Why Can't we live on Mars?

Ella Boyd

Introduction

My students are seventh graders who should have completed a unit on space near the end of their sixth grade year. While they get some basics about the planets and space in general, they get very little detail about individual planets. With this unit, I want students to understand the characteristics of Earth's atmosphere by comparing Earth's atmosphere with the atmospheres of some of the other planets. Even understanding our own atmosphere is difficult for students. The fact that oxygen makes up only 21% of our atmosphere is a hard concept for them to grasp. It seems obvious to them that oxygen should be the primary gas since it is necessary for life. They are also unaware that other planets have many of the same kinds of gases in their atmospheres as Earth does. In some cases, it's just the proportions of those gases that make their atmospheres so different. The absence of oxygen is obviously a major factor for the nonexistence of life on other planets. I will be spending a little bit of time with my students explaining the history of Earth's atmosphere and how it has changed over time to allow life as we know it to exist. Then I want to make a comparison to the atmospheres of others planets, most specifically Mars and Venus, and see how those atmospheres might be similar to what Earth's was millions of years ago. With the current questions about water and life on Mars, I hope to help students see that atmospheres are not static and their composition has everything to do with the possibility of life existing.

As part of studying the atmospheres, I want to use the opportunity to help students also understand how the composition of a planet's atmosphere determines its density and air pressure. An understanding of these concepts is important as we begin our study of weather and climate. The weather we experience on Earth results from a combination of many factors and I plan to focus on density and air pressure specifically to help students get a basic understanding of why our weather behaves the way that it does. Through a series of demonstrations on density and air pressure, I plan to lead students to a thorough understanding that air has mass which creates air pressure and the air pressures on all planets are different based on the composition of the "air" on those planets. I will also demonstrate how the temperature of the air affects its density. Earth's atmosphere is the only one in our solar system that has what we know as the water cycle, the continuous cycling of water between the ground and the atmosphere. Although other planets have cloud systems, the composition of those clouds is very different than the clouds formed in Earth's atmosphere.

As part of our study of hurricanes and how they form, I want students to also look at the Great Red Spot on Jupiter. This giant storm has been swirling for hundreds of years and is bigger than the Earth itself. An interesting comparison between this storm and a hurricane could be made looking at how the winds are generated and how the rotation of a planet contributes to the formation and the life of a storm.

For middle school students, a study of the atmosphere holds very little excitement. I have found it difficult to make it a topic that easily holds their attention. I hope comparing the atmospheres of other planets, which students usually seem to be interested in, to Earth's will increase the understanding and the interest of my students in our own atmosphere.

Objectives

The state standards this unit will address include: designing and conducting investigations to demonstrate an understanding of scientific inquiry, demonstrating an understanding of technological design, and conducting investigations to build an understanding of the atmosphere. This unit will specifically address the properties of the atmosphere, how it makes life on Earth possible, and why life on other planets in our solar system is not possible.

My particular school is a 6^{th} – 8^{th} grade middle school with approximately 1200 students. I teach on an A day/B day block schedule and I typically have 28-32 students in a class, for an average total of 175 students. Middle school science classes in my district are heterogeneously grouped, which means that I can have the highest achievers, the learning disabled, and ESL (English as a Second Language) students all in the same class. This requires a great deal of creativity, differentiated instruction, and lots of planning. This unit will utilize strategies that can be differentiated, used in small groups, and will lend themselves to whole class discussions easily.

The emphasis in middle school in our state has always been on math and language arts instruction. End of the year testing is focused on those two subjects. While we test in science and social studies, the scores on those tests do not count toward our accountability goals, so while there is less pressure on science and social studies teachers, we sometimes feel like we are teaching elective classes. The focus on math and language arts is also in the elementary schools, so science is taught "if there is time." Very often students come to middle school with little to no science background. Science content we used to assume students would have when coming to middle school is no longer part of their prior knowledge. We now have to assume zero background in science content. Fortunately, the emphasis on science in elementary school has begun to change. Testing in science for fifth graders began a couple of years ago and I am starting to see the difference in the science content students bring to middle school. One of the strategies I have employed in the last few years in an effort to make science more relevant in middle school is to create interdisciplinary units. I have learned how to engage other teachers in this and it has been successful for most of us. This unit will include several lessons that cut across the disciplines and will include: using inquiry, creating graphs, analyzing graphs, conducting research and conducting investigations.

The Atmospheres of the Planets

Earth

The atmosphere of the Earth will be the primary focus of this unit; however, part of the unit will be a comparison of Earth's atmosphere with those of the other planets and some of their moons as well. As I refer to planets in this unit, I will be referring only to planets in our solar system. Earth has had what is considered to be three different atmospheres over its 4.6 billion year history. The original atmosphere was composed primarily of hydrogen and helium. Earth's gravity was not strong enough to allow these gases to remain. Solar winds mostly dissipated these gases and extremely few molecules of those gases remain today. The second atmosphere came about primarily due to volcanic eruptions on an active crust. Carbon dioxide, water vapor, and ammonia released from these eruptions eventually became dense enough to form the second atmosphere. This atmosphere was much denser and had a much higher air pressure than our current atmosphere. That second atmosphere was very similar to the current atmosphere of Venus with the high concentration of carbon dioxide. There was almost no oxygen present at that time. Our current atmosphere began to form around 2.7 billion years ago when the first oxygen producing organisms developed. These organisms, the *cyanobacteria,* began to absorb the carbon dioxide and produce oxygen. Carbon dioxide was also being absorbed by the oceans. After another 500 million years, our atmosphere had been converted to one containing oxygen, although the present percentage of 21% was probably not achieved until four million years ago. Currently, our atmosphere is 21% oxygen, 78% nitrogen, and 1% of other gases such as carbon dioxide, methane, helium, argon, and water vapor. A few other trace gases are in that 1% as well.

As we begin discussion about the current composition of Earth's atmosphere, students are always surprised at the amount of oxygen. They assume that oxygen will make up the greatest percentage since that is what is necessary for life. Fortunately, the 21% of oxygen in our atmosphere is all that we need for our survival. We could actually survive with even a little less than that. At higher elevations on Earth, it is more difficult to breathe because the density of oxygen is much less, although the percentage of gases relative to the total atmosphere stays the same. Fewer oxygen molecules in the air mean more breaths we must take to get the right amount of oxygen.

Earth's atmosphere also contains gases that keep the Earth warm. These gases are called greenhouse gases because they provide the same effect as a greenhouse does. Radiation from the sun passes through the atmosphere to heat the surface of the Earth. The radiation is converted to infrared radiation. The infrared light is absorbed (blocked from escaping) by the greenhouse gases in Earth's atmosphere. The greenhouse gases, which include carbon dioxide, methane, nitrous oxide, and water vapor, hold on to the heat that the Earth emits and keeps Earth from becoming too cold. Methane is the strongest greenhouse gas, meaning it traps the greatest amount of heat, but on Earth, we are primarily concerned with carbon dioxide because it is much more abundant in our atmosphere. Concerns about global warming usually focus on the amount of carbon dioxide in our atmosphere and the rates at which we continue to produce it. Despite concerns about global warming, without the greenhouse effect, the Earth would be a frozen planet at an average of -18°C. We will be comparing the greenhouse effect on Earth with the greenhouse effect on one or two other planets as well. The atmosphere also contains ozone in the stratosphere which keeps much of the harmful ultraviolet radiation from the sun from reaching Earth. No other planet has the ozone that Earth does because ozone exists in our atmosphere as a product of oxygen, which exists only in minute amounts in the atmospheres of other planets. Another protection provided by our atmosphere is protection from most meteors. Observations of our moon and some other planets show obvious evidence of the many potential impacts if not for an atmosphere to burn up meteors as they come in close to Earth.

To help students understand the relationship between the density of our atmosphere and air pressure, I will be doing several demonstrations to help them make the connection between the two concepts. The demonstrations will be discussed in the activities section of this unit. The activity I developed will be attached as Appendix 1. Air pressure is caused by the weight of all the air molecules pushing down on a surface. Earth's gravity is what holds our atmosphere to the surface of the Earth. Earth's original atmosphere eventually dispersed into space because the gases, hydrogen and helium, were so light that the solar winds were able to disperse them. For Earth, the average pressure at sea level is approximately 1 kilogram per square centimeter (or 14.7 pounds per square inch), so pressure on about a square foot is almost a ton. This is a concept very hard to grasp for most students. The strategies section will include some simple activities that help to show this concept. The denser the air is, the higher the pressure will be because the more molecules per area, the more weight will be applied to a given space.

Earth is unique among the planets in having a water cycle. Water exists in all three physical states of solid, liquid and gas on Earth and no where else in our solar system. Water does exist elsewhere as a gas or a solid, but does not go through all three phases as it does here. The three states of water exist in a continuous cycle on our planet through the processes of evaporation, condensation, and precipitation. Earth's temperatures allow our water cycle to behave as it does.

The Coriolis Effect

The Coriolis Effect is an effect caused by the rotation of the Earth that shifts the directions of the global winds. In the northern hemisphere the winds are shifted to the right and in the southern hemisphere the winds are shifted to the left. Winds would blow directly from the poles to the equator if not for the influence of Earth's rotation. This effect is only apparent in the global winds and not in the local winds and breezes. The Coriolis effect creates the global wind belts. The global wind belts are three distinct areas of wind that blow around the globe. The trade winds, named for the winds that moved the sailing ships along trade routes hundreds of years ago, blow from east to west in the latitudes above and below the equator. The westerlies which blow from west to east are located between the 30 and 60 degree latitudes in the northern and southern hemispheres. The westerlies are the wind belt responsible for moving weather and storms across the United States. The third set of wind belts are the easterlies which blow from the east at both poles. The trade winds and westerlies have a large effect on the movement of hurricanes on Earth. Global wind belts are apparent on other planets as well, particularly Jupiter, which will be discussed later in this unit.

Comparing the Planets

Mars

Mars, the red planet, has an atmosphere composed of 95.4 % carbon dioxide, 2.7 % nitrogen, and 1.6% argon. Mars has only a trace amount of oxygen in its atmosphere, so there is not nearly enough to support life. Mars can be very cloudy but the clouds are primarily composed of dust. Temperatures on Mars range from a sultry 80˚ F on a summer day to less than -200˚F in the winter. Mars' tilt is very close to that of Earth's, so seasonal changes are similar. The diurnal range of temperatures on Mars is extremely varied, especially compared to Earth's diurnal range. On Mars, the diurnal range, which is the range of temperatures in a daily cycle, can be as much as 140˚F. On Earth, this range is on average 35˚F. Temperatures on Mars do not allow liquid water to exist. Missions to Mars have provided evidence that liquid water did exist at one time in Mars' history. Mars appears to be reddish because of the dust on the surface that is picked up by the wind. The red dust on Mars is composed of silicates and iron oxides much like the red clay soils found on Earth, but discussion of that would be a whole other unit. Small clouds of carbon dioxide can form around certain high mountains.

Images of Mars have shown what looks like ice in the polar regions of Mars, but this ice is actually dry ice, frozen carbon dioxide. Early observations of Mars from the *Mariner* spacecraft led some scientists to conclude that all of the ice on Mars was dry ice, but further missions and data showed that most of the ice in the polar regions is water ice and just the top layer of ice showing is dry ice. Dry ice exists at temperatures below minus 109˚F in Earth's atmosphere. Mars' much lower air pressure would allow dry ice to exist at a slightly different temperature. The air pressure at the surface of Mars is only .65% that of Earth's air pressure. Some scientists theorize that Mars actually has dry ice storms, where dry ice granules may actually rain down on the planet. This would occur seasonally with the winter months. Although still a theory, more scientists are agreeing with this theory.

Mars can also develop dust devils, small tornado-like storms, just like those that develop on Earth. When the surface of Mars or Earth is heated, the air near the surface can rise quickly and begin to spin. As the air spins, it picks up dust which makes the vortex visible. These tiny storms last only a few minutes. On Mars the dust devils pick up the brighter soil on top and can leave a darker path that traces the route of the storm. A video of these storms taken by the Mars Exploration Rover Spirit is found on the website listed in the teacher resources.

Venus

The atmosphere of Venus is composed of 96.5% carbon dioxide and about 3.5% nitrogen, which is very similar to the composition of Earth's "second" atmosphere and is comparable to the current atmosphere of Mars. That is where the similarity ends as the temperature and pressure ranges are very different. Venus is the hottest of all the planets even though it is not the closest to the Sun. Its average temperature is 867˚F, primarily because of the massive greenhouse effect on Venus. The carbon dioxide atmosphere traps the infrared heat from the ground. There is virtually no weather on Venus. The hot temperatures do not allow water to exist and there are almost no winds. Venus is sometimes called Earth's twin because the mass and diameters are so close, but that is the extent of the similarities. The clouds of Venus are made of sulphuric acid droplets, much stronger than the acid rain formed on Earth! The air pressure on Venus is about ninety two times what it is at the surface of the Earth. Venus also has very few impact craters because of the density of its atmosphere.

Jupiter

The atmosphere of Jupiter is probably one of the most active atmospheres of all the planets. It is the fastest rotating planet making a rotation of its huge mass and volume approximately every ten hours. This is because the planet is rotating at the equator at a rate of 43,000 km/hr. Because Jupiter is not a solid planet, the poles are rotating at a different rate than the equatorial area.

1300 Earths could fit into the volume of Jupiter. Even the Great Red Spot could hold two Earths side by side in it. There is very little in common between Jupiter and Earth. Jupiter's atmosphere is composed of approximately 86 % hydrogen and 14% helium, with the rest composed of small amounts of methane, ammonia, and water vapor. While Earth's atmosphere has evolved throughout its history to a very different composition from its original atmosphere, Jupiter's atmosphere has remained relatively unchanged throughout its history, primarily because the strong gravity has not allowed the lighter elements to escape. The entire visible portion of Jupiter is made up of clouds, which occur in different colored bands. The lighter bands are called zones and are composed of clouds of white or yellow. Their temperature is higher than that in the darker bands, and is believed to be bands of ascending air. The darker bands are called belts and are believed to be regions of descending air. These bands of clouds circulate in opposite directions, some going westward and some going eastward. Locked between two oppositely flowing bands of clouds is the Great Red Spot, a giant storm that has been swirling for hundreds of years. The Great Red Spot was first discovered around 1656, but had most likely been around for many years before that. The Red Spot has changed size somewhat over the last few hundred years, but has remained largely the same. This storm is often compared to the hurricanes on Earth because of its rotating winds. The Red Spot is different from a hurricane in several ways, however. The Red Spot is an anticyclonic storm that rotates counterclockwise around a high pressure system, while hurricanes rotate around a low pressure center. Hurricanes gain their strength from warm water and will lose energy over land, so even the strongest hurricanes can last only for a few weeks. The Red Spot gains its energy from heat welling upward from Jupiter. Hurricanes are pushed westward by the trade winds and will eventually turn north and sometimes even head eastward when the westerlies begin to have an effect on them. The Red Spot has survived for hundreds of years and remains along the same latitude.

Titan

The last comparison I want to make with Earth is with Titan, Saturn’s largest satellite. Titan has a smoggy, yellow-orange atmosphere of nitrogen, methane, and ammonia. Methane clouds form in the lower atmosphere of Titan and sometimes produce methane rain. Lakes of liquid methane exist on the surface. Nitrogen makes up 90% of Titan’s atmosphere and was probably formed from the breakdown of ammonia by the Sun’s ultraviolet radiation. The second most abundant gas is methane which can be compared to Earth’s water cycle. The methane clouds can actually release droplets of hydrogen. Scientists believe Titan’s atmosphere has similar characteristics of Earth’s atmosphere.

Activities

Pressure/Density Demonstrations

One of the activities I am including in this unit includes several demonstrations that focus on density and pressure. The demonstrations take place over several class periods and will include follow up activities on each of those days. The demonstration sheet that is given to the students is included as Appendix 1. The student sheet includes four parts. The first part includes the place for students to make observations about the demonstration. The second part is for a diagram of the demonstration where students are expected to make detailed diagrams of the before and after of the demonstration and to include labels. I am constantly emphasizing to my students the importance of good diagrams in science. The third part called the “I think…” section is where students are to write an inference about why they think the demonstration behaved as it did. Discussion of their inferences allows me the opportunity to identify their misconceptions about scientific principles quickly. Research about student learning shows that if misconceptions are not specifically addressed, students will hold onto those misconceptions indefinitely. We discuss their inferences and then the last part of the boxes is the "Now I know…" section where students will write the scientific explanation of what happened. This part comes from me after much discussion about their inferences.

The first and second demonstrations are both meant to show that high pressure air moves to areas of low pressure. The "Egg in a Bottle" activity, which most students acknowledge having seen before, is understood by few of them. The most difficult part of this demonstration is finding just the right size glass bottle that will allow the egg to be pushed in without getting stuck. (I found the best size to be the Coburg glass milk bottle.) The only things needed for this demonstration are the bottle, matches, and a peeled, hard boiled egg. Light a match or two and drop it into the milk bottle and immediately put the egg on top of the bottle. The immediate observation should be that the egg may vibrate a little and then will begin to appear to be pulled into the bottle. Within a few seconds the whole egg should drop down into the bottle. This occurs because the lit match heats up the air in the bottle which causes the air molecules to move faster and expand which creates higher pressure. Some of this expanding air escapes around the sides of the egg which creates the slight vibration of the egg that may have been observed. The escaping air lowers the pressure inside the bottle which creates a partial vacuum. The air outside the bottle, which is now at a higher pressure than the air in the bottle, rushes to get in and in doing so pushes the egg into the bottle. Removing the egg is more difficult but following the same principle, air can be blown into the bottle creating higher pressure which should push the egg out of the bottle. This is a very simple demonstration that shows that high pressure air moves to areas of low pressure.

The second demonstration called "Candle in a Flask" is also used to show that high pressure moves to areas of low pressure. In this demonstration, a glass baking dish is filled with an inch or two of water. I add food coloring to the water just to make it easier for students to see the water moving. A short (three to five inches) taper candle is stood up in the middle of the baking dish. I usually use clay to hold the candle up. Once the candle is standing up, I will light the candle and then invert a flask over the top of the burning candle. Within a few seconds the flame will begin to go out and students should begin to see the water rise up into the flask. Students' inferences almost always include phrases, such as "the water is being sucked up into the flask." A discussion of their inferences will usually uncover that most students believe the heat in the flask is somehow pulling the water up into the flask. Eventually, the students deduce that the heat from the candle heated the air in the flask, which raises the air pressure inside the flask. Some of the faster moving air is able to escape under the rim of the flask which creates lower pressure and therefore a partial vacuum in the flask. This means that air pressure outside the flask is higher and the higher pressure pushes on the water in the dish which then pushes it up into the flask. An extension of this demonstration is to have students estimate how much of the flask filled up with water. Students should be able to observe that approximately 21% of the flask has been filled with water, which corresponds to the amount of oxygen that was burned by the flame. Most students understand that the flame eventually goes out because there is no more oxygen but do not relate the candle going out to the actual amount of oxygen.

The third demonstration is a good visual for density. In “Bubbles in a Tank,” I put dry ice in two small beakers in the bottom of a small aquarium. I add water to the beakers to speed up the sublimation process of the dry ice. The carbon dioxide gas will, of course, sink to the bottom of the tank because of its higher density. Once there is a nice layer of gas in the bottom of the tank, I blow bubbles into the tank. The bubbles will sit on top of the layer of the carbon dioxide gas and may even bounce on top of the carbon dioxide. This really shows students that different gases have different densities. I will be able to compare atmospheres of other planets using this basic demonstration.

The last demonstration called “cold/warm fronts” is another demonstration showing density. In this demonstration, I have a container that I can put a divider into to separate the container into two equal portions. I prepare two large beakers of water. One beaker has cold water which I color blue for a better visual. I also add a little salt to the cold water beaker just to increase the density of the water and make the demonstration work better. In the second beaker, I add warm water colored red, once again just for a better visual. I pour each beaker of water into opposite sides of the container, and then lift the divider. Students will see that the cold water moves under the warm water and creates clearly divided layers in the container. This demonstration shows that the cold water is denser than the warm water and therefore moves underneath the warm water. This can then lead to the discussion of cold air being denser that warm air, which leads to the formation of fronts which leads to storms.

Planet Research activity

Another of the activities I will use in this unit is a research activity that will allow students to directly compare the atmospheres of other planets with Earth. I will assign a specific planet or moon to a group of two or three students. The planets I will be assigning will include Venus, Mars, Jupiter, Saturn, its moon Titan, Uranus, and Neptune, which all have atmospheres. Students will have a list of websites to begin their research and will have a worksheet with questions to guide their research. The worksheet is included as Appendix 2. Once students have completed their research, we will put all the information on a large chart to be able to compare the atmospheres of those planets with Earth.

The Coriolis Effect activities

There are two different activities I will be doing with students to help them understand how the Coriolis effect works. It is usually a concept they have difficulty with so these two activities will hopefully make the idea a little more concrete. One of the activities involves using a “lazy susan,” or a turntable of some type. The students can use a marble or large ball bearing for this activity. Something that can serve as a ramp is also needed. The directions for students are located in Appendix 3. The students will place a ramp at the side of the turntable and let the marble roll down the ramp. The first couple of times the students just let the marble roll down and make observations about its path. They should note that it is just a straight path. Then they let the marble roll down but turn the turntable when they let the marble go. They should observe that the marble then curves either to the left or the right depending on whether they turned the turntable clockwise or counterclockwise. Students should come to infer that the marble represents the wind and the turntable represents the Earth.

The second activity to show the Coriolis effect is with a balloon. Students will use a blown up balloon to represent the Earth. One student will hold the balloon while another will hold a marker to draw on the balloon. The student holding the balloon will rotate the balloon as another student draws a line from the top of the balloon towards the center. Students will be able to observe that the rotation of the balloon causes the line to curve to one side.

Appendix 1

Pressure and Density Demonstrations

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Please fill in each of the following charts as you observe each demonstration.

EGG IN A BOTTLE
OBSERVATIONS

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DIAGRAM	EXPLANATION: I THINK______________________________________ ____ _____________________________________ NOW I KNOW__________________________ _____________________________________ ____ ____

CANDLE IN A FLASK
OBSERVATIONS

DIAGRAM	EXPLANATION: I THINK________________________________ _______________________________________ _____________________________________ NOW I KNOW________________________________ ____ ____ ____

BUBBLES IN TANK
OBSERVATIONS

DIAGRAM	EXPLANATION: I THINK ___________________________________ ___________________________________ ___________________________________ NOW I KNOW________________________ _________________________________ _______________________________________ __________________________________

COLD/WARM FRONTS	
OBSERVATIONS	
DIAGRAM	EXPLANATION: I THINK_____________________________ ___________________________________ ___________________________________ NOW I KNOW_______________________________ _____________________________________ ______________________________________ ______________________________________

Appendix 2

Comparing the Planets Research student sheet

questions	**Planet or moon** ______________________________ ______________________________ ______________________________

What gases makes up the atmosphere of your planet? What are the percentage of those gases?	
Describe the winds on your planet	
What is the air pressure on your planet?	
What is the average temperature of your planet?	
What kind of weather exists on your planet?	

Appendix 3

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Investigating the Coriolis Effect

Objective: Demonstrate that Earth's rotation affects wind direction.

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Part 1

Materials:
Turntable or lazy susan

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Marble
Ramp as launcher

Place the ramp on the edge of the turntable. Allow the marble to roll down the ramp across the turntable. Repeat this a couple of times and note the path of the marble. Next, when you release the marble down the ramp, give the turntable a light spin and note the path of the marble. Repeat this a couple of times and continue to note the path of the marble.

Questions

1. What do you think the marble represents in this activity?
2. What does the turntable represent in this activity?
3. What is the difference in the path of the marble when you don't spin the turntable and when you?
4. How does this activity relate to the Coriolis effect as it effects global winds?

Part 2

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Materials:
Balloon
Marker

Blow up the balloon and tie it off. One partner should slowly rotate the balloon to the right. Draw a line straight down from the top of the balloon to the center as the balloon rotates. Now draw a line from the bottom of the balloon straight up to the center as the balloon rotates.

Questions

1. How did the rotation affect the lines that you drew?
2. How does this activity demonstrate the Coriolis effect?
3. How might changing the speed at which the balloon is rotated affect the results? Repeat the activity to test your prediction.

Works Cited

Comins, Neil F., and William J. Kaufmann. *Discovering the universe* . 8th ed. New

York: W.H. Freeman, 2000.

College textbook with very detailed information about the planets

Hartmann, William K., and Ron Miller. *The grand tour: a traveler's guide to the solar system*. 3rd ed., rev. ed. New York: Workman Pub., 2005.

This book has interesting narrative about many worlds, large and small, in our solar system, as well as some beautiful pictures and artist illustrations.

Hughes, David W.. *Understanding the solar system* . Hauppauge, NY: Barron's, 2006.

This little book is packed with interesting useful information.

Maran, Stephen P.. *Astronomy for dummies* . 2nd ed. Hoboken, NJ: Wiley, 2005.

Basic information about the planets and other entities in the solar system.

Phillips, Cynthia, and Shana Priwer. *Understanding astronomy* . New York: Fall River Press, 2009.

Very simplified descriptions of astronomy information.

Teacher Resources

www.ux1.eiu.edu/~cfjps/1400/atmos_origin.html
This website has basic information about the evolution of the atmosphere and a couple of good diagrams.
www.wisegeek.com/what-is-the-history-of-the-earths-atmosphere.htm
This site has interesting information about the formation of Earth's atmosphere.
http://phoenix.lpl.arizona.edu/index.php
This site provides the most up-to-date information about the mission of the Phoenix mission to Mars.
http://www.nasa.gov/mission_pages/mer/images/spirit-sol-1120.html
This website has videos of dust devils on Mars taken from the Rover Spirit.

Field Code Changed

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