LIFEPAC®

SCIENCE

STUDENT BOOK

7th Grade | Unit 2

Alpha Omega
PUBLICATIONS

SCIENCE 702

Perceiving Things

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

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Perceiving Things

Introduction

God gave you five senses to use. With these senses you can **perceive**, or be aware of, God's creation all around you. With your eyes you perceive how things look. With your ears you perceive how things sound. With your hands you perceive how things feel. With your tongue and nose you perceive taste and odor.

When we use our ability to perceive, we take in information with our minds. We observe things and perceive how they are.

Measurement is a tool that we use in perceiving things as they are. We are always asking questions that involve measurement. How much is left? How many are going? How tall is that building? How heavy is the book? How far did he go? How soon are they coming? We answer all of these questions by measuring.

Measurement involves using a standard. *When we measure, we compare the object we are measuring with a measurement standard.* To find the measurement of the object, we count how many of the standard units are needed to equal the object.

In this LIFEPAC® you will learn about the standard units in the metric system of measurement. You will practice using these units, these standards, to measure objects around you. You will learn how to make a graph to report data you collect and how to use your graphs to predict additional information. In the Bible we learn that Christ is the standard by which our lives are measured. You will discover some Biblical standards for your life and determine how you measure up to God-given patterns and standards.

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. Name the units of measurement in the metric system.
2. Tell about the history of the metric system.
3. Explain the advantages of the metric system.
4. Use the metric measurement units correctly.
5. Construct several kinds of graphs.
6. Determine the best graph to represent various data.

1. MEASUREMENT

The **metric system** is a set of units for measuring length, temperature, time, and mass. The units for length can, in turn, be used to find the measurements of area and volume. No other system of measurement is so simple to use. Scientists have been using the metric system for years. The metric system seems difficult to many people because they are not familiar with the terms or the structure of the system. Once a person becomes thoroughly familiar with the terms and the structure, he finds the system easy to use. Learning the metric system is much like learning a foreign language. As long as you have to translate the foreign language into English to understand it, it is difficult to use. As soon as you know the foreign language well enough to *think* it without translating, it is easy. So it is with metrics.

In this section you will learn about the metric system. You will also practice using the various metric units of measurement. Remember, measurement can never be exact because of human error and inaccuracy of the measuring tools. Taking several measurements and finding an average gives a better estimate of the true measurement than does one single measurement.

SECTION OBJECTIVES

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

1. Name the units of measurement in the metric system:
   - 1.1 Name the units of length.
   - 1.2 Name the units of area.
   - 1.3 Name the units of volume.
   - 1.4 Name the units of temperature.
   - 1.5 Name the units of time.
   - 1.6 Name the units of mass.
2. Tell about the history of the metric system.
3. Explain the advantages of the metric system.
4. Use the metric measurement units correctly:
   - 4.1 Use the units for length.
   - 4.2 Use the units for area.
   - 4.3 Use the units for volume.
   - 4.4 Use the units for mass.

VOCABULARY

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

area (er' ē u). An amount of surface.

centi- (sen' tu). One-hundredth (.01).

centimeter (sen' tu mē' tur). A measure equal to one-hundredth of a meter.

circumference (sur kum' fur uns). The distance around.

cubic centimeter (kyü' bik sen' tu mē' tur). A unit of measure equal to the space enclosed by a cube 1 cm by 1 cm by 1cm.

cubic meter (kyü' bik mē' tur). A unit of measure equal to the space enclosed by a cube 1 m by 1 m by 1m.

cylinder (sil' un dur). Any long, round object, solid or hollow, with flat ends.

decimal system (des' u mul sis' tum). A system of numeration that is based on units of ten.

decimeter (des' u mē' tur). Unit of measure equal to one-tenth of a meter.

diameter (dī am' u tur). A line passing from one side to the other side through the center of a circle, sphere, or cylinder.

gram (gram). A unit of mass equal to the mass of 1 cubic centimeter of water at 4° C.

gravity (grav' u tē). A force that pulls objects toward the center of earth and gives weight to objects.

kilo- (kē' lō). One thousand (1,000).

kilogram (kil' u gram). A measure equal to one thousand grams.

kilometer (ku lom' u tur). A measure equal to one thousand meters.

liter (lē' tur). The basic measure of volume in the metric system.

mass (mas). The quantity of matter anything contains.

measurement (mezh' ur munt). Finding the size, quantity, or amount by comparing with a standard.

meter (mē' tur). The basic measure of length in the metric system.

metric system (met' rik sis' tum). A decimal system of weights and measures.

milli- (mil' u). One-thousandth (.001).

milliliter (mil' u lē' tur). Unit of measure equal to one-thousandth of a liter.

millimeter (mil'u mē' tur). Unit of measure equal to one-thousandth of a meter.

perceive (pur sēv'). To be aware of through the senses.

square centimeter (skwer sen' tu mē' tur). Unit of measure of an area equal to 1 cm by 1 cm.

square kilometer (skwer ku lom' u tur). Unit of measure of an area equal to 1 km by 1 km.

square meter (skwer mē' tur). Unit of measure of an area equal to 1 m by 1 m.

standard unit (stan' durd yü' nit). Reference point from which all other measurements are made.

volume (vol' yum). Space occupied, as measured in three dimensions.

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**ėr**m; **i**t, **ī**ce; h**o**t, **ō**pen, **ô**rder; **oi**l; **ou**t; c**u**p, p**u̇**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 take**n**, /*i*/ in penc**i**l, /*o*/ in lem**o**n, and /*u*/ in circ**u**s.

HISTORY OF THE METRIC SYSTEM

The metric system began in France in 1670. Gabriel Mouton developed a system of **measurements** to replace the inefficient units then in use. His system was later revised by French scientists. Much of this revision was done by the scientist Lavoisier and the mathematician Lagrange. The system was called *metric* from the Greek word *metron* which means *measurement*.

The United States showed an early interest in the metric system. In 1792 the United States adopted the system of decimal currency. In 1821 John Quincy Adams asked Congress to adopt the entire metric system. It was not adopted at that time because the United States traded mostly with England and Canada and neither of these countries used the metric system. In 1866 Congress made metric units legal but did not take any action toward requiring the change to metric measurements.

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.

When Great Britain began a ten-year plan in 1965 to adopt metrics, the United States again became interested. In 1968 Congress authorized a study of metrics and recommended a step-by-step conversion. In 1974 however, the House of Representatives defeated the bill calling for conversion to metrics. Some groups and certain industries still proceeded to convert to metrics. In 1975 President Gerald Ford signed the Metric Conversion Act, but the United States still has not changed completely to metrics. Canada began converting to the metric system in the early 1970s.

Complete these statements with the information from this section.

1.1 The metric system contains sets of units to measure a. _____ ,
b. _____ , c. _____ , and d. _____ .

1.2 Scientists around the world use the _____ system.

1.3 *Meter* comes from the Greek word a. _____ , which means
b. _____ .

Complete these activities.

1.4 Complete the following time line to show the historical development of metrics in the United States.

1800

1980

ADVANTAGES OF THE METRIC SYSTEM

The use of the metric system has four advantages. First, the metric system is a **decimal system**. It is a base ten system similar to our currency system. Units in the metric system are increased or decreased by tens. For example, a **meter** has ten parts called **decimeters**. A decimeter has ten parts called **centimeters**. A centimeter has ten parts called **millimeters**. In the English system that our country currently uses this relationship is absent. For example, a yard does not have ten parts; it has three parts called feet. A foot does not have ten parts or three parts, but twelve parts called inches.

Second, the prefixes used in the metric system for designating parts of a unit are the same throughout the system. The prefixes **milli-, centi-,** and **kilo-** are used with **grams** as well as with meters or **liters**—all metric units. In the English system no such prefixes help us to understand the units of measurement.

Third, the metric system has only seven basic units that make up all measurements. For example, in measuring **volume** in metrics, the units are **milliliter** and liter. These two units replace the fluid ounce, teaspoon, tablespoon, cup, pint, quart, and gallon (units in the English system).

Finally, the metric system is much easier to use in computation of measurements. Compare the following two additions. The metric computation requires no changing of one unit to another. In the English system, the total number of inches is changed to feet and inches; and feet to yards and feet.

	1 yd.	2 ft.	8 in.	1.72 m
	2 yd.	2 ft.	10 in.	2.69 m
+	3 yd.	2 ft.	7 in.	3.53 m
	6 yd.	6 ft.	25 in.	7.94 m
=	6 yd.	8 ft.	1 in.	
=	8 yd.	2 ft.	1 in.	

Complete this activity.

1.5 List *and* give an example of the four advantages of using the metric system.

a. _____

Example: _____

b. _____

Example: _____

c. _____

Example: _____

d. _____

Example: _____

UNITS OF THE METRIC SYSTEM

A *standard* is the reference point from which all other measurements are made. Throughout history such things as a barley corn or the width of one's hand were used as standards. Noah used a unit of length called a cubit when he designed and built the ark as God told him. The cubit of Noah's time was the distance of an extended arm and hand from the elbow to the tip of the middle finger. In some respects this unit was a handy measuring unit. The unit was always available and reasonably convenient to use. To the early Babylonians and Egyptians, the cubit was an important unit of length.

Write an operational definition.

1.6 Throughout this LIFEPAC, you will be asked to write an operational *definition* for each kind of measurement. An operational definition is one that tells how to do something. It gives the steps and actions involved. Try writing an operational definition for measuring the length of an object. How would you measure your pencil if your standard of measurement were not a *centimeter,* but a paper clip? Write a step-by-step definition.

a. _____

_____

_____

_____

Did your operational definition include what you used for a unit and what you did with it in order to find the length of your pencil? A possible operational definition can be stated:

To find the length of my pencil, I would use a paper clip as the unit of measurement. I would count how many times the paper clip fit along a line that is the same length as my pencil. The number of paper clips would tell me how many paper clips long my pencil is.

If you had no trouble writing the operational definition, go on to the next part. If you had trouble writing an operational definition, read the example again. Write an operational definition for measuring the width of your desk, using some handy object as a standard of measurement.

b. _____

_____

_____

_____

Meter—the standard unit of length. We can measure such things as the height of a door, the length of a room, or the distance around a patio. We can use the meter to measure the height of a mountain or the length of a river. We can use the meter to measure the altitude of an airplane or the depth of an ocean. In metrics the meter is the **standard unit** of length.

The meter originally represented one ten-millionth of the distance from the North Pole to the equator along the line of longitude near Dunkerque, France. Today the meter is defined as the length of 1,650,763.73 wavelengths of the orange-red light from the isotope krypton 86 when measured in a vacuum. In more common terms the meter is slightly longer than a yard.

In order to measure small things more accurately we can use the centimeter (one-hundredth meter) or the millimeter (one-thousandth meter). To measure longer distances, such as those between cities, we can use the **kilometer** (one thousand meters).

Read about the history of measurement in an encyclopedia or other reference book.

1.7 On a piece of paper, write an essay explaining the need for a standard unit. Have your teacher read your essay and discuss it with you.

TEACHER CHECK _____ initials _____ date

Use a centimeter ruler to measure the following items.

1.8 Measure each item to the nearest centimeter.

a. _____ b. _____ c. _____

One meter contains one hundred centimeters (1 m = 100 cm). A centimeter is one-hundredth (.01) of a meter.

You can use the decimal system to write meters and centimeters just as you use the decimal system to write dollars and cents. If you have 364 cents, you can write the amount of money that you have as 364¢ or as $3.64. In the same way if you have 364 centimeters, you can write it as 364 cm or as 3.64 m. The abbreviation for centimeter and meter is *cm* and *m* respectively. You do not use a period after metric abbreviations.

Complete the following statements. The symbol ↔ means "is the same as," and the statement can be read either to the right or to the left. Example: 1 m ↔ 100 cm can be read "1 meter is the same as 100 centimeters" or "100 centimeters is the same as 1 meter."

1.9 100 cents ↔ _____dollar

1.10 100 cm ↔ _____ m

1.11 _____ cents ↔ 7 dollars

1.12 _____ cm ↔ 7m

1.13 3 dollars 97 cents ↔ _____ cents

1.14 3 m 97 cm ↔ _____ m or _____ cm

1.15 _____ ↔ $6.97

1.16 _____ or _____ ↔ 6.97 m

Use a meter stick to measure the following objects in your classroom. Compare your measurements with those of a classmate.

1.17 _____ height of classroom door

1.18 _____ distance around your desk

1.19 _____ width of a window

1.20 _____ length of your arm

A meter is made up of one thousand millimeters (1 m = 1,000 mm). A millimeter is one-thousandth (.001) of a meter. The abbreviation mm is used for millimeter. Millimeters are used to make more accurate measurements than you can make with meters or centimeters. The smaller the comparison unit, the more precise the measurement can be. For example, when a line is measured, it is more precise to say 18 mm than to say 2 cm.

Kilometers are used to measure distances between cities. The abbreviation km is used for kilometers. A kilometer is equal to one thousand meters (1 km = 1,000 m).

1,000 mm = 1 m

100 cm = 1 m

1,000 m = 1 km

Complete the following statements.

1.21 1000 mm ↔ _____ m

1.22 3000 mm ↔ _____ m

1.23 _____ mm ↔ 5 m

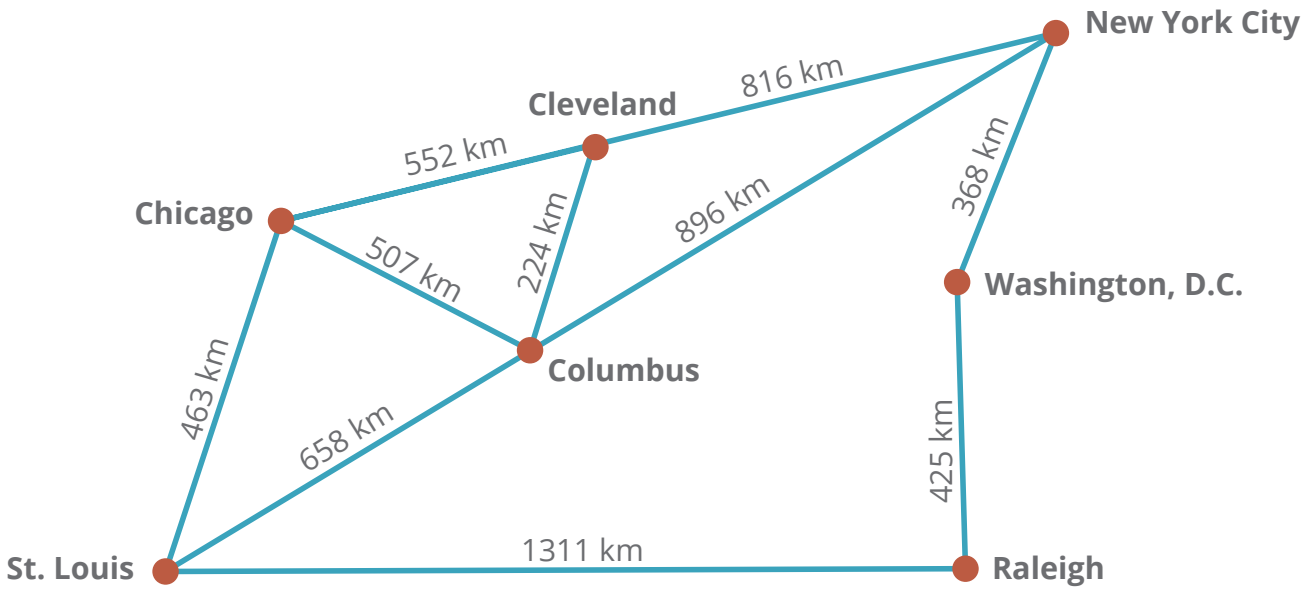
1.24 _____ mm ↔ 2 m

1.25 1000 m ↔ _____ km

1.26 4000 m ↔ _____ km

1.27 _____ m ↔ 7 km

1.28 _____ m ↔ 9 km



Use the map to find the distance between the following cities.

1.29 Chicago to Cleveland is _____ km.

1.30 Washington, D.C., to New York City is _____ km.

1.31 Cleveland to Columbus is _____ km.

1.32 New York City to St. Louis is _____ km.

SELF TEST 1

Complete the following sentences (each answer, 3 points).

1.01 The metric system is a set of units for measuring a. _____ ,
b. _____ , c. _____ , and d. _____ .

1.02 Units of length can be used to measure the a. _____ (surface) and the
b. _____ (space) of an object.

1.03 The metric system was developed in a. _____ in the year b. _____ .

1.04 The *standard* unit for mass is the _____ .

1.05 The standard unit for length is the _____ .

1.06 The standard unit for volume is the _____ .

1.07 The unit of length that Noah used in building the ark was the _____ .

1.08 The pattern by which our lives will be measured is _____ .

Answer true or false. If a sentence is false, cross out the incorrect word or words and write in words which make the statement correct (each true-false, 1 point; each correction, 3 points).

1.09 _____ The United States is one of the few countries that does not fully use the metric system for measurement.

1.010 _____ The mass of an object changes as the distance from the center of gravity changes.

1.011 _____ An equal-arm balance is used to measure mass.

1.012 _____ Weight measures the matter in an object.

1.013 _____ One milliliter is equal to one cubic centimeter.

1.014 _____ Mass is the amount of matter an object contains.

1.015 _____ Measurement helps us perceive things as they are.

Match these words and abbreviations. On the line in front of each unit in Column I write the letter from Column II that tells what the unit measures. On the line following each unit, write the correct abbreviation for that unit (each numbered item, 2 points).

	Column I	Column II
1.016	_____ meter _____	a. mass
1.017	_____ liter _____	b. area
1.018	_____ square centimeter _____	c. volume
1.019	_____ cubic centimeter _____	d. length
1.020	_____ gram _____	
1.021	_____ centimeter _____	
1.022	_____ square meter _____	
1.023	_____ square kilometer _____	
1.024	_____ millimeter_____	
1.025	_____ milliliter _____	
1.026	_____ cubic meters _____	
1.027	_____ kilometer _____	
1.028	_____ kilogram _____	

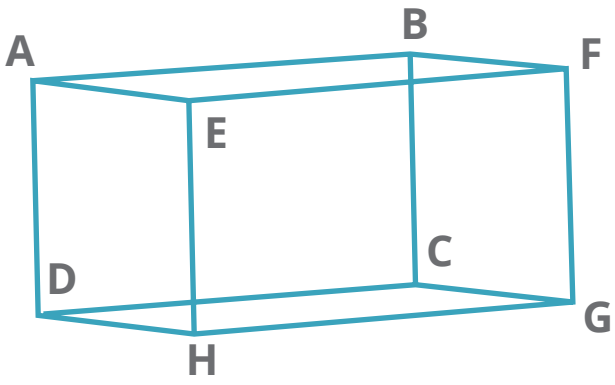
Measure and compute (each answer, 3 points).

1.029 **Measure** the length of each line segment to the nearest centimeter.

a. AE _____

b. AB _____

c. AD _____



1.030 **Compute** the area of each side.

a. ABFE _____

b. BFGC _____

c. EFGH _____

1.031 **Compute** the volume of the figure. _____

Write the answers to the following questions. Your teacher will help you assign points for each answer (each answer, 5 points).

1.032 Write an operational definition for finding the mass of your shoe. _____

_____

_____

_____

1.033 Tell how the mass for a gram unit was chosen. _____

_____

_____

_____

Complete these activities (each numbered item, 5 points).

1.034 List four advantages of the metric system.

a. _____

b. _____

c. _____

d. _____

1.035 Tell why it is necessary to have standard units if we want to communicate measurements to other people. _____

_____

_____

_____

95/119 **SCORE** _____ **TEACHER** _____ _____
initials date

SCI0702 – May '14 Printing

ISBN 978-0-86717-762-6

Alpha Omega
PUBLICATIONS

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