

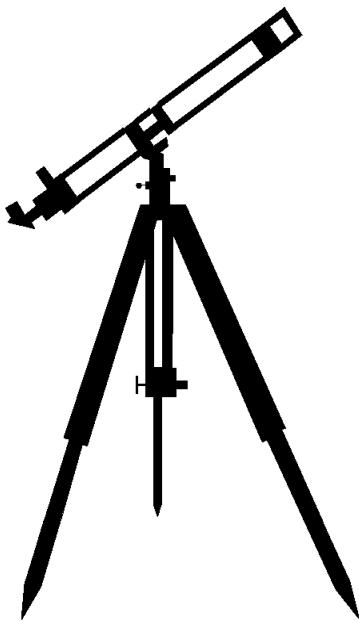


Universe Cycle

The Search for Our Beginnings



FIFTH GRADE **EARTH**



1 WEEK
LESSON PLANS AND
ACTIVITIES

UNIVERSE CYCLE OVERVIEW OF FIFTH GRADE

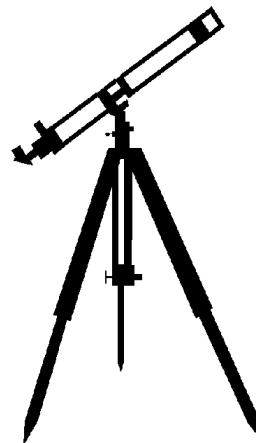
UNIVERSE

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: Discovering the influence of ice, rain, and wind.

POST: Comparing landforms on Mars and the Earth.

GEOGRAPHY

WEEK 4.

PRE: Exploring how topographic maps are made.

LAB: Comparing and contrasting topographic maps.

POST: Understanding topographic maps.

UNIVERSE CYCLE - EARTH (5)

PRE LAB

Students use the internet to investigate the formation of the planets.

OBJECTIVES:

1. Exploring how planets formed.
2. Comparing Earth formation with the other planets.

VOCABULARY:

condense
gravity
nebula
protoplanet

MATERIALS:

Internet
worksheet

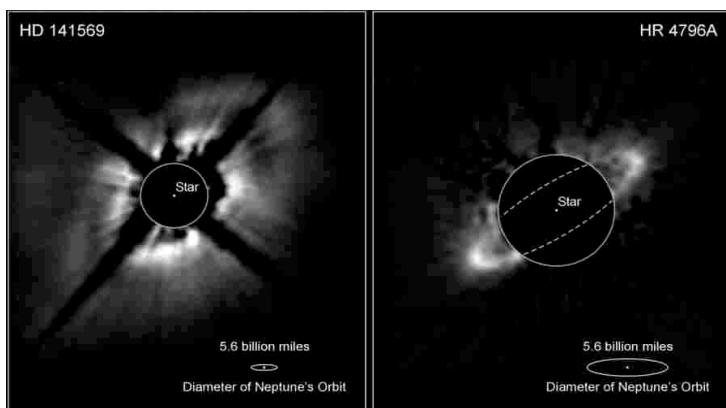


The Orion Nebula

BACKGROUND:

The most widely accepted model for the origin of the Solar System is called the nebula theory. Most generally phrased, the theory states that the Solar System condensed from a large, lumpy cloud of cold gas and dust. This idea was first in the late 18th century

by two Europeans, Immanuel Kant and Pierre Laplace. Extensive observations since then have confirmed that the nebula theory is the best explanation for the origin of the Solar System. All theories are subject to refinement as new data is gathered.



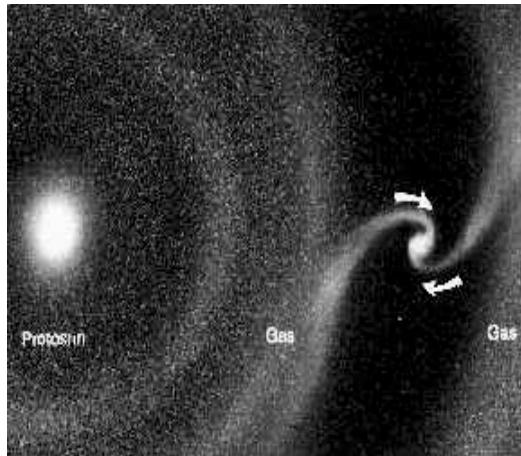
The nebula condensed and became a spinning disk. These pictures show real spinning disks in the Milky Way galaxy. The pictures were taken by the Hubble Space Telescope.

According to the nebula hypothesis, the Solar System began as a nebula, an area in the Milky Way Galaxy that was a swirling concentration of cold gas and dust. Due to some perturbation, possibly from a nearby supernova, this cloud of gas and dust began to condense, or pull together under the force of its own gravity. Condensation was slow at first, but increased in speed as

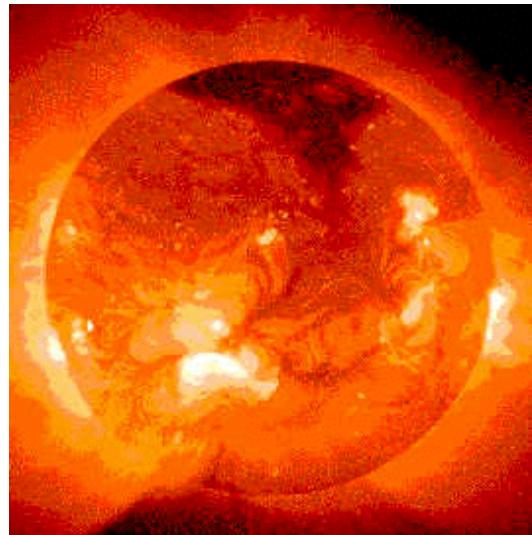
more material was drawn toward the center of the nebula. This made gravity stronger, making condensation faster.

The nebula also began to spin counterclockwise, as it conserved the angular momentum of the material drawn toward the center. This spinning made the material around the center of the condensing nebula flatten out into a disk-like shape. Nebulas at this stage, have at its center. A roughly, spherical core, surrounded by a disk. This has been observed by the Hubble Space Telescope. The remainder of the nebula theory is based more on modeling and indirect evidence.

The center of the nebula continued to contract due to gravity. Eventually, pressure and temperatures in this mass became high enough that nuclear fusion started. The central mass became a star, the Sun.



The planets formed from gas and dust in the disk.



The Sun formed from material that condensed in the center of the spinning disk.

While this was happening, condensation was also occurring in the disk. Gas and dust came together to make tiny particles, which gradually joined with other particles, making larger and larger objects. These objects grew to be several hundred kilometers in diameter; they became protoplanets. The protoplanets had much stronger gravity than the very small particles of gas and dust around them. They began to behave almost like vacuum cleaners, attracting the small particles around them. Protoplanets also collided from time to time. These collisions, plus the "vacuuming" of small particles, formed the planets of the Solar System. Gravity pulled these bodies into their current spherical shapes.

The protoplanets were not just sitting still in space while condensation occurred. As they formed, the disk of the nebula was whirling around the core, as described above. The protoplanets continued this motion by revolving around the newly evolved Sun. In addition, the protoplanets, and the planets, as they formed, began to rotate, or spin on an internal axis. This took place as some of the force from collisions was converted into rotational energy.

The large moons of the gas giant planets (Jupiter, Saturn, Uranus, and Neptune) formed in a similar fashion to the planets. The small moons of the gas giants, as well as the moons of Mars and Pluto are probably leftover debris from formation of the planets that were captured by their respective planets' gravity. They are captured moons. The Earth's

Moon probably formed a third way, from a collision between the Earth and a large protoplanet.

The Solar System has continued to evolve since its formation. It is likely that the orbits of the planets were originally more oval-shaped, and have changed to their current nearly circular shapes with time. The number of moons around some planets has increased through gravitational capture and collisions. The strength of the Sun (the amount of solar radiation emitted) has also likely changed. It is important for students to realize that the Solar System is a dynamic place.

In addition, each of the planets has evolved as well. The Earth is a good example of this. The evolution of life has radically changed the composition of the Earth's atmosphere and oceans. It has also greatly modified how rocks are weathered and eroded, and how elements cycle through the hydrosphere and lithosphere. Each of the other planets has its own story of evolution. We are just beginning to understand these.

Discussing how the Solar System formed may cause a small stir in your class if religion somehow enters into your discussion. If this happens, it is important to emphasize that the nebula hypothesis is based on scientific evidence, and is our best explanation of how the Solar System formed. However, for religious students, it may help to explain that science does not necessarily explain why the Solar System formed. For some people, this is a matter of belief. What students think and feel about this depends on their backgrounds and what their parents want to teach them. Students will make up their own minds when they mature. Presenting this material as scientific evidence will help them to form their own conclusions. Remember, many scientists have religious beliefs.

PROCEDURE:

1. Describe the formation of the Solar System to the students. Show them the pictures of a nebula, flattened planetary disk, and the Sun. The key point is that we do not really know how our Solar System was formed, although most evidence points to the nebula theory. Below is a shorten story of two different ways the Solar System could have formed. Remember don't confuse Universe Formation with Solar System Formation.

COLD WORLD. As a possible story goes, a nebula collapses under gravity. Particles come together to form larger particles. Planetesimals form which are pre-planets. The spinning attracts more particles until the size grows. The energy released during this collapse is converted into motion. The motion becomes two dominant forms, rotation and revolution. The objects that revolve tend to have a gravitational attraction to the larger mass. When the energy of the original collapse is converted, it creates a planetary system with a Sun and planets. Sounds simple enough, but all the evidence is not in, and this may change.

HOT WORLD. The other major line of thought was first proposed by Count Buffon in 1749, where two stars "bumped" in the night. This Collision Hypothesis requires that the Earth was "hot" when it formed. However, evidence from understanding how the Earth has evolved over the last 4.5 billion years suggests that the Earth had a cool beginning and has later heated up through processes of radioactivity, friction, and gravity.

2. Use the internet to search for the origin of the solar system. Use different search engines to see what information students can come up with, and then discuss with the entire class. You will get some interesting stories!

UNIVERSE CYCLE - EARTH (5)

LAB

Students plot areas of erosion on a map of the world.

OBJECTIVES:

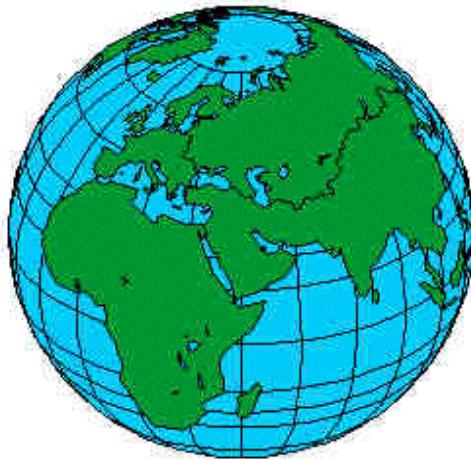
1. Comparing the Earth's eastern and western hemispheres.
2. Discovering the influence of ice, rain, and wind.

VOCABULARY:

erosion
ice
rain
wind

MATERIALS:

worksheet
inflatable world globes
colored pencils or crayons



BACKGROUND:

The Earth's landscape is influenced by many forces, including water, ice, and wind. Students should understand that one of the ways that the Earth differs from the other planets is the effects of these three forces on its surface. Liquid water is the most important agent of weathering, erosion, and transport on the Earth's surface. As water runs downhill, it carves valleys, transports loose material, and fills in low areas. Most of the Earth's surface is in fact covered by stream valleys. Landslides, which are downhill movements of large masses of loose rock and soil, are also common in areas of running water. Water adds lubrication to loose material, making landsliding easier.

Solid water, or ice, is an effective agent where it is cold, including mountainous areas (high altitudes) and near the poles (high latitudes). As they move downhill, glaciers and icecaps act like giant sheets of sandpaper or like files. They can carve away both loose material and solid rock. Mountain glaciers carve deep valleys. Ice sheets, like the ones covering Antarctica and Greenland, flatten landscapes by grinding away all the high areas.

Wind is only powerful enough to erode and transport dust- and sand-sized material. Larger particles only move during catastrophic storms. Although winds blow over much of the Earth's surface, the effects of the wind are best visible in arid, or desert regions. Here the effects of water are subdued, and the wind can pile up sand dunes and blow dust for long distances. For this reason, deserts and wind activity are often equated. This is

a reasonable approximation for students. Be aware however, that winds are also strong enough in other areas, such as along coastlines to form sand dunes and other "windy" landscapes.

The globes also show lines of longitude and latitude. These are a system for locating a point on the Earth's surface. Longitude lines run from pole to pole. They increase in value eastward from the 0° line, which runs through England. Note that the 180° line, halfway around the globe, is also the international date line. Latitude lines run from east to west. The equator is the line of 0° latitude. Lines of latitude increase in value toward the North and South Poles, which are at 90°N and 90°S, respectively. Every point on the Earth's surface has a unique latitude and longitude location.

In North America ice dominates the northern portion of Canada, portions of Alaska, and Greenland. Water is the main influence wherever there are rivers. Desert-like areas are present in the American southwest and portions of Mexico. Central America, and most of northern South America are dominated by water. There are many deserts in South America, especially in portions of Chile and Argentina. In the southern tip of South America, ice influences the landscape.

Africa is a continent that most people associate with jungles. However, as the students look at the Inflatable World Globe, they will notice that northern Africa is dominated by desert. A wide band of river-dominated area occurs in central Africa; some of this is true jungle. The southern part of Africa is a mixture of river and desert areas.

The European portion of the Eurasian continent is dominated by rivers, so again water is the major factor. In some areas of the northern Eurasian continent, ice dominates. In the central portion of the Eurasian continent, desert is very common.

Australia is dominated by a desert-like climate, so wind is important. Antarctica on the other hand is dominated by ice.

In terms of patterns, students should be able to see that areas at high latitudes are dominated by ice. In addition, they may also notice that desert areas occur in two bands, located 30°-40° north and south of the equator.

PROCEDURE:

1. Introduce students to the forces of wind, water, and ice. Explain that they will be examining the inflatable globes to try and learn the distribution of these forces on the Earth's surface.
2. Point out the longitude and latitude lines on the globes. Explain their meaning to the class. You may wish to find the latitude and longitude of your location, and have the students try and find it on their globes.
3. In Exercise 2, the students take information from the globe and transfer it to the worksheet. Have them color the continents appropriately. Make plenty of allowance for interpretation in their answers.

UNIVERSE CYCLE - EARTH (5) LAB

PROBLEM: What forces carve the landscape in different parts of the world?

PREDICTION: _____

MATERIALS: inflatable world globe or other world maps, colored pencils or crayons

PROCEDURE:

EXERCISE 1: Examine the inflatable globe with your partner. Answer the following :
Name 5 areas that may be influenced by:

wind	water	ice

EXERCISE 2: Examine the globe again. On the map, color the areas that are influenced by water blue, the areas effected by ice green, and the areas effected by wind red.



CONCLUSION:

When you are done, answer the following question: Do you see any pattern to where areas influenced by wind, ice, or water are located? Explain your answer.

UNIVERSE CYCLE - EARTH (5)

POST LAB

Students look at photographs of the surface of Mars.

OBJECTIVES:

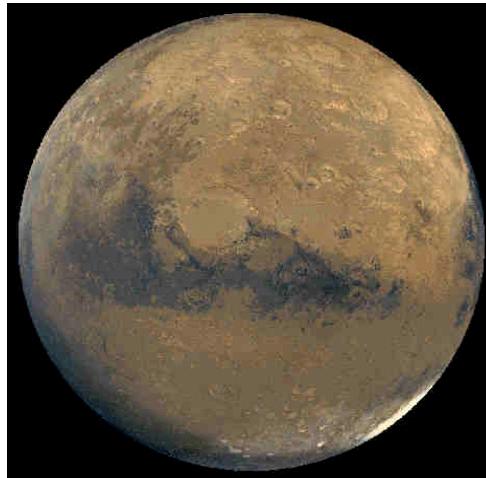
1. Comparing the landforms of Mars and Earth.
2. Exploring the real meaning of photos and maps.

VOCABULARY:

channel
glacier
Martian
surface
valley

MATERIALS:

landscape models



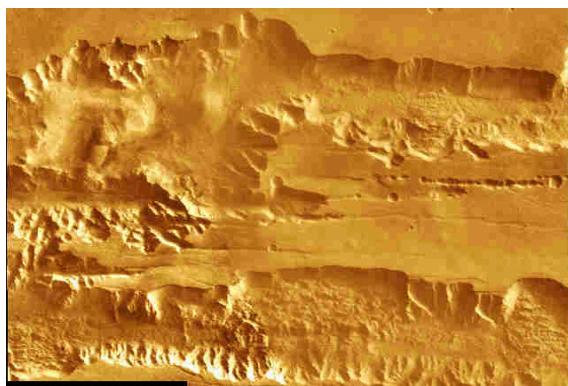
BACKGROUND:

A full view of Mars. Note the abundant meteorite impact craters.

Mars, more than any other planet, has characteristics that would seem to make it an Earth-like world. Its period of rotation and the inclination of its axis are similar to those of the Earth. Mars is similar in composition to the Earth, but probably has less iron and more lightweight elements. Finally, only Earth and Mars, among the inner planets, have satellites. However, the surfaces of Earth and Mars are very different. The Earth's surface is continuously modified. Plate tectonics changes the locations of such features as continents, ocean basins, mountain ranges, and volcanoes. The abundance of water

on the Earth's surface enhances the weathering and erosion of material on the surface. High areas are destroyed and low areas are filled in. Finally, the activity of life enhances weathering and erosion of the surface, and has drastically altered the composition of the Earth's atmosphere and oceans.

In contrast to the Earth, the surface of Mars is very old, and changes very slowly. Mars is slightly more than one quarter of the volume of Earth. This means that the interior



Canyons and valleys - evidence of erosion by landslides and (?) water.



Olympus Mons Volcano -
25 kilometers high!

of the planet has largely cooled off. Mars thus lacks major tectonic activity, although Marsquakes have been detected. The abundance of large volcanoes and wide rift valleys on its surface testify to past events, but these features are all more than several hundred million years. Mars also lacks surface water. Again, there is evidence that water may have flowed on Mars early in its history (billions of years ago) but now the surface of the planet is very dry. None of the Earth's usual water related surface processes including streams, glaciers, and ocean, are active on Mars. However, spacecraft have photographed abundant sand dunes on the Martian surface, as well as dust storms in the atmosphere. These indicate that wind

processes are still active on Mars, just like on Earth. There is currently no evidence for life on Mars.

The surface of Mars is marked by abundant impact craters. These formed when asteroids struck the planet. The Earth is also hit by extraterrestrial objects, but here craters are quickly destroyed by erosion and surface processes. This difference is another indication that the surface of Mars is old.

However, there is a feature on Mars that is somewhat similar to Earth especially the canals that look like great rivers. Some scientists feel that these are evidence that water was once present on the surface.



A view of the Martian surface from the Viking 1 lander.
Note sand dunes



Another Viking lander view of the surface of Mars.

These channels have a curious history. After they were observed by Pietro Secchi in 1876, Giovanni Schiaparelli made a map of them in 1877. The map used the Italian word canali which means channel. English speaking countries thought they meant canal, which is a human-made structure and stories began of Martians. These stories were widespread up to the middle 20th century. In our language, the term Martians is commonly used to describe inhabitants from other planets. These channels are probably of water origin, and

were present when the atmosphere supported water.

PROCEDURE:

1. Have students look at the model of the Earth and visualize looking at the surface from different angles. The objective is to make students realize that it is difficult to make observation of a planet we do not fully understand. Another important point is to for students to compare the differences between the landscapes of Earth and Mars. Students should realize that the Earth is unique because it has so many agents of erosion. This creates a land full of water that supports living organisms.

2. Have students look at the plastic landscape model of the surface of the Earth.



Imagine your eyes as a camera. Look at the landscape in the five positions drawn in the diagram. Ask students the questions below. Read the questions first, so that you have an idea of what to observe.

- A. What would be the best to use to take a picture of the model that would show all of its features?
- B. Which position shows the true width of objects on the model?
- C. Which position most distorts the shapes of objects?
- D. Which position best shows the height of mountains?

Answers:

A. from position 3; B. position 3; C. position 2 and 4; D. position 1 and 5;

3. As students look at pictures of Mars, which can be found on the Internet or use the ones in the background information, ask them if they can visualize what the surface of Mars looks like. On each photo you look at, ask students about which angle the picture was taken. You may want to use the Internet for recent photos of Mars to enhance this activity.



Martian windblown soil, with the Pathfinder rover for scale.