orbits of Saturn and Neptune are further apart than the Earth and Venus. This observation was well known by the eighteenth century.

Bode's Law gives a simple method for remembering the relative distances of the planets from the Sun. Bode's Law is not a real physical law; it does not represent a real physical property of the Solar System. It just approximates the distances to the planets. This "law" gives the distance form the Sun to the planets when the numbers 0, 3, 6, 12, 24, etc., (doubling the previous number) are each added to 4, and the result is divided by 10. The results of this sequence are shown in the table on the next page. Note that Bode's Law only works when the asteroid belt is included as a "planet" (current evidence suggests that no planet ever existed in the asteroid belt). One unit on the chart is equal to the distance from the Sun to the Earth. You will use these relative units in the Exercise below with the students.

Planet	Distance from the Sun, via Bode's Law
Mercury	**0.4**
Venus	**0.7**
Earth	**1.0**
Mars	**1.6**
asteroid belt	**2.8**
Jupiter	**5.2**
Saturn	**10.0**
Uranus	**19.6**
Neptune	**38.8**
Pluto	**77.2**

In the lab, the students will measure these distances as meters e.g., "Venus" will be 0.7 meters, or 70 centimeters, from the Sun. Before the lab, we recommend that you use string to measure the correct distances. This can easily be laid out to see which student group has the correct answers.

PROCEDURE:

1. This lab is a game that demonstrates to the students how far the planets are from one another by making them think about placement of the planets (aka "students"). The object of the game is for the students to put themselves at the correct planetary order, but to also space themselves at the measurements that you give them. Eventually there should be a shape of a planet on a stick for each of the students (3 of each planet).

2. This lab works best outdoors. Divide the class into groups of eleven or more. Explain the lab to the students. Tell them that their groups will compete to see who can "measure" the relative distances of the planets from the Sun. Each student in the group will have a specific job. Nine of the students will be the planets. One student will measure, using the distances on the worksheet, and place the planets at the correct distances from the Sun. The remaining students should record the information and double check the measurements. Have the students meet before they go outside. They should decide which student will be each planet, and write the information on their worksheets. The designated students should then make a card with the name of their planet on it. This will make it clear to you which planet that person is representing.

3. Prevent cheating by having the groups start at 90 degrees from each other. Place an object to indicate the Sun in the center. You may want to make a round spot on the playground ground. This will make it easier to see which team is correct.

4. Go over how to measure with a tape measure. Emphasize that the students must cooperate, because they have to keep count of how far away they are from each other. Some students may realize that if they mark the ground off in meters using a piece of chalk and the tape measure they will complete the activity quickly. You may want to give them this technique as a hint if they get frustrated or confused.

5. After the groups finish the activity, check their results. The winner is the group that is finished first correctly. When all the groups have been measured, return to the classroom and have the students complete the remainder of the worksheet.

6. Some students may see that there seems to be some relationship between the distances. Do not try to explain Bode's Law to the students, but acknowledge that they are observing a real relationship. If the students do not see a relationship, that is fine. The objective of the lab is just to experience the distances and to think about it. There are no right or wrong answers when you ask a student to "think."

UNIVERSE CYCLE - SOLAR SYSTEM (2) LAB

PROBLEM: Is there any order to the distances of the planets from the Sun?

PREDICTION:_____

MATERIALS: paper to write name of planet on, crayons, metric measuring tape, chalk
PROCEDURE: Your teacher will divide you into teams of 11 or more. Have nine people each be a planet. Record their names on the chart. They should also write the name of their planet on a piece of paper.

The other team members will put the planet students in the correct order, from closest to furthest from the Sun, using the chart below. They will then put them at the right distance from the Sun, using the numbers below. Use the tape measure to find the right distance.

The team is complete when it has assigned all the planets and the planets are in their correct positions and distances. When you are finished your teacher will check your arrangement. The first team to correctly place the planets in the correct position is the winner.

planet	name of person	distance from Sun relative
MERCURY		30 cm
VENUS		50 cm
EARTH		75 cm
MARS		1.5 meters
JUPITER		3.85 meters
SATURN		7.2 meters
URANUS		14.4 meters
NEPTUNE		22.5 meters
PLUTO		29.5 meters

CONCLUSION: Do you see any relationship between the distances between the planets as you move away from the Sun?. Discuss the answers with your classmates.

_____
_____
_____

UNIVERSE CYCLE - SOLAR SYSTEM (2)

POST LAB

Students compare the gas and terrestrial planets on a data chart.

OBJECTIVE:

1. Discovering the planets.
2. Exploring terrestrial and the gas planets.

VOCABULARY:

gas giants
moon
planet
ring
terrestrial

MATERIALS:

worksheets
crayons
Solar System Placemats

BACKGROUND:

Students should recognize that information on almost any aspect of astronomy is subject to change. Information on the planets will change as new space probes visit the planets.

This activity will emphasize that the planets fall into two compositional groups: the terrestrial (rock-like) planets (Mercury, Venus, Earth, Mars, and Pluto) and the gas planets (Jupiter, Saturn, Uranus, and Neptune). The background information in the Pre Lab exercise give many details on the composition and features of the planets. You may wish to review this before doing the Post Lab.

PROCEDURE:

1. In order for students to fill in the data sheets you may want to create stations around the classroom that will help the students learn about each planet. For instance, for Jupiter, you may want to make a station that says “Jupiter” and have 16 small gum balls (or any other object) to represent the moons of Jupiter. This way, as the students fill in the data chart they will have some information to guide them.

Before the students begin working, go over each type of information they are to gather. A planet has a hydrosphere if it has surface water. An atmosphere is the layer of

gas that surrounds a planet's surface. Quakes are movements of the planet's surface. Volcanoes on the surface may indicate shaking and quakes. Rings are bands of rock and frozen gas that surround a planet, usually above its equator. Moon means the planet has satellites revolving around it. Life means organisms exist on the planet, like we have on Earth.

2. At each station, have the students color in the picture of each planet. You may want to give them the following hints to help them pick the correct colors.

MERCURY - picture of fast runner (travels the quickest around the Sun); rock (terrestrial)

VENUS - flames (hottest planet); cotton balls (shrouded in clouds); rock (terrestrial)

EARTH - plants (life on planet); glass of water (only planet with water); rock (terrestrial)

MARS - red soil (gives reddish color); rock (terrestrial)

JUPITER - red eye (spot on Jupiter); gas balloon (gas planet); ring

SATURN - rings; gas balloon (gas planet)

URANUS - color green (appears green); gas balloon (gas planet)

NEPTUNE - color blue (blue planet); gas balloon (gas planet)

PLUTO - rock (terrestrial); ice cube (coldness of planet)

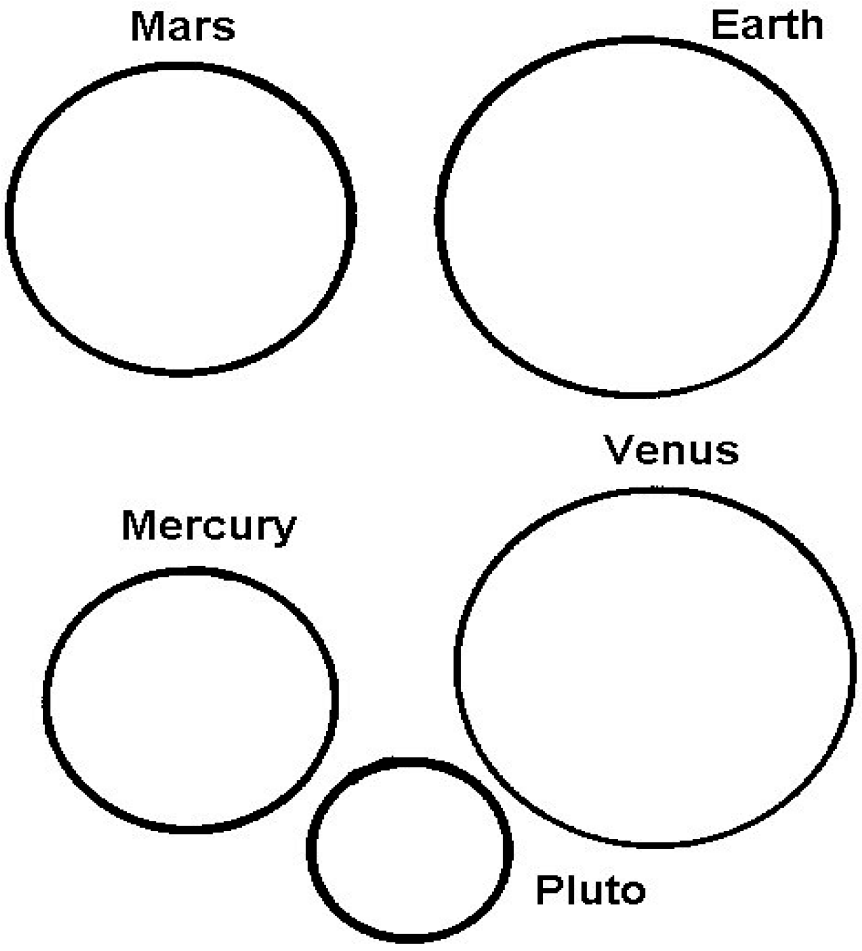
	Mer.	Ven.	Ear.	Mars	Jup.	Sat.	Ura.	Nep.	Plu.
hydrosphere	no	no	yes	no	no	no	no	no	no
quakes	no	no	yes	yes	no	no	no	no	no
atmosphere	no	yes	yes	yes	yes	yes	yes	yes	yes
rings	0	0	0	0	1	7	10	4	0
moons	no	no	1	2	16	20	15	8	1
life	no	no	yes	no	no	no	no	no	no

UNIVERSE CYCLE - SOLAR SYSTEM (2)

POST LAB

TERRESTRIAL PLANETS

	Mercury	Venus	Earth	Mars	Pluto
hydrosphere					
quakes					
atmosphere					
rings					
moons					
life					



UNIVERSE CYCLE - SOLAR SYSTEM (2) POST

GAS GIANTS

	Jupiter	Saturn	Uranus	Neptune
hydrosphere				
quakes				
atmosphere				
rings				
moons				
life