LIFEPAC®

SCIENCE

STUDENT BOOK

9th Grade | Unit 10

Alpha Omega
PUBLICATIONS

SCIENCE 910

Science Review

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

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Science Review

Introduction

The comforts of modern life rely on the developments of science. Technology is the result of practical advances in science. The ideas covered in a study of science often have important practical applications. In this LIFEPAC® you will review the material in LIFEPACs 901 through 909 and study some practical applications of the science you have learned.

The units of measurement used in science are the same units that are used in commerce. Questions involving volume, mass, and length arise daily. A good understanding of measurement is not only important in science but also in our everyday lives.

The health sciences are very important to you because they concern the function and care of your body. Vaccinations, water and sewage treatment, and medical care help provide for a lifetime of good health. Foreign travel, camping, and hiking require special applications of some basic scientific information. Each person must care for his own body. In 1 Corinthians 6:19-20 we are told that our bodies are the temple of God. Christ has commanded us to care for our bodies so that we may better serve the kingdom of God.

The United States is a land of many geological wonders. Our nation has some of the world's most majestic mountains, canyons, seacoasts, and waterways. Ecclesiastes 3:11 states that God has made every thing beautiful. An understanding of geology makes visits to these beautiful areas of God's Creation more meaningful and interesting.

With the advancements of science has come an increase in population and living standards which, in turn, increase our demand for energy. The use of this energy for transportation and technology causes pollution. The chemicals needed to help the earth to produce sufficient food may have unfortunate side effects for animals, plants, and people. Just as the Lord God put Adam in the garden of Eden (Genesis 2:15) "...to dress it and to keep it," we are also to be caretakers of the earth. Educated persons need to make wise decisions so that the earth can provide for the basic needs of many people.

Objectives

Read these objectives. The objectives tell you what you will be able to do when you have successfully completed this LIFEPAC. When you have finished this LIFEPAC, you should be able to:

1. List the common metric units for length, volume, and mass.
2. Convert units of length, volume, and mass from English to metric units.
3. Define weight and mass.
4. List health precautions that travelers can take before and during a visit to foreign nations.
5. List important health concerns for campers and hikers.
6. Prepare a personal health record.
7. List four ways that land areas are constructed.
8. Describe how erosion provides the raw materials needed for land construction.
9. Describe how plate tectonics explains mid-ocean ridges, volcanoes, earthquakes, and new crust formation.
10. Describe the earth in relation to the solar system, the Milky Way, and the universe.
11. Name three types of telescopes.
12. Name two functions of the space program.
13. Sketch an atom and label its parts.
14. Define fission and fusion.
15. List five alternative energy sources that could help conserve fossil fuels.
16. Discuss the problems of increasing populations.
17. Discuss the problems of environmental damage.

Survey the LIFEPAC. Ask yourself some questions about this study and write your questions here.

1. PRACTICAL USES OF MEASUREMENT

Every day people are confronted with problems involving the use of length, volume, **mass**, and **weight**. Vacationers cannot pack for a trip without considering the volume of the car trunk. Air travelers must be concerned with mass since airlines still weigh the amount of luggage a passenger may take. Hikers take dried food on the trail because fresh food is too heavy to carry.

Highway signs give distances to major towns and intersections.

The United States is undergoing a slow conversion to the metric system. All government publications now use both the metric and English units. Scientists have always used the metric system. The United States is the only major world country not using the metric system of measure.

SECTION OBJECTIVES

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

1. List the common metric units used for length, volume, and mass.
2. Convert units of length, volume, and mass from English to metric units.
3. Define weight and mass.

VOCABULARY

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

kilogram (kil´ u gram). The standard unit of mass used in the metric system; (kg).

liter (lē ´ tur). The standard unit of volume in the metric system; (L).

mass (mas). The amount of matter in an object.

meter (mē ´ tur). The standard unit of length in the metric system; (m).

weight (wā t). A measure of the pull of gravity on an object.

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**ă**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; /*u*/ 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 METRIC SYSTEM

The metric system is based on decimals. The United States dollar, which is also based on a decimal system, can be compared to metrics. The dollar is divided into dimes and pennies. To convert from one dollar ($1.00) to one dime ($.10) all that is required is to move the decimal point to the left one place. In converting from one dime ($.10) to one penny ($.01) the decimal point is simply moved again one place. To move from penny to dime and back to dollar is only a matter of moving the decimal point to the right rather than to the left.

The modern metric system is known as the International System of Units. The name International System of Units with the international abbreviation SI was given to the system by the

General Conference on Weights and Measures in 1960.

Length. Centimeters, **meters**, and kilometers are the metric units corresponding to the English units of inch, foot, yard, and mile. Remember the example of the dollar and apply it to the use of centimeters. This page is 21.3 centimeters wide. To express the width of this page in meters is just a matter of moving the decimal point two places to the left to become .213 meters. If for some reason it was necessary to express this page width in kilometers, the decimal would be moved three additional places to the left and become .000213 kilometers.

Contrast the ease of that operation with that required in the English system. This page is 8.375 inches wide. To convert this measurement to feet requires remembering that 12 inches is equal to one foot. After division the number is .698 feet. To convert this measurement into units of a mile is even more awkward. This time the conversion factor is 5,280 feet per mile. Once again long division is required to determine that this page is .00013 miles wide. In the English system many conversion factors have to be memorized and many more errors are likely to occur.

Volume. Teaspoons, tablespoons, cups, quarts, and gallons are the basic units of volume in the English system. The metric system makes use of milliliters and liters. Although most American recipes are still given in the English system, new cookbooks are listing metric units in the margin. Multiplying a recipe to serve a crowd requires cumbersome conversions in the English system. Most cooks would have to search through a cookbook to find the table of conversions, which states that three teaspoons equals one tablespoon and that sixteen tablespoons will fill one cup. If a multiplied recipe called for 40 teaspoons of an ingredient, dividing by 3 would be necessary to determine that 13.3 tablespoons were needed. Since 16 tablespoons equals one cup by dividing 16 into 13.3, the cook would learn that a quantity of .83 cups is needed. Still the problem is not solved. Because measuring cups are not marked off in those units, it would be difficult to measure out exactly .83 cups of an ingredient.

A metric recipe is easy to multiply for service to a crowd. If a recipe must be tripled and if it called for 20 milliliters of sugar, multiplying by three would indicate that 60 milliliters were needed. If 500 milliliters of flour were required for one recipe, then 1,500 milliliters would be needed for a triple recipe. Since 1,000 milliliters equals a liter, this amount of flour would be equal to 1.5 liters. Metric recipes require no awkward mathematics or charts when a cook wishes to alter a recipe.

Complete this activity.

1.1 What metric unit would best measure each of the following items?

millimeter, meter, milliliter, metric ton, centimeter, kilometer, liter

a. _____ fabric

b. _____ volume of a soft drink can

c. _____ size of a garden

d. _____ thickness of a book

e. _____ auto gas tank

f. _____ diameter of pipe

g. _____ size of a house

h. _____ amount of liquid medicine to take daily

i. _____ truck load of sand

j. _____ distance to Chicago

k. _____ amount of salt in a cake

l. _____ height of a building

m. _____ length of a watch band

n. _____ depth of a swimming pool

o. _____ water needed to fill an aquarium

WEIGHT VERSUS MASS

Mass is the measurement of the amount of matter in an object. **Weight** is a measure of the pull of gravity on that object. The distinction between the two ideas is rarely necessary in daily life unless one is a science student. In science it is important to know the difference between weight and mass.

Weight. Many everyday products are sold by weight. Potatoes, meat, and most foods are sold by weight. Many Americans are constantly watching their weight. The post office weighs your package. Wrestlers are placed in weight classes and only compete with other wrestlers of the same weight class.

Weight is the measure of the pull of gravity on an object. Scientists tell us that every object exerts a force of gravity on every other object in the universe. These forces are too small to measure; they are almost too small to even think about! Only when large bodies are involved is the pull of gravity easily measurable. Bodies as large as the earth or the moon have gravities that are easily measured. The iron core of the earth has a high density. Since it is so dense it has a very great pull on objects on the surface of the earth. The farther an object is from the center of the earth, the less the pull of gravity would be. If you would weigh yourself on a mountaintop and then at sea level, you would discover that you weighed less on the mountain peak.

Mass. The mass of an object does not depend on gravity. Mass is a measure of the amount of matter in an object as determined by comparing it to the amount of matter in a known object. Old-fashioned candy scales had two pans. A metal object equal to the amount of candy to be purchased was put on one pan. Candy was then added to the other pan until the two pans balanced. You made a similar type of balance in LIFEPAC 902. This type of balance is used by scientists.

The mass of an object remains the same anywhere in the universe. Weight changes with a change in elevation on the earth or the mass of the planet. In outer space between planets where gravity does not exist, astronauts have mass but not weight. Photographs of space flights often show astronauts floating freely in space. This lack of weight has caused many interesting problems in space travel. Astronauts have trouble cutting their hair because

uncontrolled trimmings float around the space craft and get into the instruments. That problem was solved by holding a vacuum cleaner right over the scissors. Showering presented another problem. The water just stayed around their bodies and would not drip off. The astronauts finally resorted to scrubbing themselves with moist towels instead of using the shower.

Units of mass. Although mass and weight are not actually comparable units, they are used interchangeably in everyday measurement.

Since most instruments are not sensitive enough to measure minute differences in gravity, when metric and English systems are equated, the numbers used are those at sea level. Units of mass in the metric system are the gram, **kilogram**, and metric ton. Units in the English system are the ounce, pound, and ton. To convert from ounces to pounds to tons requires knowing that 16 ounces equals one pound and 2,000 pounds is equivalent to one ton. In the metric system, grams, kilograms, and metric tons can be converted simply by moving the decimal point the proper direction and number of places.

A student weighing 90 pounds would have to multiply by 16 to learn that his weight was 1,440 ounces. This same student would need to remember that 2,000 pounds is equivalent to one ton before the 90 pounds could be converted to .045 ton. A student using the metric system does not even need pencil and paper to convert into either larger or smaller metric units. A 45 kilogram person weighs 45,000 grams or .045 metric tons. All that is required is proper placement of the decimal point.

Conversions				
	English Units	Metric Units	English to Metric	Metric to English
Length	inch	centimeter	1 in. = 2.54 cm	1 cm = .4 in.
	foot		1 ft. = 0.3 m	1 m = 3.3 ft.
	yard	meter		
	mile	kilometer	1 mi. = 1.6 km	1 km = .6 mi.
Volume	cup	milliliter		
	quart	liter	1 qt. = .95 L	1 L = 1.06 qt.
	gallon			
Mass	ounce	gram	1 oz. = 27 g	
	pound	kilogram	1 lb. = 454 g	1 kg = 2.2 lb.
	ton	metric ton		

Figure 1 | English and Metric Units

Complete these activities.

1.2 Convert each of the following items into the appropriate metric unit.

a. 10 pounds of potatoes = _____

b. 3 yards of fabric = _____

c. a 1-ounce candy bar = _____

d. a gallon of milk = _____

e. a 1-pound loaf of bread = _____

f. 15 gallons of gas = _____

g. 2 miles to school = _____

h. a 30-inch waist = _____

i. a 6-foot deep pool = _____

j. a 4-inch flower pot = _____

k. a 15-foot canoe = _____

l. a 60-mile trip = _____

m. a 2-quart canteen = _____

n. 26-inch bicycle = _____

o. a 10-foot high jump = _____

p. an 8-mile hike = _____

1.3 If you lived in a city that was 600 meters above sea level would you weigh more or less when you went to visit these other cities? You will need to use an atlas to find elevations.

a. New York City _____

b. London, England _____

c. La Paz, Bolivia _____

d. San Francisco _____

e. Quito, Ecuador _____

f. Lima, Peru _____

g. Melbourne, Australia _____

h. Mexico City, Mexico _____

i. Rio de Janeiro, Brazil _____

j. Denver, Colorado _____

1.4 Optional: The October 1974 issue of National Geographic had an interesting and amusing article called "Skylab" telling of life on the space laboratory. We often complain because things are too heavy. On Skylab the astronauts found that weight was sometimes a handy force. Do some online research and list five interesting situations that astronauts face because their equipment has no weight.

a. _____

b. _____

c. _____

d. _____

e. _____

TEACHER CHECK _____ initials _____ date

Review the material in this section to prepare for the Self Test. The Self Test will check your understanding of this section. The items you missed on this test will indicate specific areas where restudy is needed for mastery.

SELF TEST 1

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

1.01 65 milliliters = _____ liters

1.02 280 meters = _____ kilometers

1.03 21 kilograms = _____ grams

1.04 8,320 milliliters = _____ liters

1.05 4.5 kilograms = _____ grams

1.06 .35 meters = _____ centimeters

1.07 .71 liters = _____ milliliters

1.08 6.1 meters = _____ kilometers

1.09 .003 kilometers = _____ meters

1.010 10.5 liters = _____ milliliters

1.011 32 grams = _____ kilograms

1.012 150 centimeters = _____ meters

1.013 12 meters = _____ centimeters

1.014 .35 kilometers = _____ meters

1.015 6,250 grams = _____ kilograms

1.016 50 centimeters = _____ meters

Complete these sentences (each answer, 3 points).

1.017 America is undergoing a gradual change to the _____ system.

1.018 The only major world country not using the metric system is

_____ .

1.019 An object taken from the earth to the moon would have the same mass but a different

_____ .

Define these terms (each answer, 5 points).

1.020 mass _____

1.021 weight _____

Perform the following numerical conversions (each answer, 3 points).

1.022 three miles to school = _____ kilometers

1.023 two-quart casserole = _____ liters

1.024 ten gallons of gas = _____ liters

1.025 two-ounce candy bar = _____ grams

1.026 six-inch flower pot = _____ centimeters

Answer these questions (each answer, 5 points).

1.027 If you could travel to a distant planet, how would your weight and mass be affected on the planet's surface? _____

_____

1.028 As you traveled through the space between planets, how would your weight and mass be affected? _____

_____

74/92 **SCORE** _____ **TEACHER** _____ _____
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