



# SCIENCE

STUDENT BOOK

▶ **10th Grade**

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# SCIENCE 1001

## Taxonomy: Key To Organization

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

# SCIENCE 1000 SUPPLIES

Many of the things that you will need to perform the experiments in Science 1000 can be found around the home. For instance, instead of using test tubes, you may substitute baby food jars and lids. Instead of a beaker, you may use a mayonnaise jar. Some of the things you will need to successfully perform the experiments you will just need to borrow or buy. There are resources in your area where you may be able to find these materials. Your local school may lend you a microscope or perhaps you can buy an older one from them when they purchase new ones. There may be major discount department stores in your area that sell these things for low cost. Ordering science material through the mail or over the Internet is also a possibility. With each complete boxed set of science curriculum, you should receive an order blank from a trusted supplier for science supplies in the sizes and amounts that you will need to successfully perform the experiments.

If you did not receive an order blank, call the Alpha Omega Publications Customer Services Department for more information.

A suggested support item for this course is the 10th Grade Science Experiments video, SD1001. 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.

Remember, it is the supervisors' or parents' responsibility to make sure that all students follow proper safety procedures for experiments and lab work. Any questions that you have about chemicals or supplies should be directed to the supplier of those materials. It cannot be assumed that all necessary warnings and precautions are contained in this material.



As a Christian school curriculum publisher, we discuss what is taught and believed regarding the creation and origins of life on our planet from the Christian point of view. It is the responsibility of the family to decide what they desire to be learned by their students in the school and the home, and whether or not the biblical view is what they want to be taught. There are a number of Christian websites on the Internet, however, that may be examined to get further information on the origins of life from a biblical point of view. One of them is the Creation Research Institute website.

# Basis of Life

## Introduction

The importance of the chemical elements to life is brought to our attention in the book of Genesis. We read that God took the “dust of the earth” (or elements) to create man through His own miraculous process. The same point is made clear when we read that after death our bodies decompose into the “dust of the earth” from which we were created. A third reference to life being composed of the elements from the earth is made when Jesus took dirt, spat in it, and anointed the eyes of the blind man. Everything we eat and drink to keep us alive and healthy is made up of chemical elements from the earth.

All living things share this property: They are composed of matter and energy. In this LIFEPAC® you will learn something about the function of life-forming chemicals. Fundamental in this study is an introduction to basic chemistry and chemical processes.

## 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. Diagram an atom.
2. Identify and write the names and symbols of principal chemical elements found in living organisms.
3. Define and describe a molecule.
4. Describe electron shells and the arrangement of electrons within them.
5. Explain how atoms combine to form compounds.
6. Describe water as a solvent, transport medium, chemical reactant, and heat absorber.
7. Describe and compare acids, bases, and salts.
8. Explain how a constant pH level is maintained in living organisms.
9. Identify and describe the different kinds of chemical reactions.
10. Define chemical equilibrium and the factors that alter it.
11. Describe the role of activation energy in driving a chemical reaction.
12. Distinguish between inorganic and organic compounds.
13. Describe and compare the composition and function of carbohydrates, lipids, and proteins.
14. Compare dehydration synthesis and hydrolysis in the forming and breaking down of organic molecules.
15. Compare the DNA and RNA molecules.
16. Describe the function of nucleic acids.
17. Define enzyme and describe how an enzyme acts as a regulator of chemical reactions in living organisms.

# 1. MICROBIAL TAXONOMY

In your first LIFEPAC you were introduced to the very important field of biology called taxonomy. In this section of the Microbiology

LIFEPAC, we will briefly revisit this classification process and the six kingdom taxonomy system as it relates to microscopic organisms.

## Section Objectives

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

1. List the kingdoms in the six-kingdom classification system.
2. Identify which kingdoms are composed of prokaryotes and which are made up of eukaryotes.
3. Discuss the history and development of the microscope.
4. List some benefits and limitations of the light microscope and electron microscope.

## Vocabulary

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

**Animalia**  
**Protista**

**Eubacteria**  
**Fungi**

**prokaryote**  
**Archaea**

**Plantae**

**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.

## SIX-KINGDOM CLASSIFICATION

The great diversity of these microscopic organisms has for many years caused much discussion (and often disagreement) among taxonomists who attempt to classify these life forms. While we must recognize that there are many taxonomy systems that are being used, the six-kingdom system is one that is commonly accepted and used. In this system, the kingdoms are **Animalia** (animals), **Plantae** (plants), **Fungi**, **Protista**, **Eubacteria**, and **Archaea**. The kingdoms Plantae and Animalia were introduced in your first LIFEPAC. Since the other four kingdoms include mostly microorganisms, we will be studying them in this microbiology LIFEPAC.

All living organisms can be classified into two groups based on their cellular structure. These two groups are called eukaryotes and prokaryotes. These two groups are based on two very



| Phagocytosis

different types of cells. The cellular structure of a prokaryote does not have a true nucleus or any other membrane-bound structures within each cell. The cellular structure of a eukaryote includes a membrane-bound nucleus and various other membrane-bound organelles.

**TABLE 1: ESSENTIAL ELEMENTS IN LIVING ORGANISMS**

ELEMENT	SYMBOL	ATOMIC NUMBER	FUNCTION
<b>MOST ABUNDANT</b>			
Hydrogen	H	1	water and organic compounds
Carbon	C	6	all organic compounds
Nitrogen	N	7	all amino acids
Oxygen	O	8	water; cell respiration; organic compounds
<b>LESS ABUNDANT</b>			
Sodium	Na	11	membrane polarization
Magnesium	Mg	12	chlorophyll; cofactor
Phosphorous	P	15	energy transfer; many organic compounds
Sulfur	S	16	some amino acids; some organic compounds
Chlorine	Cl	17	membrane polarization
Potassium	K	19	membrane polarization
Calcium	Ca	20	bone and teeth; muscle contraction and
Iron	Fe	21	cofactor hemoglobin; cofactor
<b>TRACE AMOUNTS</b>			
Boron	B	5	plant metabolism
Fluorine	F	9	teeth and bone growth
Silicon	Si	14	growth; diatom structure
Vanadium	V	23	growth factor
Chromium	Cr	24	insulin function
Manganese	Mn	25	cofactor
Cobalt	Co	27	vitamin B <sub>12</sub> structure, cofactor
Copper	Cu	29	hemocyanin; oxidative enzymes
Zinc	Zn	30	cofactor
Selenium	Se	34	liver function
Molybdenum	Mo	42	cofactor
Tin	Sn	50	role? but essential
Iodine	I	53	thyroid hormone

## EXAMINATION OF THE CELL

A characteristic which separates the theoretical, and often erroneous, science of Aristotle from the science of today's classroom, hospital, and factory is recognition of the need for observation and experimentation. Virtually all you read in your text and reference books is the product of *observation* and *experimentation*.

Biology is very much an observational science. The microscope extends your power to see as pliers extend your power to hold. Science LIFE-PAC 1003 introduced you to the microscope, and Science LIFE-PAC 1004 applies what you have learned to the observation of cell detail.

**Use of the microscope.** Let's review techniques and principles on the use of a microscope.

1. When you carry your microscope, hold it by the arm with one hand and by the base with the other hand.
2. Orient your microscope and position the mirror so that light is focused into the low-power objective. If your microscope is electric, switch on the light. Look into the eyepiece to see that the field is brightly illuminated.
3. Place a prepared slide onto the stage and hold it down with slide clips.
4. Looking from the *side* of the microscope, lower the *low*-power objective using the coarse adjustment.
5. When the objective is as far down as it will go without damaging the slide or lens of the objective (about one to two millimeters separation), look into the eyepiece and begin to turn *upward* using the coarse adjustment until the image becomes visible.

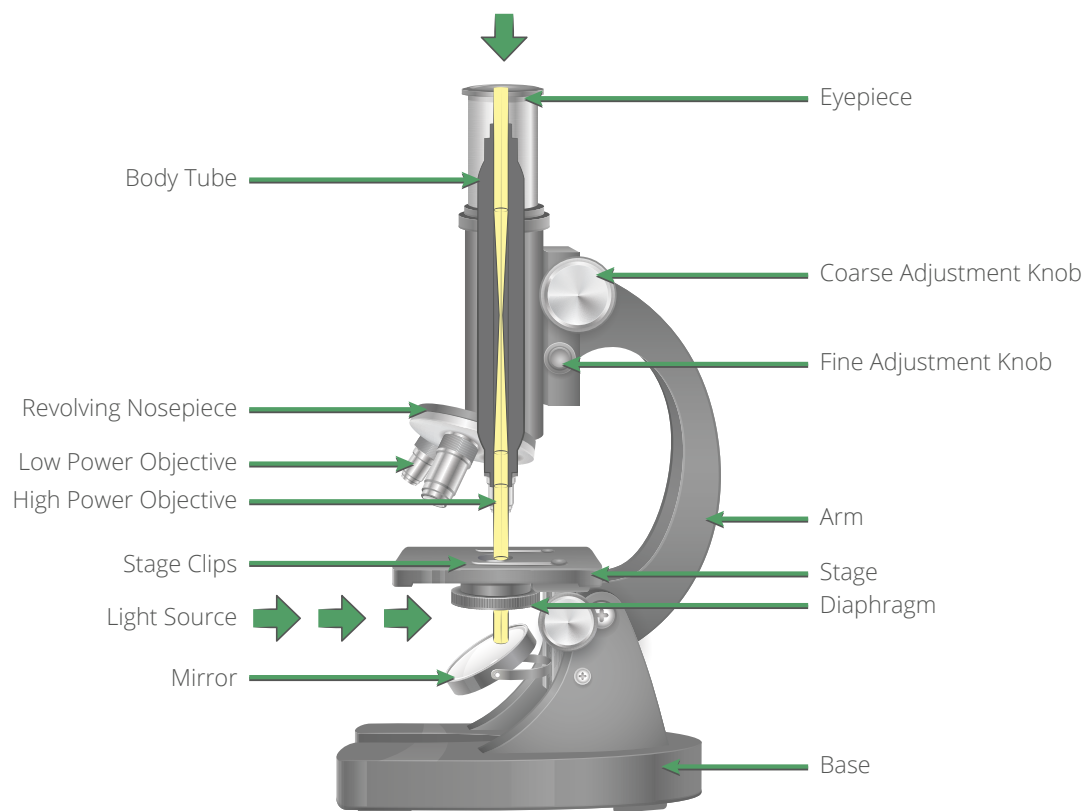
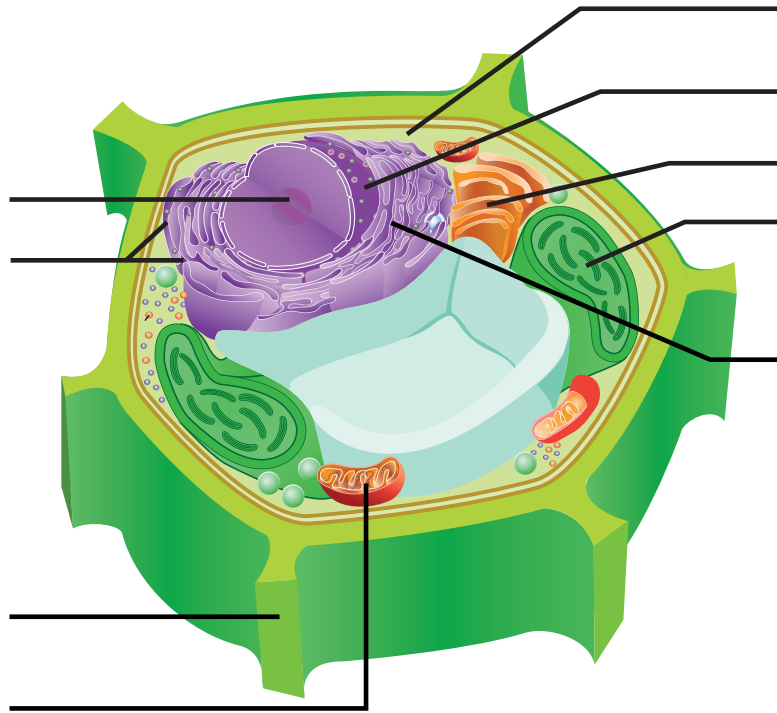


Figure 3 | Parts of a Microscope

1.12 Label the following diagram with these cell parts described in 1.11.



1.13 Obtain or make a box at least a foot square or larger with one open side. Using thread or wire, suspend cytoplasmic and nuclear structures mentioned in the LIFEPAK. Make these cell parts from construction paper, styrofoam, or other materials. Use the cell diagram for guidelines. Label each part in a scale drawing accompanying your project.

**TEACHER CHECK**

\_\_\_\_\_ initials

\_\_\_\_\_ date



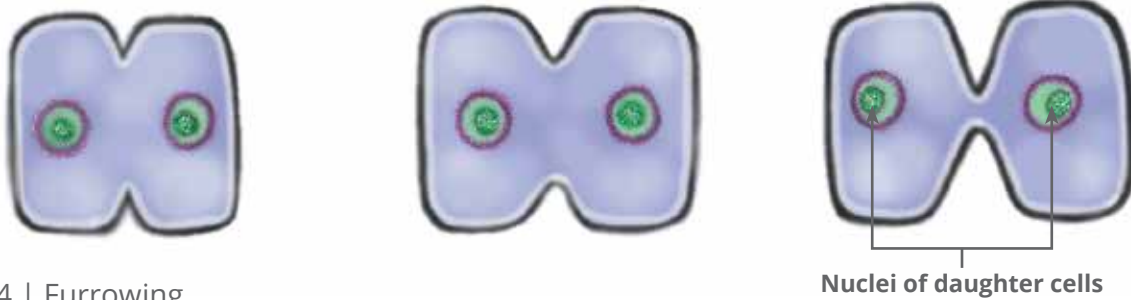


Figure 4 | Furrowing



### Examine mitosis.



View 1008 Flytrap Adventure and Microscope: Chromosomes, from the 10th Grade SCIENCE EXPERIMENTS Video

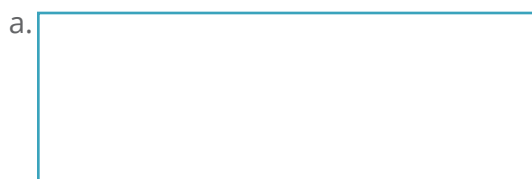
#### These supplies are needed:

- microscope
- prepared slide of onion (*Allium*) root, stained to show chromosomes
- prepared slide of whitefish blastula, stained to show chromosomes

**Follow these directions and complete the activities.** Put a check in the box when each step is completed.

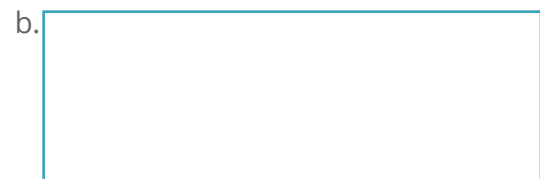
1. Place the slide of onion root on the stage of the microscope.
2. Focus the microscope on the slide using the lower power objective lens (as studied in Science LIFEPAK 1003). Bring the cells of the root into focus. Ask your teacher or helper to assist if you have trouble.
3. Move the slide until the section of onion root just above the root tip is in view, and search the area until cells in different phases of mitosis are in view. They will resemble the cells diagramed in Figure 2. (Telophase is often the most difficult to find.)
4. Using a high power objective, focus the microscope and search for cells in mitosis.

**1.17** In the cell outlines that are shown, draw each of the major phases of mitosis. Below each write a brief description of what your drawing shows. (Since no visible changes occur during interphase it is not included.)



prophase

\_\_\_\_\_



metaphase

\_\_\_\_\_

## Mitosis Experiment

(Continued on next page)

# SELF TEST 1

**Match these items** (each answer, 2 points).

- |      |       |                   |    |                        |
|------|-------|-------------------|----|------------------------|
| 1.01 | _____ | phytoplankton     | a. | tiny animals           |
| 1.02 | _____ | relationships     | b. | surroundings           |
| 1.03 | _____ | ecosystem         | c. | dynamic equilibrium    |
| 1.04 | _____ | environment       | d. | cycle                  |
| 1.05 | _____ | balance of nature | e. | grass of the seas      |
|      |       |                   | f. | dependent, competitive |

**Answer true or false** (each answer, 1 point).

- 1.06 \_\_\_\_\_ Organisms with similar requirements usually share environmental factors.
- 1.07 \_\_\_\_\_ All forms of life on earth are linked together in some type of food relationship.
- 1.08 \_\_\_\_\_ The ultimate source of energy for life on earth is the sun.
- 1.09 \_\_\_\_\_ Everything living depends on something else for its life.
- 1.010 \_\_\_\_\_ The balance of nature is like a living seesaw.
- 1.011 \_\_\_\_\_ Nature is not balanced as long as a state of dynamic equilibrium exists.
- 1.012 \_\_\_\_\_ Only people upset the balance of nature.
- 1.013 \_\_\_\_\_ Nothing is free in nature; what is removed must be replaced.
- 1.014 \_\_\_\_\_ Habitats vary because environmental factors vary.
- 1.015 \_\_\_\_\_ Every time people do something to the environment, reactions usually happen as predicted.



# SCIENCE

TEACHER'S GUIDE

▶ **10th Grade**

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# SCIENCE 1000

## Teacher's Guide

### **LIFEPAC® Overview** **5**

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## 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 10th Grade Science Experiments video, SD1001. 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.

# TEACHING NOTES

## MATERIALS NEEDED FOR LIFE PAC

### Required

- dictionary
- encyclopedia or online resources
- assorted fresh fruits
- ten assorted small objects from a hobby or collection
- ten fresh flowers
- dissection kit
- ten photos of animals that inhabit one area of the earth

## ADDITIONAL LEARNING ACTIVITIES

### Section 1: The History of Taxonomy

1. Try to go for one full day without using any names for any persons or items. Discuss the importance of names and the confusion that would result without them.
2. Write a report about either Aristotle or Linnaeus and his contributions to taxonomy.

### Section 2: Binomial Nomenclature

1. Visit an aquarium shop or a greenhouse. Ask the owner in advance to give the students a tour and to tell how scientific names are used in his business.
2. Each person should bring in one plant or leaf that is identified by genus and species. House plants, flowers, trees, and shrubs could all be used. Make a display for the classroom.
3. Find the genus and species of ten organisms including humans and any pets owned by the family. Scientific names are often given in the encyclopedia.

### Section 3: Plant and Animal Classification

1. Gather all of the Golden Press Nature Guides that are available from students or the library. Take hikes or gather specimens that can be identified using the guides you have located. Plan a field day and identify as many organisms as possible. Stress ecology; do not destroy any unusual specimens.
2. Collect and press common local flowers. Make attractive note cards with them and give as a gift to a shut-in.
3. Each person should collect and mount twenty common insects. Pool the findings and eliminate duplicates. Make one master. Display and identify as many insects as possible. Label the collection with scientific names, name of collector, and date and site of collection.
4. Write a 500-word report on a sea animal of your choice. Sea urchin, sea cucumbers, jellyfish, and nudibranchs are interesting animals to consider.

# ANSWER KEYS

## SECTION 1

- 1.1 classification and organizing
- 1.2 Examples; any order:  
a. botany  
b. zoology (paleontology, microbiology)
- 1.3 Adam
- 1.4 Either order:  
a. taxonomy  
b. genetics
- 1.5 a. similarities  
b. differences
- 1.6 the Holy Spirit
- 1.7 sort, group, or label anything
- 1.8 It is used in everyday life, to enjoy life around us, to enjoy God’s handiwork.
- 1.9 taxonomy is the science that brings order and meaning to the puzzle of diversity
- 1.10 a group of organisms with many similarities (dogs are a kind of living thing)
- 1.11 the genetic principle of parents producing offspring like themselves.
- 1.12 true
- 1.13 false
- 1.14 false
- 1.15 true
- 1.16 true
- 1.17 false
- 1.18 true
- 1.19 true
- 1.20 three groups of plants (herbs, shrubs, trees) and two groups of animals (with and without red blood cells)
- 1.21 noting differences between flowering and nonflowering plants; placing plants into four groups
- 1.22 Aristotle grouped plants; herb, shrub, tree. Theophrastos grouped plants: herb, subshrub, tree, shrub.
- 1.23 drawings not correct myths added/guesses and untested information added
- 1.24 wrote about medical and agricultural uses of plants
- 1.25 firsthand observations
- 1.26 a. Carolus Linnaeus  
b. “Father of Modern Taxonomy.”
- 1.27 Either order:  
a. binomial classification  
b. extensive classifying of plants according to flower structures
- 1.28 Either order:  
a. Species Plantarum  
b. Systema Naturae
- 1.29 stamen number in flowers
- 1.30 Linnaeus’s kinds were without variation. Today, we recognize that kinds do display variation. Example: all dogs are of one kind, but show wide variation in size, shape, color, habit.
- 1.31 He developed a system in which anyone could derive the same classification for the same organism. He used the talents God gave him for organizing and for perception with a willingness and delight in his work. God blessed his efforts.
- 1.32 Teacher check

## SELF TEST 2

- 2.01 false  
 2.02 true  
 2.03 true  
 2.04 false  
 2.05 true  
 2.06 a  
 2.07 b  
 2.08 d  
 2.09 b  
 2.010 a  
 2.011 f  
 2.012 g  
 2.013 b  
 2.014 e  
 2.015 c  
 2.016 h  
 2.017 i  
 2.018 a  
 2.019 d  
 2.020 variation or (subspecies, breeds, races and varieties)  
 2.021 Either order:  
     a. different  
     b. similar  
 2.022 a. noun  
     b. genus  
 2.023 morphology  
 2.024 order  
 2.025 species  
 2.026 reproductive isolation  
 2.027 subjective  
 2.028 a. division  
     b. phylum  
 2.029 a. kingdom  
     b. phylum or division  
     c. class  
     d. order  
     e. family  
     f. genus  
     g. species  
 2.030 Any two; either order:  
     a. Complexity of classifying, limitations of knowledge  
     b. limitations of personal experience, lack of firsthand information  
 2.031 Their offspring, the mule, cannot reproduce.  
 2.032 Genus name is first. It is capitalized and is a noun. Species name is second, lower case and functions as an adjective. Both are italicized or underlined.

## SECTION 3

- 3.1 false  
 3.2 true  
 3.3 false  
 3.4 true  
 3.5 true  
 3.6 Teacher check  
 3.7 Teacher check  
 3.8 Teacher check  
 3.9 life  
 3.10 Any five; any order:  
     a. unicellular or multicellular  
     b. saclike body  
     c. segmented or nonsegmented  
     d. digestive system  
     e. appendages or symmetry, number of legs, exo- or endo-skeleton, teeth patterns  
 3.11 Any order:  
     a. protoplasm and cell(s)  
     b. growth  
     c. reproduction  
     d. response to stimuli  
     e. require food  
     f. removal of waste  
     g. respiration  
 3.12 Any order:  
     a. locomotion  
     b. lack of cell wall in animal cells  
     c. acquiring food  
     d. manner of growth  
     e. speed of reaction to stimuli  
 3.13 Examples:  
     big  
     hairy  
     four-legged  
     spotted  
     long teeth  
 3.14 a. Plantae  
     b. Anthophyta  
     c. Monocotyledonae  
     d. Poales  
     e. Poaceae  
     f. *Zea*  
     g. *mays*  
 3.15 a. Plantae  
     b. Anthophyta  
     c. Dicotyledonae  
     d. Rosales  
     e. Rosaceae  
     f. *Malus*  
     g. *sylvestris*  
 3.16 Teacher check



- 3.17** a. Animalia  
b. Chordata  
c. Amphibia  
d. Anura  
e. Ranidae  
f. *Rana*  
g. *pipiens* or *Rana pipiens*
- 3.18** a. Animalia  
b. Chordata  
c. Mammalia  
d. Carnivora  
e. Felidae  
f. *Felis*  
g. *leo*
- 3.19** Teacher check
- 3.20** a. two (2)  
b. six (6)
- 3.21** Example:  
clear, consistent, not too complicated
- 3.22** Ginkophyta
- 3.23** Anthophyta
- 3.24** 260,000
- 3.25** Chordata
- 3.26** Arthropoda
- 3.27** about 1,000,000
- 3.28** more
- 3.29** Any two; either order:  
a. Protoplasm cells  
b. reproduction, respiration
- 3.30** Any two; either order:  
a. no cell walls, no chlorophyll  
b. different growth, locomotion
- 3.31** Any two; either order:  
a. protoplasm, cells, growth  
b. reproduction, respiration, food intake, locomotion
- 3.32** Any two; either order:  
a. walk upright, sensitivity  
b. intellect, reason, memory, speech
- 3.33** Yes — people produce people, many variations of people as a kind
- 3.34** Examples:  
Animalia, Chordata, Mammalia  
Primates, Hominidae, *Homo sapiens*

## SELF TEST 3

- 3.01** e
- 3.02** d
- 3.03** i
- 3.04** g
- 3.05** b
- 3.06** l
- 3.07** m
- 3.08** a
- 3.09** f
- 3.010** k
- 3.011** true
- 3.012** true
- 3.013** true
- 3.014** true
- 3.015** true
- 3.016** d
- 3.017** c
- 3.018** c
- 3.019** a
- 3.020** a
- 3.021** key
- 3.022** dichotomous key
- 3.023** parallel
- 3.024** *Rana pipiens*
- 3.025** a. -aceae  
b. -ae
- 3.026** a. division  
b. phylum
- 3.027** fewer
- 3.028** Either order:  
a. red-blooded  
b. nonred-blooded
- 3.029** a. kingdom  
b. phylum (division)  
c. class  
d. order  
e. family  
f. genus  
g. species
- 3.030** First word is genus — underlined (italicized) and capitalized; noun. Second is species — underlined (italicized) and lower case; adjective
- 3.031** Any two; either order:  
a. locomotion, food intake  
b. cell walls, chlorophyll

## LIFEPAC TEST

1. f
2. a
3. c
4. g
5. h
6. i
7. e
8. j
9. b
10. d
11. true
12. false
13. false
14. false
15. true
16. d
17. b
18. a
19. a
20. a
21. b
22. a
23. c
24. d
25. d
26. classification
27. Linnaeus
28. Either order:
  - a. similarities
  - b. differences
29.
  - a. genus
  - b. noun
30.
  - a. species
  - b. adjective
31. kingdom
32. three
33. speciation
34. morphology
35. key
36. two-choice key
37. artificial

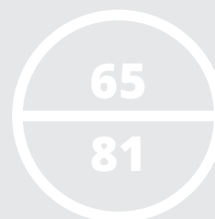
# SCIENCE 1001

## ALTERNATE LIFEPAC TEST

**NAME** \_\_\_\_\_

**DATE** \_\_\_\_\_

**SCORE** \_\_\_\_\_



**Match these items** (each answer, 2 points).

- |                            |   |
|----------------------------|---|
| 1. _____ classification    | a. development of new species from an ancestral species             |
| 2. _____ artificial system | b. the beginning  |
| 3. _____ variation         | c. categories   |
| 4. _____ speciation        | d. form of an organism  |
| 5. _____ kingdom           | e. a system of distinguishing groups for purposes of identification |
| 6. _____ origin            | f. a classification plan based on relationships of common ancestry  |
| 7. _____ taxonomy          | g. a classification plan based on grouping by features              |
| 8. _____ morphology        | h. differences among offspring of a particular species              |
| 9. _____ taxon             | i. the largest taxonomical category                                 |
| 10. _____ natural system   | j. science of classification of organisms                           |

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

11. \_\_\_\_\_ Creation took six days.
12. \_\_\_\_\_ A dictionary is an artificial system of classification.
13. \_\_\_\_\_ The largest phylum of plant species is chordata.
14. \_\_\_\_\_ Natural classification systems are based upon similarities in appearance.
15. \_\_\_\_\_ The biosphere is a region of the atmosphere.

**Complete these statements** (each answer, 3 points).

26. The way a plant looks is its \_\_\_\_\_ .
27. The tool used to classify is called a \_\_\_\_\_ .
28. The largest taxon is \_\_\_\_\_ .
29. Taxonomy is the science of \_\_\_\_\_ .
30. The first word of the scientific name is the \_\_\_\_\_ .
31. The second word of the scientific name is the \_\_\_\_\_ .
32. The "Father of Modern Taxonomy" was \_\_\_\_\_ .
33. Variation that results in the evolution of one species to another is called \_\_\_\_\_ .
34. The "doctrine of signatures" was characteristic of the \_\_\_\_\_ .
35. The kind of organism living in an area is \_\_\_\_\_ .
36. The word that means *cut* or *split in two parts* is \_\_\_\_\_ .
37. The time required for \_\_\_\_\_ is millions of years for each step.