LIFEPAC®

SCIENCE

STUDENT BOOK

8th Grade | Unit 10

Alpha Omega
PUBLICATIONS

SCIENCE 810

Science And Technology

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

Author:
Hilda Bruno, M.A.

Editor-In-Chief:
Richard W. Wheeler, M.A.Ed
Editor:
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Westover Studios Design Team:
Phillip Pettet, Creative Lead
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Nick Castro
Andi Graham
Jerry Wingo
Don Lechner

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

Science And Technology

Introduction

We are blessed with a natural curiosity that may lead us into strange places. This curiosity stimulates questions and a search for answers. When the study of natural and physical things in the world is conducted in an orderly fashion, we arrive at a scientific conclusion. When the conclusion is applied in a practical way, it is technology. In Science LIFEPACs 801 through 809, you have studied science and technology. These two areas are the basis for many types of jobs and gratifying careers.

Even before God closed off the garden of Eden, God told Adam and Eve to keep the garden; He told them to work. The Bible becomes even more emphatic about this instruction in 2 Thessalonians 3:10. The apostle Paul wrote to God's people, "...if any would not work, neither should he eat." God expects us to work, but He provides a reward if we work well. Jesus said in Luke 10:7 that "...the labourer is worthy of his hire."

You are old enough to think seriously about plans for your future. Ask God to open your eyes to all the possibilities and to guide you. In the next ten years, the number of people expected in the work force is greater than the number of jobs anticipated. Do you think you should quit school as soon as you can so you can jump into the competition for a job? Vocational analysis in government, industry, and labor say a loud "No." Employers are becoming more careful in their hiring practices. The better qualified applicant will get the job.

You have not had enough education or experience to decide on a vocation now. In this LIFEPAC®, we shall review the science you have studied, we shall consider technology, and we shall try to make personal career choices. Practical application of science principles will be made to help you. Ask God's help each time you open this LIFEPAC. He will guide your thinking and planning.

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. Compare science of the past to science of the present.
2. Explain the scientific method.
3. Calculate measurements in the metric system.
4. Describe the characteristics of matter and matter in change.
5. List examples of potential and kinetic energy and show work accomplished.
6. Explain the forms of conversion of energy.
7. Describe magnetism and its relation to electricity.
8. List vocations available in science and technology dependent on electricity.
9. Explain the meaning of work scientifically and in view of Christian responsibility.
10. List simple machines and explain each in terms of examples from daily life.
11. Explain how the human body functions like a machine.
12. Tell how we must care for our body as "the temple of God."
13. List job opportunities in the life sciences.
14. Describe the balance and disruptions of nature and state your place in the universe.
15. Describe vocational opportunities in science and technology.
16. Develop techniques for working out a career plan.

1. BASIC SCIENCE

Vocations in science today require certain general skills. You must work according to the scientific method, record findings carefully and in order, and develop skill in mathematics and measurements.

Proficiency in general scientific skills is excellent, but it will not guarantee a job for you. You must develop two personal skills, **adaptability** and **resiliency**. If you are willing to accept circumstances and move along with good humor when things do not work out just as you desire, your chance for success is good. Putting road blocks in front of us is one way God directs us to do His will. He also wants us to be persevering and to stick with the task if we are convinced it is what God wants us to do.

The earth and all that is in it was created by God. To understand the world around us requires a basic understanding of the smallest particles of matter.

SECTION OBJECTIVES

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

1. Compare science of the past to science of the present.
2. Explain the scientific method.
3. Calculate measurements in the metric system.
4. Describe the characteristics of matter and matter in change.

VOCABULARY

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

adaptability (u dap tu bil' u tē). Power to change easily to fit different conditions.

anthracite (an' thru sīt). A coal that burns with very little smoke or flame; hard coal.

bituminous (bu tü' mu nus). Coal that burns with much smoke and yellow flame; hard coal.

chemical formula (kem' u kul fôr' myü lu). An expression showing by symbols and figures the composition of a compound.

electrolysis (I lek trol' u sis). The decomposition of a chemical compound by the passage of an electrical current through a solution of the compound.

electroplate (I lek' tru plāt). To cover with a coating of metal by means of electrolysis.

experiment (ek sper' u munt). To try to find out; make trials, tests.

investigate (in ves' tu gāt). To search into; examine closely.

ion (ī un). An electrically charged particle.

isotope (ī' su top). Any of two or more forms of a chemical element having the same chemical properties and same atomic number but different atomic weights.

molecular structure (mu lek' yu lur struk' chur). Manner in which the atoms of a particular molecule are attached to one another.

obsolete (ob' su lāt). No longer in use; out-of-date.

proficiency (pru fish' un sē). Knowledge; skill, expertness.

prospective (pru spek' tiv). Looking forward to the future.

residue (rez' u dü). What remains after a part is taken; remainder.

resiliency (ri zil' e un sē). The power of springing back; buoyancy, cheerfulness.

structure (struk' chur). In chemistry the manner in which atoms making up a particular molecule are attached to one another.

subscript (sub' skript). Written underneath or low on the line.

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**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.

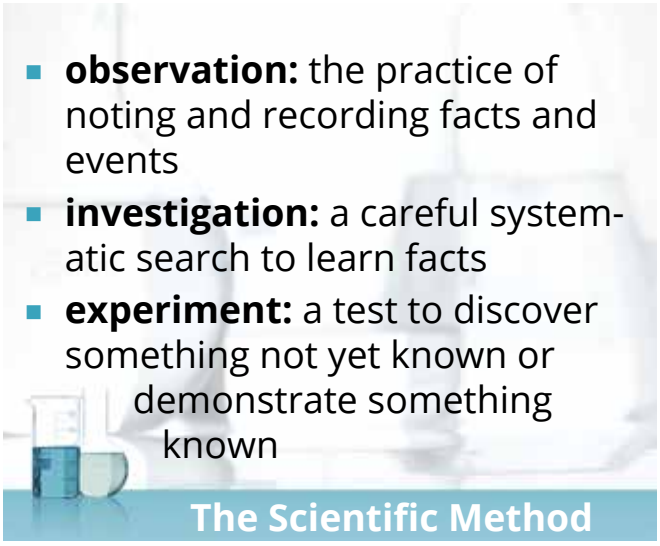
SCIENCE SKILLS

Aristotle is given credit for being the first to use an orderly system in his study of plants and animals. He did not **investigate** to see if his findings were true. Therefore, he is not thought of as a true scientist.

Meaning. Science comes from the Greek word meaning *to know* or *to discern*. *Discern* means *to perceive* and *to separate things out mentally*. *Perceive* means *to recognize differences by the senses*. With our minds and senses we must distinguish between facts. The meaning of *science* has changed through the years from its original Greek meaning of *to know* to *a systematized knowledge derived from observation, study, and experimentation.*

Method. Since we have added to our original meaning of science, we must practice ways of developing systematized knowledge, recording observations, and experimentation. To know what we are doing, we must develop personal study skills. The scientific method is a skill the **prospective** scientist must master.

In Science LIFEPAC 801, you learned the nine steps of the scientific method: (1) choose a problem, (2) state what you think is the probable solution to the problem, (3) research what other scientists have done to solve the problem, (4) experiment to prove or disprove your hypothesis, (5) state the hypothesis again as a theory, (6) if wrong, state a new hypothesis, (7) write a paper on what you did to prove your hypothesis, (8) change your hypothesis if it is proved wrong, and (9) state the theory as a law.



As a young scientist, you will not do all the steps of the scientific method, but you will have to practice how to observe, to investigate, and to **experiment**. A standard way of keeping records will help you to be accurate and complete. You will use the *Science Record*. Be sure to distinguish between an observation, an investigation, and an experiment.

Complete this activity.

1.1 List the nine steps of the scientific method in order.

a. _____ b. _____

c. _____ d. _____

e. _____ f. _____

g. _____ h. _____

i. _____

Match these items.

1.2 _____ heating ice to change to water and to steam

1.3 _____ noticing that the building is tall

1.4 _____ watching birds fly

1.5 _____ listing colors of birds in your back yard

1.6 _____ using a thermometer to find temperature of boiling water

1.7 _____ counting the people walking through the hallway

1.8 _____ using a crowbar to open a wooden box

a. observation

b. investigation

c. experimentation

Complete this investigation.

1.9 Complete the following Science Record (SR) by writing your name and the date.
a. Number the Science Record. Future ones will be numbered consecutively (2, 3, and so forth).

b. Place Statement 1 in the correct blank.

c. Place Statement 2 in the correct blank.

d. Place Statement 3 in the correct blank.

e. Place Statement 4 in the correct blank.

f. Write your own results based on the information given.

g. Write your own conclusion based on the information given.

Statements

1. Has science advanced since Aristotle? How?
2. Science LIFEPAC 801, an encyclopedia, or online resource.
3. Read A BRIEF HISTORY OF SCIENCE from Science LIFEPAC 801 or an article about the history of science in an encyclopedia or online resource.
4. Many people contributed to the advancement of science.

SCIENCE RECORD

Observation # _____ Name _____

Investigation # _____ Date _____

Experiment # _____

Problem: _____

Materials: _____

Method: _____

Result: _____

_____

_____

_____

Conclusion: _____

_____

_____

Measurement. The metric system is used by scientists all over the world. 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. Most countries except the United States, which still uses the English system, have converted all measurements to metric units. Great Britain, from whom we got the English system, uses the metric system. Canada put metric measurements on the highway speed and distance signs in 1977. In some parts of the United States, you will find signs showing two measurements, *English* and *metric.*

Although President Ford signed the Metric Conversion Act in 1975 and in 1977 President Carter named the United States Metric Board to plan the voluntary conversion to metric, the United States has still not converted to the metric system. However, all foreign countries use the metric system. Therefore, all industries making engines and other equipment made to be sold in foreign countries will use metric. Farmers, housewives, and everyone using things produced in foreign countries and the United States will need to know metric to use and repair these metric items. This international usage requires that everyone learns how to use the metric system.

There are many reasons why the SI system has not been fully adopted in the U.S. Schools will have to provide special courses for teaching metrics. Metric tools for measuring will have to be bought; tools used to build things and to repair things will have to be changed to metrics. Everything will have to be relabeled. Keyboards may have to be changed. Conversion will cost money and prices will go up. Because of this cost and inconvenience, the voluntary conversion to the metric system has not been successful.

The conversion to metrics has been slow in the United States. However, if you are interested in science or technology as a career, you must learn to work with metric.

The metric system is a preferred form of measurement because the units have a uniform scale of relationship–the decimal. The main units are the *meter* for length, *liter* for volume, and *kilogram* for mass. In metrics, temperature is measured in degrees *Celsius.* The thermometer is divided into 100 degrees from freezing (0) to boiling (100). The units of the metric system are consistent with multiples of ten and have uniform names.

Write the prefix to the word and the abbreviation in the blanks. You may review Science LIFEPAC 801 or consult an encyclopedia for this activity.

	Prefix			Abbreviation
1.10	_____	gram	= 1,000 grams	_____
1.11	_____	gram	= 100 grams	_____
1.12	_____	gram	= 10 grams	_____
1.13	_____	gram	= 1 gram	_____
1.14	_____	gram	= 0.1 gram	_____
1.15	_____	gram	= 0.01 gram	_____
1.16	_____	gram	= 0.001 gram	_____

Complete this chart for the meter.

	Name		Number of Meters	Abbreviation
1.17		=		
1.18		=		
1.19		=		
	meter	**=**	**1 meter**	**m**
1.20		=		
1.21		=		
1.22		=		

Answer these questions.

1.23 In what practical ways will a conversion to metrics make a difference in our lives? Name five.

a. _____ b. _____

c. _____ d. _____

e. _____

1.24 What is the maximum speed limit in metric and English units?

a. _____ metric

b. _____ English

TEACHER CHECK _____ initials _____ date

CHARACTERISTICS OF MATTER

John Dalton of England proposed his atomic theory in 1808. He thought the atom was like a saucer. Today, we know the electrons are whirling around the nucleus in different orbits at different levels. Understanding both the hugeness of the universe and the tiny details of the atom is a difficult task. God has written a mystery in the heavens and on earth that challenges our imagination and keeps us looking for answers to our questions. The orderliness of both the universe and the atom is an excellent example of pure science. Because of this orderliness, matter can be described and classified by its properties.

Properties of matter. Matter is a substance you can identify with your five senses. You test it for appearance, odor, touch, taste, mass, volume, and so forth. All materials have characteristics and can be recognized by these characteristics.

Human beings are constantly testing for the properties of matter. A baby reaches for an object; later he touches it; and then he recognizes color, shape, and form. Soon a child adds the use of other senses. Through his observations the child, and later the adult, learns that things have size, take up space, and have mass. The general characteristics of color, odor, taste, hardness, brittleness, luster, and form are observed. These characteristics are called the *physical properties of matter*.

Can you identify a rock by its physical characteristics? Select a specific rock specimen. Examine it. You may find it is not as hard as most rocks. Perhaps the rock is very black. Small chips fall off and seem to have a definite structure. Rubbing the rock makes your hands black. The peculiar odor is familiar to you. You decide it is coal. If you have had any experience with coal, you know it must be **bituminous**, or soft coal.

Anthracite, or hard coal, usually does not rub off on your hands easily. You have decided it is a solid and have, therefore, eliminated liquid or gas as a form. The piece of coal is part of a truckload of coal delivered for your fireplace. The half ton your father ordered takes up space and must be stored. The pile of coal has mass and volume. By finding the density of the coal with the formula *mass divided by volume*, you can learn another property. Compare the piece of coal to another rock of equal size, and you might be able to compare the density. A review of Science LIFEPAC 802 will give some help with this problem. If both rocks have a volume of 40 cm^3, the coal weighs 120 g, and the other rock weighs 160 g, which has the greater density?

To find the density of an unknown object, find the mass of the object first. Place a beaker or cup in another dish that can catch the overflow water. Fill the beaker or cup with water to the top. Drop your unknown object into the water and catch the overflow. Measure the overflow with the graduated cylinder. Remember, the curved surface of the liquid in a graduated cylinder is read at the bottom. How many cm^3 is it? Divide the mass in grams by the cm^3 and you will know the density of your object.

When the density of an object is less than the fluid it is floating in, the fluid beneath the object exerts an upward push or force called *buoyancy.* Density and buoyancy are special properties of matter.

Try this investigation.

These supplies are needed:

- 6 unidentified items in a box
- beaker or cup
- dish to catch water
- graduated cylinder
- magnet

Follow these directions. Put a check in the box when each step is completed.

- ☐ 1. Select a partner to work with you. Partner's name _____
- ☐ 2. Ask the teacher for the box of unknown items.
- ☐ 3. Use the Science Record form.
- ☐ 4. Number the SR form as Experiment #1.
- ☐ 5. Write the problem: How can unknown objects be identified by their physical properties?
- ☐ 6. Complete the SR form as you make tests on the unknown objects. Keep careful, accurate records. The six items in box should be tested by using the senses, finding the mass and density, observing magnetic properties, and so forth. A good attempt should be made to identify each object. Identification is good, but the manner of conducting the experiment and writing up the information is more important.

Physical Properties Experiment

SCIENCE RECORD

Observation # _____ Name _____

Investigation # _____ Date _____

Experiment # _____

Problem: _____

Materials: _____

Method: _____

Result: _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Conclusion: _____

_____

_____

TEACHER CHECK _____ _____

initials date

SELF TEST 1

Match these items (each answer, 2 points).

1.01	_____	nucleus and electrons in orbit	a. adaptability
1.02	_____	maximum speed limit	b. liter
1.03	_____	positive personal skill	c. Aristotle
1.04	_____	turns blue litmus red	d. technology
1.05	_____	scientific measurement	e. resiliency
1.06	_____	quart plus	f. 110 km/h
1.07	_____	first to use an orderly system of study	g. atom h. cubic centimeter
1.08	_____	turns red litmus blue	I. acid
1.09	_____	bounce back with good humor	j. base
1.010	_____	applied science	k. 88 km/h

Write true or false (each answer, 1 point).

1.011 _____ The word *atom* means to *fuse*.

1.012 _____ An acid and base combine to form a salt.

1.013 _____ The midpoint of the pH scale is neutral.

1.014 _____ Baking a cake is the same at low or high altitude.

1.015 _____ The smallest particle of matter is the atom.

1.016 _____ God controls the bonds that hold a molecule together.

1.017 _____ Sugar water is a mixture.

Complete these sentences (each answer, 3 points).

1.018 Science is the systematized knowledge derived from a. _____ , b. _____ , and c. _____ .

1.019 The main units in the metric system are length a. _____ , volume b. _____ , and mass c. _____ .

1.020 During the process of electrolysis of water, a. _____ and b. _____ are collected.

1.021 Matter changes in a. _____ , b. _____ , and c. _____ ways.

1.022 The Nobel Prize was won by a. _____ for finding that electrons in atoms stay in b. _____ .

1.023 The process by which an atom splits to produce energy is known as _____ .

1.024 Scientists estimate that _____ compounds are known.

1.025 The upward force that make a cork float is called _____ .

1.026 The expression $2Ag + S \rightarrow Ag_2S$ is called a(an) _____ .

1.027 The symbol for water (H_2O) is called a (an) _____ .

Answer these questions (each answer, 5 points).

1.028 Why is the metric system a preferred form of measurement? _____

_____

_____

_____

1.029 What are five properties of matter? _____

_____

_____

1.030 How does a pressure cooker cook food faster? _____

_____

_____

77/96 **SCORE** _____ **TEACHER** _____ _____
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804 N. 2nd Ave. E.
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800-622-3070
www.aop.com