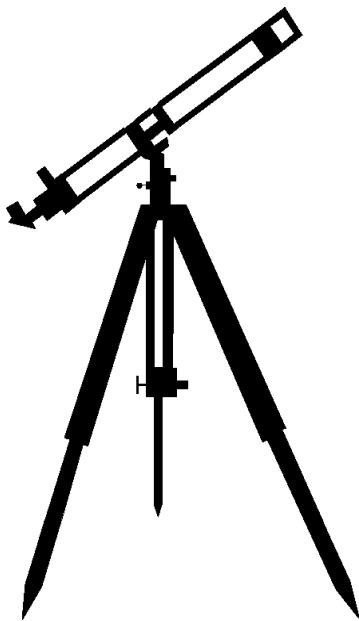




Universe Cycle
The Search for Our Beginnings



FIFTH GRADE **SOLAR SYSTEM**



1 WEEK
LESSON PLANS AND
ACTIVITIES

UNIVERSE CYCLE OVERVIEW OF FIFTH GRADE

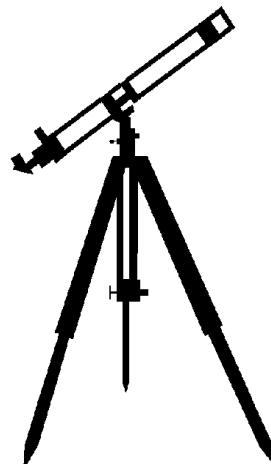
UNIVERSE

WEEK 1.

PRE: *Comparing components of the Universe.*

LAB: *Exploring how the Universe may have formed.*

POST: *Comparing constellation charts with celestial globes.*



SOLAR SYSTEM

WEEK 2.

PRE: *Comparing and contrasting the features of the planets.*

LAB: *Comparing meteorites to Earth rocks.*

POST: *Discovering the atmosphere on different planets.*

EARTH

WEEK 3.

PRE: *Exploring how planets are formed.*

LAB: *Comparing landforms of the Moon, Mars, and Earth.*

POST: *Discovering influence of ice, rain, and wind.*

GEOGRAPHY

WEEK 4.

PRE: *Exploring how topographic maps are made.*

LAB: *Comparing and contrasting topographic maps.*

POST: *Understanding topographic maps.*

UNIVERSE CYCLE - SOLAR SYSTEM (5)

PRE LAB

OBJECTIVES:

Students search the Internet to obtain new information on the Solar System.

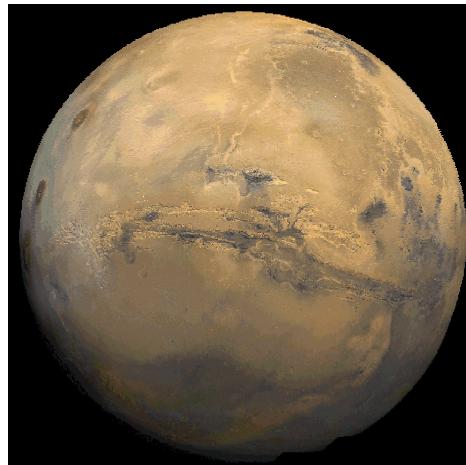
1. Examining the planets.
2. Comparing and contrasting the features of the planets.

VOCABULARY:

gas giant
planet
terrestrial

MATERIALS:

worksheet
Solar System Placemat
Internet



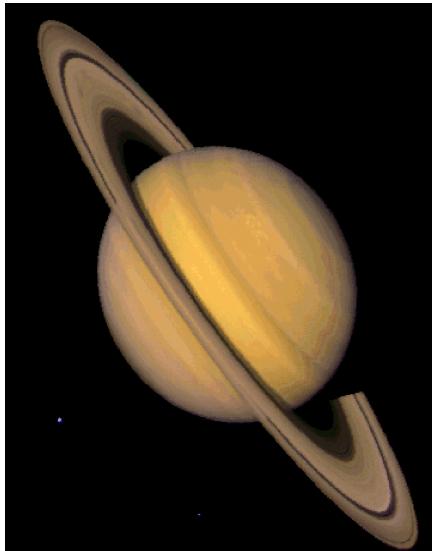
Mars, a terrestrial planet

BACKGROUND:

The Sun, the planets, and countless minor objects such as asteroids and comets make up the Solar System. The Solar System is dynamic, always moving. Almost all of its components revolve around the Sun, held in orbit by immense gravitational attraction of the Sun. All of the planets, and many smaller objects also rotate, or spin on an axis.

The planets can be divided into two groups. Mercury, Venus, Earth and Mars form the terrestrial planets. They are small and are composed of rock and metal, like the Earth. Jupiter, Saturn, Uranus, and Neptune are grouped as the Jovian or gas giant planets, because of their large sizes and gas-rich compositions. There is most likely a solid core in the gas giants, but this has not been confirmed. Planetary scientists know too little about Pluto to include it in either group. It is probably a terrestrial-like planet.

In the last decade, a wealth of new information on each of the planets has become available. The table on the next page summarizes several characteristics of each planet. Note that the temperature given for Venus is a direct measurement from a Russian spaceship for daytime. For Jupiter, Saturn, Uranus, and Neptune, the temperatures are averages.



Saturn, a gas giant

PLANET	diameter (km)	length of day	length of year	lowest surface temp C°	highest surface temp C°
MERCURY	4,880	59 days	88 days	-170	+400
VENUS	12,100	243 days	224.7 days	?	+480
EARTH	12,740	24 hours	365.25 days	-53	+50
MARS	6,794	24.5 hours	687 days	-143	+17
JUPITER	143,200	10 hours	11.86 yrs	?	-148
SATURN	120,000	10.5 hours	29.46 yrs	?	-178
URANUS	51,800	15.5 hours	84 yrs	?	-214
NEPTUNE	49,500	18.5 hours	165 yrs	?	-218
PLUTO	2,500	6.5 days	248 yrs	?	-330?

PROCEDURE:

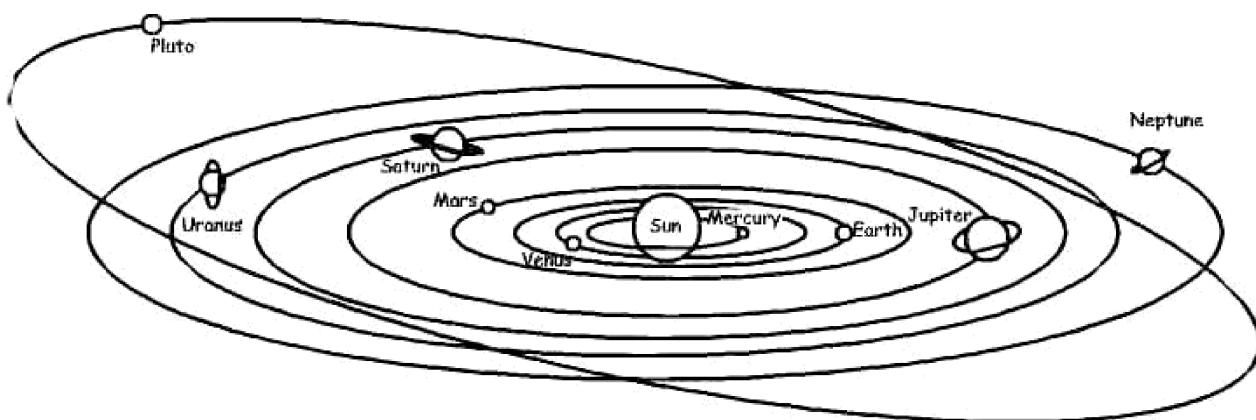
1. Hand out the Solar System Placemats and worksheets. Have the students fill out the worksheet using the placemat. Review their answers, using the chart shown above. Notice that the inner or terrestrial planets: Mercury, Venus, Earth and Mars are more similar as a group, than the Jovian or gas giants of Jupiter, Saturn, Uranus, and Neptune. Pluto is different, but considered a terrestrial-like planet.
2. You may want to use this exercise to help students learn how to use search engines on the Internet. Have them go to your favorite search engine and use the names of the planets for a search. They can get the information from the internet instead of the placemats.
3. Discuss any new information that students have learned. Remember the Internet probably has more current information.

UNIVERSE CYCLE - SOLAR SYSTEM (5) PRE LAB

1. Fill in the information from using the Planets Placemats, lecture, or other sources.

	diameter (km)	length of day	length of year	* low temp C°	*high temp C°
MERCURY					
VENUS					
EARTH					
MARS					
JUPITER					
SATURN					
URANUS					
NEPTUNE					
PLUTO					

2. Is this diagram accurate in respect to the orbits. Clue: Are the distances the correct proportion?



UNIVERSE CYCLE - SOLAR SYSTEM (5)

LAB

Students examine a tektite and compare it to Earth rocks

OBJECTIVES:

1. Comparing meteorites to Earth rocks.
2. Learning names for meteorites.

VOCABULARY:

meteor
meteorite
meteoroid
asteroid
tektite
rock

MATERIALS:

Universe Cycle - Solar System (5)
hand lens
ruler



Meteorites

BACKGROUND:

A meteoroid is a naturally occurring, relatively small, solid body. Bodies larger than 1 kilometer in diameter are usually called asteroids. Meteoroids and asteroids move quickly, at speeds of greater than 10 km/second, about 58,000 miles per hour!

When a meteoroid enters through the Earth's atmosphere, it is slowed by friction with atmospheric molecules. This causes the meteor to heat up. It often glows, and leaves a trail of vaporized material and ionized air behind it. A glowing meteoroid moving through the atmosphere is called a meteor. Meteoroids enter the Earth's atmosphere continuously. Most of these objects, however, are dust to sand sized particles, which burn up, or vaporize, high in the atmosphere.



Meteorite impact crater in the Australian outback.

If a meteor survives its passage through the atmosphere and strikes the



Regmaglypt texture of meteorite from Sikhote Alin, Russia

Earth's surface, it is called a meteorite. This can happen in two ways. Some meteors disaggregate or explode in the atmosphere, and their remnants fall to the surface. If a meteor travels all the way to the surface, it usually creates a crater. The energy of the meteor compresses the ground where it strikes, forming a hemispherical cavity. In addition, much of the meteor, and some of ground is vaporized.

Material is also ejected from the crater, landing in piles all around it. This material may include bits of the meteor and surface rocks, as well as molten rock formed by

the energy of the impact. This molten rock is similar in appearance to terrestrial magma. In some impacts, large blobs of molten rock are flung outward. These strike the surface and quickly cool, forming glassy objects called tektites. Tektites in this scenario are considered primarily melted Earth materials that sprayed upward and outward during an exceptional meteorite impact.

Meteorites and tektites are rare for three reasons. First, much of a meteorite is vaporized during its impact with the surface. Second, after they reach the Earth's surface, meteorites and tektites are subjected to weathering and breakdown. Third, these objects may be buried by the deposition of sand, mud, or other sediment.

Meteorites have three general compositions:

a. Iron meteorites are composed mainly of metallic iron and nickel, often mixed together as an alloy.

b. Stony meteorites contain mainly silicate minerals, such as pyroxene, plagioclase feldspar, and olivine. They also contain minor amounts of metals, particularly nickel and iron alloys. Stony meteorites account for 95% of all meteoritic material.

c. Stony-iron meteorites contain a mixture of silicate minerals and nickel-iron alloy. Stony meteorites are similar to igneous Earth rocks like basalt. Iron meteorites probably resemble the material in the Earth's core.

You may wish to tell the students that their tektite samples are from Thailand, and are about 1.2 million years in age. They came from a crater that has not been found, but was probably someplace in Cambodia. Tektites from this impact have been found as far away as central Australia.

PROCEDURE:

In this lab the students will compare meteorites with Earth rocks and then see what happens to a meteorite when it hits the Earth's surface.



Camel Donga meteorite from Australia

1. The students have samples of granite, basalt, obsidian, sandstone, and schist from Earth. They also have a small meteorite to use for comparison. This sample is a tektite from Indonesia. Tell students to compare and contrast the samples.

2. In this lab the students will compare samples of tektites with five Earth rocks: granite, basalt, obsidian, sandstone, and schist. They will probably conclude that the tektite is most similar to basalt or obsidian because both samples will be black in color and contain visible minerals. However the composition of tektites is more similar to obsidian. Basalt is actually quite different; the tektites contain much more silica. The granite, sandstone, and schist do not resemble the meteorite at all.



Tektite collection

UNIVERSE CYCLE - SOLAR SYSTEM (5) LAB

PROBLEM: What type of Earth rocks do meteorites resemble?

PREDICTION: _____

MATERIALS: samples of granite, basalt, obsidian, sandstone, and schist; meteorite, hand lens or microscope, ruler.

EXERCISE 1. Look at your meteorite samples. Describe it by using the hand lens and ruler.

EXERCISE 2. Describe the different Earth rocks that you have at your station. Describe color, texture, density, size of minerals, or other components you see.

	DESCRIPTION
granite	
basalt	
obsidian	
sandstone	
schist	

Compare your meteorite to the samples of Earth rocks. Which rocks does it resemble? Explain.

CONCLUSION: Can you tell the type of rock that the meteorite may have come from? What might that suggest about the origin of the meteorite?

UNIVERSE CYCLE - SOLAR SYSTEM (5)

POST LAB

Students take notes on a data sheet.

OBJECTIVES:

1. Discovering the atmosphere on different planets.
2. Interpreting data on atmosphere.

VOCABULARY:

atmosphere
carbon dioxide
helium
hydrogen
Solar System

MATERIALS:

worksheet

BACKGROUND:

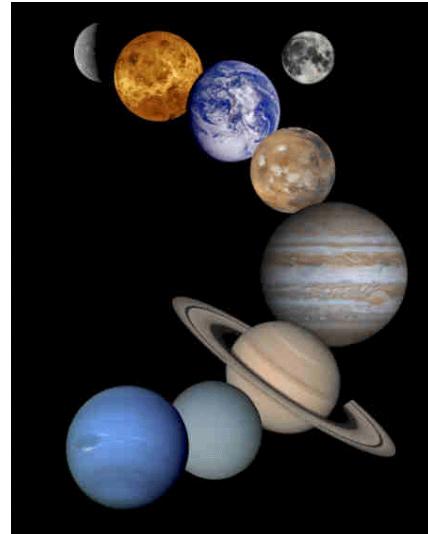
An atmosphere is the layer of gases that envelop a planet. On the Earth, it is this envelope that allows organisms to live. Atmospheric ozone protects us from ultraviolet radiation. CO₂ and other gases trap heat and keep the surface warm enough for life to thrive. Oxygen has allowed life to evolve.

Each of the planets has a different atmosphere, although there are clear similarities between the atmospheres of the four terrestrial planets and the four gas giant planets. The terrestrial planets are rich in heavier gases and gaseous compounds, such as carbon dioxide, nitrogen, oxygen, ozone, and argon. In contrast, the gas giant atmospheres are composed mostly of hydrogen and helium.

The atmospheres of at least the inner planets has evolved since they formed. This is clearest for the Earth. The Earth's original atmosphere was probably similar to Venus in composition, consisting of carbon dioxide and nitrogen. The evolution of photosynthesis converted carbon dioxide in the Earth's atmosphere to oxygen, increasing the amount of O₂ in it from an initial 0.01% to its current 22% level.

Here is basic information on the atmosphere of each planet to guide your Post Lab discussion. **Mercury** has a very thin, almost undetectable atmosphere composed of sodium and potassium gas. These elements were likely blown from the surface of Mercury by the solar wind.

The atmosphere of **Venus** is composed mainly of carbon dioxide with minor amounts of nitrogen and trace amounts of oxygen, helium, neon, and argon.



The **Earth**'s atmosphere primarily composed of nitrogen and oxygen. Minor gases include carbon dioxide, ozone, argon, and helium.

Mars' atmosphere is a thin layer composed mainly of carbon dioxide. Nitrogen, argon, and small traces of oxygen and water vapor are also present.

Jupiter's atmosphere contains mainly helium and hydrogen with trace amounts of water, ammonia, methane, and other carbon compounds. Three layers of clouds may exist in Jupiter's outermost atmosphere. The lowest are made of water ice or droplets, the next are crystals of a compound of ammonia and hydrogen sulfide, and the highest clouds are ammonia ice. There seems to be no solid surface under the atmosphere, only a transition from gas to liquid metallic hydrogen. In the top one-fourth of the planet, the pressure and temperature are so high that the hydrogen atoms are stripped of their outer electrons, forming a liquid metal.

Like Jupiter, **Saturn** has a thick atmosphere composed of hydrogen and helium. The ratio of hydrogen to helium ratio decreases with depth. Methane and ammonia are also present. The atmosphere of Saturn envelops a thick layer of metallic hydrogen.

Uranus' atmosphere is composed mainly of hydrogen and minor amounts of helium. Methane is present in minor amounts, and probably forms most of the clouds seen by space probes and telescopes. Uranus and Neptune both appear blue because methane strongly absorbs light of other wavelengths.

The atmosphere of **Neptune** consists mainly of hydrogen and helium, but about 2.5-3% of the atmosphere is methane. Like Uranus, clouds in Neptune's atmosphere are composed of crystals of methane.

Pluto's atmosphere seems to be very thin, and is likely composed of nitrogen and carbon dioxide.

Note that none of the other planets or moons in the Solar System have atmospheres similar to the Earth. This means that if humans travel to other bodies, they will have to bring their own atmosphere in order to survive.

PROCEDURE:

1. Present the information on planetary atmospheres discussed in the Background with your students. Have them fill out the worksheet as you talk. If you write the information on the board, you may want to use chemical notation as a shorthand.

2. After the students record this information, have them compare and contrast the different atmospheres. They should observe that the inner planets all have nitrogen and carbon dioxide, except for Mercury. They should note that the gas giant planets have abundant helium, hydrogen and methane. You may wish to explain that planetary atmospheres have changed through time, using the Earth as an example.

UNIVERSE CYCLE - SOLAR SYSTEM (5) POST LAB

COMPARISON OF PLANETARY ATMOSPHERES

As your teacher discusses the different planets, record the composition of their atmospheres. After the lecture, determine which planets have similar atmospheres using the information you have recorded.

PLANET	ATMOSPHERE	SIMILAR PLANETS
MERCURY		
VENUS		
EARTH		
MARS		
JUPITER		
SATURN		
URANUS		
NEPTUNE		
PLUTO		