Name: _____ Period: _____ Date: ___/___/___

EA11 Fact Sheet

EARTH, MOON, SUN AND SEASONS

CLASSWORK AGENDA FOR THE WEEK

(1) Demonstrate that the earth rotates on its axis.
(2) Explain the cause of earth's seasons.
(3) Explain the cause of lunar and solar eclipses and calculate the diameter of the sun.
(4) Show why the moon has phases.

Nicolaus Copernicus, a Polish-born scientist (b. 1473; d. 1543), changed the way people think about the universe. He proved that the earth **revolves** around the sun at a time when most people believed the earth was the center of the universe. Copernicus's idea was strange to most people because it challenged their direct observations. After all, we wake up every morning, see the sun rise and move across the sky, then dip over the horizon at dusk. At night, we watch the moon move across the sky hour after hour and see the stars travel in counterclockwise circles around the fixed North Star. It appears that the whole univese is revolving around us! In the previous unit—*Mapping the Heavens*—you used some of the same demonstrations Copernicus used to explain his theory. Using those and other demonstrations Copernicus suggested that the earth **rotates** on its **axis** once every 24 hours which causes day and night. But it was not until 1851 that the French physicist **Jean Bernard Léon Foucault** (b. 1819; d. 1868) proved beyond a doubt that the earth does rotate. He did this using a simple swinging pendulum. Copernicus explained that the **moon** was a **satellite** of earth and made one full trip around our planet about once every thirty days. He showed that the sun is the center of our solar system, shedding light on earth and on the other eight distant planets.

Ancient people reasoned that the earth was a sphere long before Columbus sailed to America. They watched ships "sink" beyond the horizon and return home, indicating the earth's surface was curved and not flat. They studied the shadow of the earth that was cast on the moon during lunar eclipses, noting that the shadows were always round. The Greek geographer and mathematician **Eratosthenes** (b. 276 B.C.; d. 194 B.C.) calculated the size of the earth in the third century B.C. and was accurate to within a few hundred miles.

Later astronomers like **Galileo Galilei** (b. 1564; d. 1642) made even more accurate calculations to determine the sizes of the moon, sun, and planets. Galileo discovered that the moon was not smooth but was covered with craters and rugged mountains. Using parallax, astronomers found the average distance to the moon to be **242,000 miles** (or about **390,000 kilometers**). They were able to explain **lunar** and **solar eclipses** as well as the **phases of the moon** (e.g., **crescent**, **quarter**, and **gibbous**) after studying the changing position of the moon relative to the earth and sun. Galileo discovered sunspots moving across the surface of the sun, suggesting that the sun—like earth—rotates on an axis. The earth is about **93,000,000 miles** (or **150,000,000 kilometers**) from the sun and completes one revolution around the sun every **365.25 days** (e.g., 1 year). The average distance from the earth to the sun is called one **astronomical unit** (or **a.u.**). The dimensions of the Solar System can be expressed in astronomical units. The most distant planet, Pluto, orbits at about 39.4 a.u. from the sun. The outer limit of the Solar System at about 100 a.u. from the sun is called the **heliopause**.

The sun is a medium-sized star of average brightness. The sun's **radiation** (e.g., light, heat, and ultraviolet rays) is produced in its dense, hot **core**. In the sun's core **nuclear fusion** combines **hydrogen** atoms to form **helium** atoms at the rate of hundreds of million metric tons per second. Even at this incredible rate of consumption the sun has enough hydrogen to burn for another 6 billion years. As dependable as it is, however, the sun is very active. Dark **sunspots** accompanied by violent **magnetic**

storms appear on the sun's surface in 11 year cycles. These storms give rise to gigantic bursts of energy that cause energetically charged atomic particles to flow out into space. This flow of energetic particles can effect the earth's weather, and radio and television communications. It can knock satellites out of their orbit and injure astronauts working in space. This blizzard of dust, gas, and energy is called the **solar wind**. The solar wind supplies our planet with enough energy to keep all of us alive. It drives the weather and can alter the climate. Today we know that the change of seasons is caused by the shift in the tilt of the earth as it revolves around the sun on its voyage through the storm of solar wind.

Homework Directions

1. Draw and label the positions of the earth, sun, and moon during a lunar and solar eclipse. Label the umbra and penumbra in each diagram.
2. Draw and label the positions of the earth and sun at summer solstice, autumnal equinox, winter solstice, and vernal equinox. Show the correct tilt of the earth in each position.

Assignment due: _____

_____ Student's Signature

_____ Parent's Signature

____/____/____ Date