LIFEPAC®

SCIENCE

STUDENT BOOK

6th Grade | Unit 8

Alpha Omega
PUBLICATIONS

SCIENCE 608
Spaceship Earth

LIFEPAC Test is located in the center of the booklet. Please remove before starting the unit.

Author:
Barry G. Burrus, M.Div., M.A., B.S.

Editors:
Alpha Omega Staff

Illustrations:
Alpha Omega Staff

Revision Editor:
Alan Christopherson, M.S

MEDIA CREDITS:
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804 N. 2nd Ave. E.
Rock Rapids, IA 51246-1759

Spaceship Earth

Introduction

In His wisdom and love, God created a beautiful home for us – the earth. Our home, the earth, can also be compared to a "spaceship." What is a spaceship? It is a vehicle carrying human beings and other cargo that travels through space. Our earth is like that. Earth is constantly in motion through the vast spaces of the universe. It rotates about its axis. It orbits around the sun. It travels with the rest of our solar system around the center of our **galaxy** – the Milky Way Galaxy. Finally, it travels with the rest of the Milky Way Galaxy through the Universe. Truly, the earth is a huge "spaceship," carrying us and all living things with it as it journeys through space.

In this LIFEPAC®, you will learn more about the earth's size, shape, and motion through space. You will also learn about the relationship of the earth to the moon and the sun, and how these three bodies interact to form **eclipses**. Finally, you will learn more about our solar system which includes the sun and its eight planets.

Objectives

Read these objectives. These objectives tell what you should be able to do when you have completed this LIFEPAC. When you have completed this LIFEPAC, you should be able to do the following:

1. Describe earth's size and shape and its motion through space.
2. Explain how night and day occur on the earth.
3. Define the time zones on earth and be able to locate the prime meridian and the International Dateline.
4. Explain the seasons of the year and how they occur.
5. Describe what happens when the vernal and autumnal equinoxes occur.
6. Describe what happens during a solar eclipse and a lunar eclipse.
7. Name and describe the main parts of our solar system.
8. List the eight major planets of our solar system from the sun outward and describe the relative size and composition of each planet.
9. Define and describe some major characteristics of asteroids, comets, and meteoroids.

1. EARTH'S MOTION

When you look at the earth around you each day, it appears to be very fixed and **stable**. Yet, we know that the earth is actually in motion in several ways. The fact that we have day and night shows that the earth rotates about its axis, with half of it **illuminated** by the sun and the other half dark because it is hidden from the sun. In addition, the fact that we have four seasons of the year is explained by the motion of the earth around the sun once a year. The earth also moves through space in other ways, and you will learn more about the various movements of "spaceship Earth" in this section of the LIFEPAC.

Even though the earth is constantly in motion, God has wonderfully designed our earth to support life. He did this by giving the earth a definite size and shape. He also designed the earth to support life by placing the earth in a position from the sun that allows the right life-supporting temperatures to exist on earth. He also placed adequate water, oxygen, and carbon dioxide upon earth to support life. God designed the motions of the earth to occur in regular cycles, such as day, night, and the four seasons of the year. This regular motion of the earth also helps to support and sustain life on earth.

Throughout history, human beings have used the regular motions of the earth to express the passage of time. They have also devised different ways of designating *position* and location on the earth. In this section of the LIFEPAC, you will also learn more about the way humans in most nations of the world today designate time and location upon earth.

Section Objectives

Review these objectives. When you have completed this section, you should be able to:

1. Describe Earth's size and shape and its motion through space.
2. Explain how night and day occur on the earth.
3. Define the time zones on earth and be able to locate the prime meridian and the International Dateline.
4. Explain the seasons of the year and how they occur.
5. Describe what happens when the vernal and autumnal equinoxes occur.

Vocabulary

Study these words to enhance your learning success in this section.

autumnal equinox (ô tum nəl ē kwə noks). Occurs on September 22 or 23, when the days and nights are equal.

ellipse (i lips). An egg-shaped figure similar to a circle which also describes the path or orbit of one body around another.

galaxy (gal ək sē). A system of numerous associated stars traveling together through the universe. Our galaxy is the Milky Way Galaxy, containing hundreds of billions of stars.

illuminated (i lü mə nā t ed). Supplied or brightened with light.

longitude (lon jə tüd). A distance measured in degrees east or west on the earth's surface from the prime meridian.

meridian (mə rid ē ən). An imaginary line running north-south around the earth through the north and south poles.

orbit (ôr bit). Curving path that a moving body takes around another body in space.

rotation (rō tā shən). The action or process of rotating or turning about an axis or center.

sidereal day (sī dir ē əl dā). The time that the earth takes to make exactly one complete rotation to the very same position on earth compared to far distant stars. It is 23 hours 56 minutes 4.091 seconds.

solar day (sō lər dā). The time that the earth takes to make one complete rotation relative to the sun. It is 24 hours.

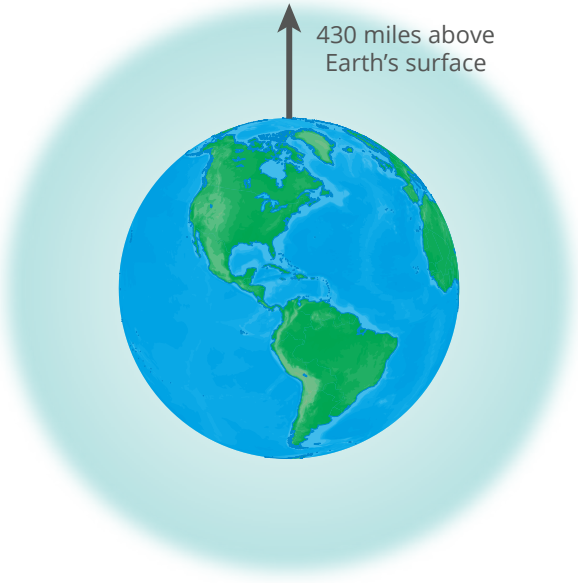
stable (stā bəl). Firmly established; not changing, moving, or fluctuating.

vernal equinox (vė r nəl ē kwə noks). The spring equinox on March 19, 20, or 21 when the days and nights are of equal length.

Note: *All vocabulary words in this LIFEPAC appear in* **boldface** *print the first time they are used. If you are not sure of the meaning when you are reading, study the definitions given.*

Pronunciation Key: h**a**t, **ā**ge, c**ã**re, f**ä**r; l**e**t, **ē**qual, t**ė**rm; **i**t, **ī**ce; h**o**t, **ō**pen, **ô**rder; **oi**l; **ou**t; c**u**p, p**u**t, r**ü**le; **ch**ild; lo**ng**; **th**in; /*ŦH*/ for **th**en; /*zh*/ for mea**s**ure; /*ə*/ represents /*a*/ in **a**bout, /*e*/ in tak**e**n, /*i*/ in penc**i**l, /*o*/ in lem**o**n, and /*u*/ in circ**u**s.

| The size and shape of the Earth vary slightly in relation to one another.



| Atmosphere above Earth

EARTH'S SIZE AND SHAPE

Before discussing the motion of "spaceship Earth," let us consider a few facts about "spaceship Earth" itself. Viewed from space, the earth appears as a large sphere (ball). It has vast swarms of white clouds, blue oceans, and brown and green land areas. At the top of the earth is the North Pole, and the South Pole is near the bottom of the earth. The areas surrounding the poles are large, ice-covered areas that appear white. This view of the earth from space, showing its overall appearance, is truly beautiful. Let's consider some details about the overall size and shape of the earth.

Size and shape. The earth is shaped like a large sphere. However, the earth is not perfectly round. It is slightly flattened at the poles. This means that the diameter of the earth measured from the North Pole to the South Pole is slightly less than the diameter across the middle of the earth at the equator. From pole to pole, the diameter of the earth is about 7,900 miles (12,714 kilometers). At the equator, the diameter of the earth is about 7,926 miles (12,756 kilometers). Therefore, the distance from pole to pole is 26 miles (42 kilometers) less than the diameter of the earth at the equator. This is why the earth is actually slightly flattened at the poles, although it may look perfectly round when viewed from far away in space.

In the same way, the distance around the earth is shorter at the poles than at the equator. At the poles, the earth is 24,860 miles (40,008 kilometers) around. At the equator, it is slightly greater: 24,902 miles (40,075 kilometers) around. However, the equator is not actually the "fattest" part of the earth. The distance around the earth is greatest along a circle slightly south of the equator. Therefore, the earth's shape is a little bit like that of a pear, which has its fattest part just below its middle. But this bulge in the earth's shape is so small that the earth still looks like a perfectly round sphere when viewed from space.

The earth not only has a great size in volume and distance, it also has a very, very large mass. The mass of the earth is:
13,190,000,000,000,000,000,000,000 pounds
or
5,983,000,000,000,000,000,000,000 kilograms!

The atmosphere. So far, we have only considered the solid earth and the waters upon the earth when considering its size and shape. But there is another part of "spaceship Earth" that travels with it as it travels around the sun and through the universe. This is the *atmosphere* above the earth. Air surrounds the entire earth in the atmosphere. It is like a thick, clear, spherical layer surrounding the globe of the earth. The atmosphere extends as far as 430 miles (692 kilometers) above the surface of the earth. The air in the atmosphere gets thinner and thinner the greater the distance from the surface of the earth. Above 300 miles, the atmosphere is so thin that satellites and spacecraft orbiting the earth encounter almost no resistance from the air molecules and atoms.

Complete the following activity.

1.1 In the space below, draw a circle representing "spaceship Earth."

Place a dot at the top of the circle representing the North Pole and a dot at the bottom of the circle representing the South Pole. Draw a line between the North Pole and the South Pole. Just above this line, write the number of miles between the North Pole and South Pole as a diameter of the earth. Also write that number here: a. _____ .

Draw a horizontal line at the middle of the circle representing the equator. Just above that line, write the number of miles across the earth at the equator as a diameter of the earth. Also write that number here: b. _____ .

What is the difference between the two numbers? c. _____ .

Is the earth perfectly round? d. _____ .

Answer true or false.

1.2 _____ Earth can be called a "spaceship" because it is like a vehicle carrying humans and other cargo through space.

1.3 _____ Earth's only motions are to rotate about its axis and to orbit around the sun.

1.4 _____ Earth appears to us to be very fixed and stable, but it is not.

1.5 _____ The regular motions of the earth help support and sustain life.

1.6 _____ Viewed from space, earth appears as a large sphere.

1.7 _____ The earth is perfectly round.

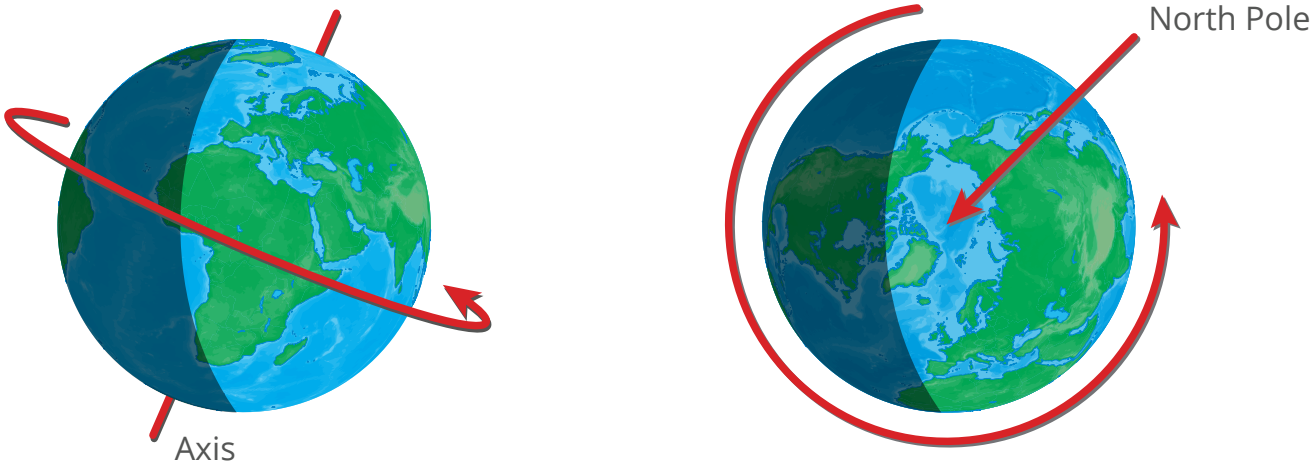
1.8 _____ At the poles, the earth is about 790 miles in diameter.

1.9 _____ The atmosphere of the earth extends to about 430 miles beyond the surface.

EARTH'S ROTATION

The motion of the earth that is most obvious is the one that produces day and night. Of course, ancient peoples thought that the sun traveled around the earth from east to west, producing day and night. Today, we know that it is actually the **rotation** of the earth that causes day and night. The rotation of the earth is the first type of motion that "spaceship Earth" experiences.

The earth rotates about an imaginary axis that extends through the North and South Poles. Rather than being straight up and down, the axis of the earth is tilted at 23.5 degrees from the vertical. The earth spins around this axis. Looking down at the earth from the North Pole, the earth would be spinning in a counterclockwise direction. One half of the earth is always illuminated as it faces the sun. The other half of the earth is always dark with night as it is turned away from the sun. As the earth rotates in a counterclockwise direction, people who have been in night will begin to see the light of the sun coming from the east. As the earth continues to rotate, they will see the sun "come up" in the east. These people will then experience daylight as their side of the earth rotates in the light of the sun. Finally, as night approaches, they will see the sun "set" in the west, and the sun will finally disappear below the horizon as the earth rotates and their location on the earth is hidden from the sun.



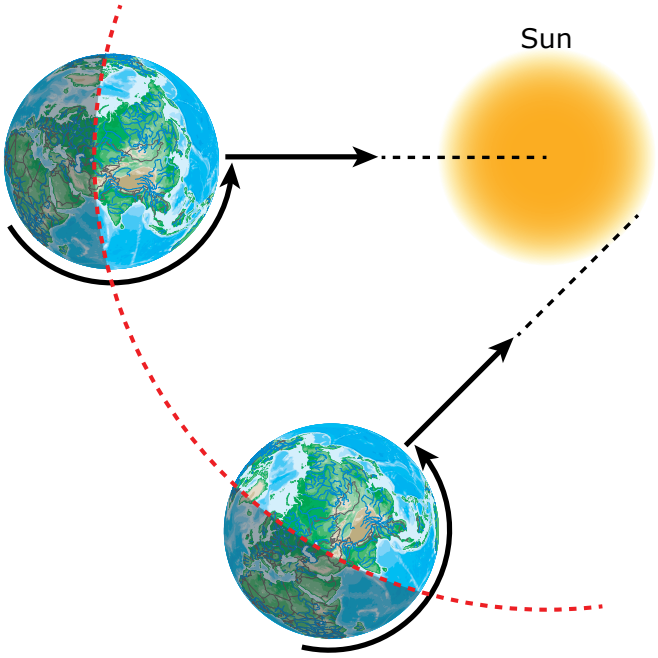
| The Earth is titled on its axis, and rotates in a counterclockwise direction.

In relation to the sun, the earth takes 24 hours to make one complete rotation about its axis. This is called a **solar day**. In relation to the very same position on earth compared to far distant stars, however, the earth takes 23 hours 56 minutes 4.091 seconds to make one complete rotation. This is called a **sidereal day**. Why this difference? The answer has to do with the fact that the earth is also slowly orbiting around the sun as it rotates each day. Therefore, in relation to the sun, a point on the earth has to travel a small amount more each day for the same point on earth to be in a direct line with the sun. This accounts for the 3 minutes 55.909 seconds difference between a *solar day* and a *sidereal day*.

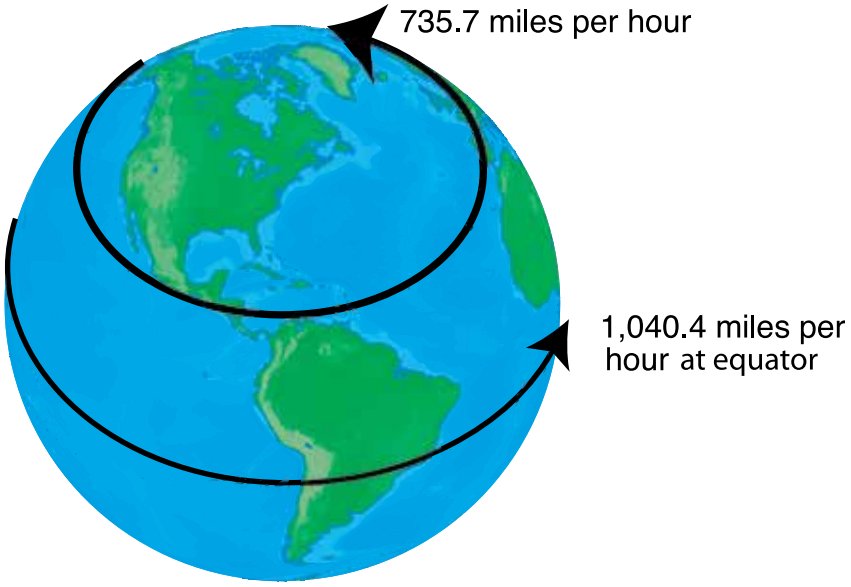
How fast do you travel as the earth rotates around its axis? The answer depends on your location on the surface of the earth. The speed due to rotation at the equator can be calculated by dividing the distance around the earth at the

equator (the distance traveled in one rotation of the earth) by the time in a sidereal day. This would be 24,902 miles divided by 23 hours 56 minutes 4.091 seconds. The answer is 1,040.4 miles per hour. So, even if you were "standing still" at the equator, you would actually be traveling 1,040.4 miles per hour due to the rotation of the earth.

If you were located half way between the equator and the North Pole, your speed would be less than it would be at the equator because the distance around the earth at that point is less: about 17,607 miles. Therefore, dividing that distance by the time in a sidereal day would give you a speed of 735.7 miles per hour due to the rotation of the earth. Earth's motion due to rotation is much faster than it normally seems as you look around you each day!



| Sidereal day



| Speeds on the Earth due to rotation

Answer these questions.

1.10 Why do we have day and night on the earth? _____

_____

_____

1.11 What is the difference between a *solar day* and a *sidereal day* ? _____

_____

_____

1.12 Why does your speed of motion due to rotation of the earth depend on your location?

_____

_____

_____

SELF TEST 1

Match these items (each answer, 3 points).

1.01	_____	orbit
1.02	_____	ellipse
1.03	_____	inertia
1.04	_____	7,900 miles
1.05	_____	24,860 miles
1.06	_____	430 miles
1.07	_____	595 million miles
1.08	_____	vernal
1.09	_____	Milky Way
1.010	_____	24 hours

a. diameter of earth at Poles
b. distance around earth at Poles
c. extent of earth's atmosphere
d. one orbit of earth around sun
e. distance from earth to sun
f. solar day
g. sidereal day
h. spiral galaxy
i. of spring
j. helps earth continue to go around sun
k. shape of the earth's orbital path around sun
l. curving path that a moving body takes around another body in space

Answer true or false (each answer, 2 points).

1.011	_____	Earth can be called "spaceship" because it is like a vehicle carrying humans and cargo through space.
1.012	_____	The regular motions of the earth help support and sustain life.
1.013	_____	Viewed from space, the earth appears as a large sphere.
1.014	_____	The earth is perfectly round.
1.015	_____	Longitude is the distance measured in degrees east or west from the International Date Line.
1.016	_____	At any time, half the earth faces the sun and the other half faces away from the sun.
1.017	_____	Due to the earth's rotation, a person would be traveling faster at the equator than he would at a position halfway from the equator to the North Pole.
1.018	_____	The military denotes 1:00 P.M. as 1300.

1.019 _____ There are three time zones in the continental United States.

1.020 _____ The earth's path around the sun is a perfect circle.

Write the correct letter and answer on the blank line (each answer, 3 points).

1.021 The earth is tilted on its axis at an angle of _____ .
a. 15° b. 23.5° c. 180°

1.022 The ancient Jews began their day at _____ .
a. sunset b. midnight c. sunrise

1.023 Each time zone around the world represents about _____ of longitude.
a. 15° b. 23.5° c. 90°

1.024 The Prime Meridian runs through _____ .
a. Los Angeles, California b. The Pacific Ocean c. Greenwich, England

1.025 When it is 8:00 A.M. in New York, it is _____ in California.
a. 7:00 A.M. b. 6:00 A.M. c. 5:00 A.M.

1.026 A leap year has _____ days.
a. 365 b. 365.5 c. 366

1.027 The earth is closer to the sun during the Northern Hemisphere's _____ .
a. summer b. fall c. winter

1.028 The earth travels around the sun in an orbit shaped like a(n) _____ .
a. ellipse or oval b. straight line c. perfect circle

1.029 The seasons in the Southern Hemisphere are _____ from the ones in the Northern Hemisphere.
a. the same as b. one season behind c. reversed

1.030 The North Pole is dark 24 hours a day in _____ .
a. the summer b. August c. the winter

1.031 "Spaceship Earth" travels about _____ miles per hour in its journey around the center of the Milky Way.
a. 150 b. 7,900 c. 101,000

Complete this list (each item, 2 points).

1.032 List 4 ways that "spaceship Earth" is in motion.

a. _____

b. _____

c. _____

d. _____

Answer these questions (each answer, 3 points).

1.033 How do night and day occur on the earth? _____

_____

_____

1.034 What are the seasons of the year and how do they occur? _____

_____

_____

_____

1.035 What happens when the vernal and autumnal equinoxes occur? _____

_____

_____

_____

_____

80/100 **SCORE** _____ **TEACHER** _____ _____
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Alpha Omega
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800-622-3070
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