LIFEPAC®

SCIENCE

STUDENT BOOK

8th Grade

Alpha Omega PUBLICATIONS

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SCIENCE 801
Science and Society

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

Structure of Matter 1

Introduction

The Greek philosophers of the third and fourth centuries B.C. were great thinkers, and they thought about matter and about problems that are studied today by chemists and physicists. They asked questions like this: If you divide a cup of water in half, then divide it in half again, and continue dividing it in half, do you ever run out of water and end up with something else? The thinkers of ancient Greece tried to *reason* things out without doing experiments. As a result, not all of them got the same answers.

The man who came closest to our modern view of matter was Democritus, who lived about 460 B.C. He believed that all matter was composed of a large number of small objects which he called atoms (this Greek word means *indivisible*). Democritus thought these objects were all of the same material, but came in different shapes and sizes.

Aristotle believed that all matter was composed of four things: earth, fire, air, and water. He disagreed with almost all of the ideas of Democritus.

Ideas changed very little until the seven-teenth century when such scientists as Robert Boyle and Isaac Newton developed new theories about matter. These men did some experimenting along with their thinking and developed the atomic theory. This theory states that matter is made up of atoms, which act as building blocks for all matter.

Today with the aid of the electron microscope and other modern technology, molecules can be "seen"; models of particles even smaller than atoms have been set up. Throughout the centuries mankind has attempted to unravel the inner secrets of matter, of all that God has so perfectly and wonderfully created.

In this LIFEPAC® you will study some of the information scientists have discovered about matter and thus gain an ever greater appreciation for what God did for us in creating this magnificent universe. He also has given us the intelligence to understand some of what He has done. As you begin this LIFEPAC on the structure of matter, pray also that you will learn more about God who created it.

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. Explain what matter is.
2. List two general properties of matter.
3. List at least five special properties of matter.
4. Describe one chemical property of matter.
5. State the differences among solids, liquids, gases, and plasmas.
6. Calculate the volume of a solid and liquid.
7. Calculate the density of matter.
8. Explain the different parts of an atom.
9. Draw a molecular diagram linking atoms together.
10. Explain briefly the atomic theory.
11. Write a definition of an element.
12. Interpret the numbers and symbols on the Periodic Table.
13. Write a definition of a compound.
14. Write a definition of a mixture.
15. Name at least two examples each of an element, compound, and mixture

1. MATTER AND CHANGE

Change is all around us. The world is constantly changing. In winter, water changes from liquid to solid on lakes and streams. Clothes on the wash line change from wet to dry. Lead solder changes when heated. Silver tarnishes from shiny to black. Dead plants and animals change with decay. Your body grows and you change to larger clothes. A popsicle melts in the sun. All these examples describe changes in matter.

Matter changes in many different ways. Scientists put all changes in matter into three groups: physical changes, chemical changes, and nuclear changes. Describing physical, chemical, and nuclear changes is what this section is about. As you learn how matter changes, think about how you are changing. You are certainly growing physically. Are you growing spiritually? God wants us to grow and change spiritually as well as physically. Ephesians 4:15 states that we are to grow up in all aspects unto Him, who is the head, even Christ.

SECTION OBJECTIVES

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

1. Define physical change.
2. List three examples of physical change.
3. Define chemical change.
4. Describe a way by which a liquid may be tested to see if it is acid, base, or neither.
5. State the differences among evaporation, condensation, dissolving, and distillation.
6. Define nuclear change.
7. List three kinds of radiation given off by radioactive matter.
8. Compare and contrast fission and fusion.
9. Name an instrument used to detect and study radiation.

Vocabulary

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

composition (kom' pu zish' un). The makeup of anything.

condensation (kon' den sā' shun). Act of changing a vapor to a liquid.

decompose (dē' kum pōz'). To decay, rot.

dissolve (di zolv'). To become liquid by breaking up into parts.

distillation (dis' tu lā' shun) The process of separating the parts of a substance by heating.

electron (i lek' tron). A small particle of an atom with a negative charge.

evaporation (i vap' u rā' shun). The act of changing a liquid of solid to a gas.

fission (fish' un). The splitting that occurs when the nucleus of an atom absorbs a neutron.

fusion (fyü' zhun). A melting together.

Let's investigate.

These supplies are needed:

- heat source (electric hot plate)
- white bread
- cooked egg white
- paper towel
- bits of cheese
- glucose test strips (from drugstore to test for sugar in urine)
- dried milk
- soda cracker
- egg yolk
- aluminum foil
- potato slice
- any fruit
- iodine (colored, with dropper)
- bits of green or yellow vegetables
- bits of various food

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

The following tests can be done either at home or at school. In either case, share your results with your parents. Test each foodstuff for starch (carbohydrate), protein, minerals, sugar, and fat. Use only a small bit of food for each test. Immediately after each test, record your observations on the chart called Food Test Observations.

STARCH TEST #1

- ☐ 1. Chew a small piece of cracker for a few minutes. Do you notice a change? Starch is partly changed to sugar while it is chewed. Saliva in your mouth changes part of the cracker's starch to sugar.
- ☐ 2. Record your results on the chart.

STARCH TEST #2

- ☐ 1. Place bits of several food samples on a paper towel.
- ☐ 2. Drop one or two drops of iodine on each.
- ☐ 3. DO NOT EAT these samples.
- ☐ 4. Observe. Iodine on starchy foods will change from brown to blue-black. Foods with less starch may take several minutes.
- ☐ 5. Record your results on the chart.

SUGAR TEST

- ☐ 1. Place a smashed bit of food in a test tube.
- ☐ 2. Cover the food with water.
- ☐ 3. Heat the test tube in hot water for five minutes.
- ☐ 4. Test with a strip of glucose test strips. Check tape with color scale on tape container.
- ☐ 5. Record your results.

Food Test Experiment

total potential energy. As it moves downward the potential energy gradually becomes kinetic energy. At the bottom of the swing, the pendulum has only kinetic energy. As the pendulum moves upward on the other side, the total kinetic energy is changed back into potential energy.

A baby seems to know without being told that objects perched on the edge of a table have potential energy. A tiny shove and the object suddenly is changing its potential energy to kinetic energy.

A child on a sled at the top of a snowy hill has potential energy. As the sled starts down the hill the potential energy becomes kinetic energy.

A skydiver poised in the door of an airplane has potential energy. As he jumps the potential energy becomes kinetic energy.

Water at the top of a dam has potential energy. As the water falls over the edge of the dam, the potential energy is released and becomes kinetic energy.

In each of these examples, we can see that the object had potential energy because of a high position from which a fall was possible. In this section we have discussed two kinds of mechanical energy: kinetic and potential. In the next section we shall consider other kinds of energy.

Complete these statements.

1.28 Stored energy is _____ energy.

1.29 The two kinds of mechanical energy are a. _____ and

b. _____ .

1.30 To do work energy must be _____ .

Label this pendulum.

1.31 _____ **Energy**

1.33 _____ **Energy**

1.32 _____ **Energy**

TEACHER CHECK _____ initials _____ date

Review the material in this section in preparation for the Self Test. The Self Test will check your mastery of this particular section. The items missed on this Self Test will indicate specific areas where restudy is needed for mastery.

Multiply or divide to make these metric distance conversions. Time yourself as you do the ten exercises without a calculator.

1 kilometer = 1,000 meters

1 meter = 100 centimeters or 1,000 millimeters

1.47 174 centimeters= _____ meters

1.48 7 meters = _____ centimeters

1.49 29 centimeters = _____ millimeters

1.50 29 centimeters = _____ meters

1.51 3 kilometers = _____ meters

1.52 10,000 meters = _____ kilometers

1.53 10,000 meters = _____ centimeters

1.54 10,000 meters = _____ millimeters

1.55 79 millimeters = _____ centimeters

1.56 1,000 meters = _____ kilometers

Answer these questions.

1.57 How long did you take to work 1.47-1.56? _____

1.58 Explain the difference in your times. _____

_____

_____

Research and report.

1.59 Use outside sources to research one of these topics.

Isaac Newton	Robert Boyle
Nicolaus Copernicus	history of metric or English system

The report should be at least five handwritten, double-spaced pages including a short bibliography. Especially include a section on their Christian testimony.

TEACHER CHECK _____ initials _____ date

Complete these sentences.

1.3 Leaves have a waxy coating to _____ .

1.4 Chlorophyll is found in small packets called _____ .

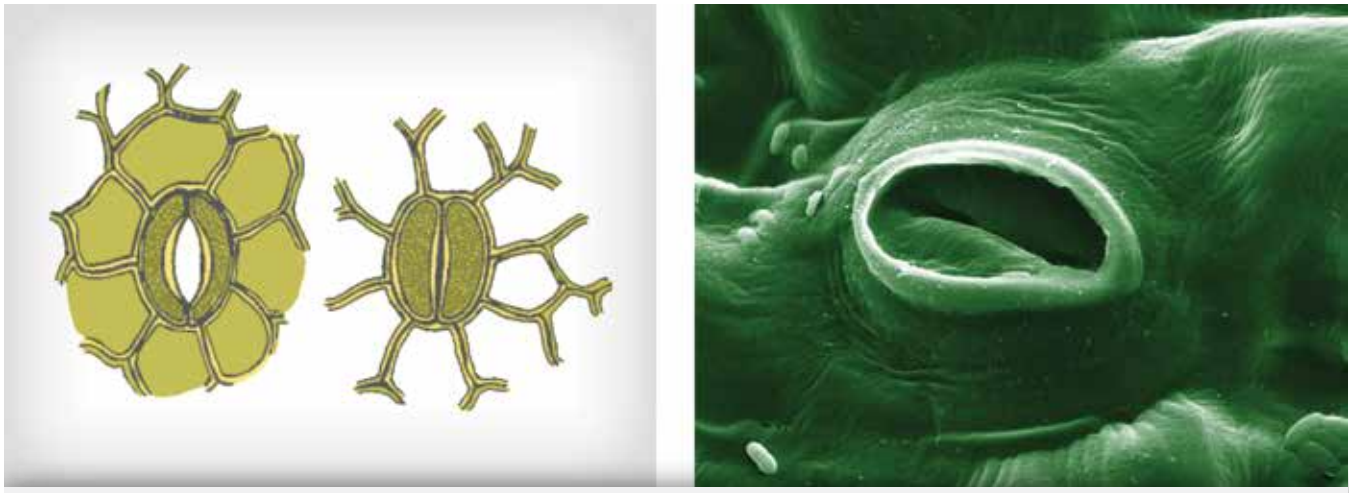
1.5 Plant pigments can be of four colors: a. _____ , b. _____ , c. _____ , and d. _____ .

Stomata (singular: stoma) are openings in the leaf surface, mainly on the underside. Carbon dioxide enters the leaf through the stomata, and water and oxygen escape through the stomata. A leaf may have 300,000 stomata. Two special cells called **guard cells** control the size of the opening. Unlike other leaf epidermal cells, guard cells do have chlorophyll. When light strikes the chloroplasts of the guard cells, the cells bow and an opening develops (Figure 2). Carbon dioxide can now enter the cell and photosynthesis occurs. When the light is gone, the guard cells shrink and come together. The stoma is now closed. The stomata also closes when conditions are dry.

Water vapor escapes from the leaf also through the stomata. This water loss is called **transpiration**. On a warm day a corn plant loses as much as two liters of water. Evaporation of the water provides a cooling system for the plant. The plant may die if high temperatures continue for long or if no soil moisture is available to replace lost water.

Desert plants have a variety of adaptations to combat the loss of water through transpiration. Desert shrubs have small leaves with few stomata. Other desert plants form leaves only when sufficient moisture is available for growth. They drop their leaves when the soil becomes dry. Cacti have only spiny leaves and carry on photosynthesis in their thickened stems.

Plants need light, water, carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, and about ten other chemical elements. The carbon comes from the carbon dioxide of the air.



stoma open *stoma closed* *tomato leaf stoma*

Figure 2 | Guard Cells

SELF TEST 1

Match these items (each answer, 2 points).

1.01	_____	William Gilbert
1.02	_____	magnetite
1.03	_____	electromagnet
1.04	_____	inverse square
1.05	_____	lines of force
1.06	_____	alnico
1.07	_____	demagnetize
1.08	_____	domain
1.09	_____	Oersted
1.010	_____	supermagnet

a. temporary magnetism
b. man-made permanent magnet
c. iron oxide
d. lines representing the strength and direction of magnetic force
e. *De Magnete*
f. very cold
g. strength decreases as the square of the distance
h. current-carrying wire has a magnetic field
i. small region within a magnet
j. drop or hammer
k. king of Sweden

Complete these activities (each answer, 5 points).

1.011 Draw the lines of force around a single bar magnet.

1.012 Draw the lines of force around two bar magnets, N pole to S pole.

Complete these activities (each answer, 3 points).

1.031 Write the complete balanced equation for photosynthesis.

a. _____ + b. _____ c. $\xrightarrow{\quad}$ d. _____ + e. _____ + f. _____

1.032 List the three major contributions to modern agriculture.

a. _____ b. _____

c. _____

1.033 List the nine major requirements for plant growth.

a. _____ b. _____

c. _____ d. _____

e. _____ f. _____

g. _____ h. _____

i. _____

1.034 Name five plant storage organs and give an example of each.

a. _____

b. _____

c. _____

d. _____

e. _____

93/116 **SCORE** _____ **TEACHER** _____ _____
initials date

LIFEPAC®

SCIENCE

TEACHER'S GUIDE

8th Grade

Alpha Omega PUBLICATIONS

SCIENCE 800
Teacher's Guide

INSTRUCTIONS FOR SCIENCE

The LIFEPAC curriculum from grades two through twelve is structured so that the daily instructional material is written directly into the LIFEPACs. The student is encouraged to read and follow this instructional material in order to develop independent study habits. The teacher should introduce the LIFEPAC to the student, set a required completion schedule, complete teacher checks, be available for questions regarding both content and procedures, administer and grade tests, and develop additional learning activities as desired. Teachers working with several students may schedule their time so that students are assigned to a quiet work activity when it is necessary to spend instructional time with one particular student.

The Teacher Notes section of the Teacher's Guide lists the required or suggested materials for the LIFEPACs and provides additional learning activities for the students. The materials section refers only to LIFEPAC materials and does not include materials which may be needed for the additional activities. Additional learning activities provide a change from the daily school routine, encourage the student's interest in learning and may be used as a reward for good study habits.

If you have limited facilities and are not able to perform all the experiments contained in the LIFEPAC curriculum, the Science Project List may be a useful tool for you. This list prioritizes experiments into three categories: those essential to perform, those which should be performed as time and facilities permit, and those not essential for mastery of LIFEPACs. Of course, for complete understanding of concepts and student participation in the curriculum, all experiments should be performed whenever practical. Materials for the experiments are shown in Teacher Notes – Materials Needed.

A suggested support item for this course is the 8th Grade Science Experiments video, SD0801. The video includes presentations of many of the experiments in this course. Several of the experiments that require special equipment or materials are demonstrated on these videos. They can either be used for answering the questions of the lab report or as a demonstration of the procedure prior to performing the experiment. A notice is included with each experiment in the LIFEPAC where the video is available.

Science Projects List

Key

(1) = Those essential to perform for basic understanding of scientific principles.

(2) = Those which should be performed as time permits.

(3) = Those not essential for mastery of LIFEPACs.

S = Equipment needed for home school or Christian school lab.

E = Explanation or demonstration by instructor may replace student or class lab work.

H = Suitable for homework or for home school students. (No lab equipment needed.)

V = This experiment is available on the Science Experiments video.

Science 801

pp	23	(1)	S & V

Science 802

pp	7	(1)	H & V
	8	(1)	S
	11	(1)	S
	14	(2)	E & V
	16	(1)	H & V
	18	(2)	H
	20	(2)	S
	38	(1)	S
	39	(2)	H
	48	(1)	H & V

Science 803

pp	7	(1)	H & V
	11	(1)	H
	12	(3)	E & V
	17	(1)	S & V
	20	(1)	S & V
	25	(1)	H & V
	38	(1)	H & V
	39	(1)	H & V
	46	(1)	S & V
	48	(1)	S
	54	(1)	S

Science 804

pp	12	(1)	H
	22	(1)	H

Science 805

None

Science 806

pp	7	(1)	S
	8	(1)	S
	11	(1)	S & V
	24	(1)	S & V
	44	(2)	H

Science 807

pp	23	(1)	S
	41	(1)	S

Science 808

pp	8	(1)	H
	9	(1)	H
	12	(1)	H
	16	(2)	H
	30	(1)	H or S
	32	(1)	H
	36	(2)	H
	43	(1)	H

Science 809

pp	7	(1)	S
	10	(1)	H
	53	(3)	E

Science 810

pp	12	(1)	S
	16	(2)	H
	21	(1)	S
	23	(3)	H
	24	(2)	S
	33	(2)	S
	37	(1)	H
	41	(1)	S
	51	(1)	H

Materials Needed for LIFEPAC:

Required:
Encyclopedia
ruler at least 10 centimeters long
graduated cylinder marked in milliliters
balance scale (triple beam or other type)

Suggested:
8th Grade Science Experiments video

Additional Learning Activities

Section 1: Science Today

1. Direct the student(s) to make a chart of events of science and technology in chronological order.
2. Use the charts to develop a time line of events in science and technology. This time line could be used also in the social sciences. Additional reference materials may be used to complete this activity.
3. Take a friend and a recording device and talk to someone who is over sixty years old. Ask questions about how the person lived when he or she was a child. What kind of medicine did the doctors have? Be certain to prepare a list of questions in advance.
4. Read a book on the history of science, one area of science, or one scientist.

Section 2: Science and Technology

1. With a friend develop a method to test the tensile strength of materials such as rubber bands, string, fine wire, etc. Test several items.
2. With friends make designs using potatoes. Slice the potatoes to make a flat surface. Cut in a design. Ink the potatoes with a stamp pad. Compare what can be done by this method with what can be done with Gutenberg's movable type.
3. Make squares one centimeter on each side on index cards. Spread the cards with petroleum jelly. Place the cards around school and home. Leave them for three days. Count the number of particles stuck to each square. Take the average of the cards. Where was the pollution greatest? Why?
4. Read the newspaper or online news sources. Clip or printout articles which relate to conflicts between science, technology, and society.
5. Design and build a model bridge. Test it to see how strong it is. Use straws, balsa, or toothpicks.

Section 3: Science and Technology of Tomorrow

1. From old magazines have students cut pictures of futuristic living. Explain how to make a collage. Have the students make a collage.
2. In the public library or online look up architecture. See changes that have taken place in buildings. Check names like Frank Lloyd Wright and Paolo Soleri.
3. From the encyclopedia, almanac, or online get figures on the United States population for the ten-year intervals since 1790. Make a graph.

Administer the LIFEPAC Test.

Complete these statements choosing from the terms listed below (each answer, 3 points).

shaduf	Copernicus	solar energy
God	coal	Einstein

21. One in control of everything is _____ .
22. The Egyptians developed the _____ for irrigation.
23. A non-polluting, safe form of energy is _____ .
24. _____ developed the equation, $E = mc^2$.
25. Galileo agreed with the theory of _____ that the earth was not the center of the universe.

Answer these questions (each answer, 3 points).

26. What are three problems of modern society?
    a. _____
    b. _____
    c. _____

27. What was the result of Johann Gutenberg's invention?

    _____

    _____

28. What are three benefits of modern technology?
    a _____
    b. _____
    c. _____

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Date _____

Score _____

1.99 9
1.100 29
1.101 - 1.104 teacher check
1.105 approximately 1 kilogram, or 1,000 grams
1.106 approximately 20 g
1.107 approximately 4,000 g
1.108 $8.2 \cdot 10^1$
1.109 $1.263 \cdot 10^3$
1.110 $1 \cdot 10^6$
1.111 $5.41 \cdot 10^2$
1.112 $2.000004 \cdot 10^6$
1.113 $1.063 \cdot 10^2$
1.114 $8.205 \cdot 10^2$
1.115 410
1.116 50,000,000,000
1.117 183,000
1.118 1,546.3
1.119 96,254.8
1.120 2
1.121 1
1.122 3
1.123 4
1.124 5
1.125 C
1.126 I
1.127 I
1.128 C
1.129 8.43
1.130 90,900
1.131 566
1.132 10,400
1.133 $4.8 \cdot 10^2$
1.134 $8.4 \cdot 10^6$
1.135 $5.5 \cdot 10^3$
1.136 4.3

SECTION TWO

2.1 true
2.2 false
2.3 true
2.4 true
2.5 false
2.6 false
2.7 false
2.8 false
2.9 true
2.10 true
2.11 c
2.12 b
2.13 c
2.14 a
2.15 c
2.16 e
2.17 a
2.18 b

SELF TEST 1

1.01 knowledge
1.02 experimentation
1.03 Aristotle
1.04 gold
1.05 hypothesis or theory
1.06 Renaissance
1.07 earth
1.08 Sir Isaac Newton
1.09 Charles Darwin
1.010 microorganisms or organisms
1.011 b
1.012 f
1.013 d
1.014 a
1.015 c
1.016 c
1.017 b
1.018 a
1.019 a
1.020 c
1.021 milliliters
1.022 4.142×10^3
1.023 5,200
1.024 29.6
1.025 4

SELF TEST 2

2.01 significant figures
2.02 technology
2.03 tensile strength
2.04 wheel
2.05 crossbow
2.06 Democritus
2.07 metric
2.08 dynamo (generator)
2.09 Leeuwenhoek
2.010 communication
2.011 true
2.012 true
2.013 false
2.014 false
2.015 false
2.016 true
2.017 false
2.018 true
2.019 true
2.020 false
2.021 c. "animalcules"
2.022 a. irrigation
2.023 a. 5
2.024 c. radiation
2.025 c. gunpowder

1. false
2. true
3. true
4. false
5. true
6. false
7. true
8. false
9. false
10. true
11. 620,000
12. 1,000
13. 11.1
14. e
15. h
16. b
17. d
18. c
19. g
20. a
21. God's Word
22. Darwin
23. solar energy
24. inclined plane
25. Galileo
26. Any three; any order:
    good medicine, life-support machines, synthetic foods, improved food supply, comforts, conveniences
27. Many ancient writings were lost.
28. Example; any order:
    a. pollution—produced by industry
    b. food shortages from increased population
    c. possible harm from synthetic foods