LIFEPAC®

SCIENCE

STUDENT BOOK

6th Grade | Unit 10

Alpha Omega
PUBLICATIONS

SCIENCE 610

The Earth and the Universe

LIFEPAC Test is located in the center of the booklet, as well as a periodic table for reference. Please remove before starting the unit.

Author:
Barry G. Burrus, M.Div., M.A., B.S.

Editors:
Alpha Omega Staff

Illustration:
Brian Ring/Alpha Omega Staff

MEDIA CREDITS:
Pages 5: © Eraxion, iStock, Thinkstock; **28:** © Marcochow, iStock, Thinkstock; **32:** © leonello, iStock, Thinkstock; **35:** © danefromspain, iStock, Thinkstock; **36:** © DigitalStorm, iStock, Thinkstock; **40:** © NASA, Bill Anders; **48:** Top, © James Steidl, iStock, Thinkstock; Bottom, © NASA, Goddard Space Flight Center.

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

The Earth and the Universe

Introduction

God has created a fascinating universe! It is full of wonder and beauty. The book of Genesis describes the creation of the world and all things in it (Genesis 1-2). When God finished creation, He said that it was very good. People can get some understanding of the beauty, power, and majesty of God simply by observing His creation. As St. Paul wrote in his letter to the Romans, "For the invisible things of him from the creation of the world are clearly seen, being understood by the things that are made, even his eternal power and Godhead; so that they are without excuse:" (Romans 1:20) God's power and divinity can be known by observing the things that He has made, that is, all things in His creation!

In the previous nine books of this Science LIFEPAC ® series, you have studied some of the wonders of the earth and the universe that God has made. You have studied plant and animal systems, aspects of chemistry and physics, "spaceship earth," the solar system, and the stars. In this LIFEPAC, you will get an overview of the material covered in the previous nine LIFEPACs of this series. By reviewing the material in this one LIFEPAC, you will hopefully grow in your appreciation and love of God who created all these things in His wisdom and love. In addition, you will discover that God's detailed plan can be seen within all of His Creation, from tiny DNA molecules to the vast galaxies of the universe.

The new vocabulary in this LIFEPAC is limited. Instead, most of the vocabulary to be covered in this LIFEPAC will be reviewed in the vocabulary presented in the previous LIFEPACs. As you go through this LIFEPAC, you may need to refresh your memory of topics and information covered in earlier LIFEPACs. By reviewing this material, your understanding and **retention** of these important science topics should be increased.

Objectives

Read these objectives. These objectives tell what you should be able to do when you have completed this LIFEPAC. When you have completed this LIFEPAC, you should be able to do the following:

1. Describe the plant processes of photosynthesis, transport, and regulation.
2. Describe the digestive, excretory, skeletal, and nervous systems of humans.
3. Discuss genetics and aspects of reproductive systems in plants and animals.
4. Give some examples of biomes and cycles in nature.
5. Explain the nature of matter and relate the various particles to the structure of matter.
6. Explain the main divisions of the Periodic Table of the Elements and identify common chemical symbols.
7, Explain the basic concepts of light and the ways that colors are produced.
8. Explain how sound is produced and describe the characteristics of sound.

1. PLANT AND ANIMAL SYSTEMS

Within all plants and animals, there are many complex processes occurring that allow the organism to live, grow, and reproduce. Many parts of plants and animals work together to perform a common function or purpose. We call these complex, interacting parts "systems." When considered carefully, these systems indicate the intelligent design of a loving and wise God.

In this section of the LIFEPAC, you will review some of the complex systems in plants and animals (primarily humans). You will also review information on biomes and cycles in nature. Finally, you will review information on genetics and how various traits are inherited in plants and animals.

| Plants and animals have complex systems!

Section Objectives

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

1. Describe the plant systems of photosynthesis, transport, and regulation.
2. Describe the digestive, excretory, skeletal, and nervous systems of humans.
3. Discuss genetics and aspects of reproductive systems in plants and animals.
4. Give some examples of biomes and cycles in nature.

Vocabulary

Review the vocabulary words in Science LIFEPACS 601, 602, 603, and 604.

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

cytokinins (sī tō kī nənz). A chemical regulator found in coconut milk that causes roots, stems, leaves, and buds to form from one piece of plant tissue.

framework (frām wėrk). A basic structure.

interrelate (in tər ri lāt). To have a mutual relationship.

retention (ri ten shən). The act of retaining, especially the ability to keep things in mind.

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**e**rm; **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; */TH/* 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 circus.

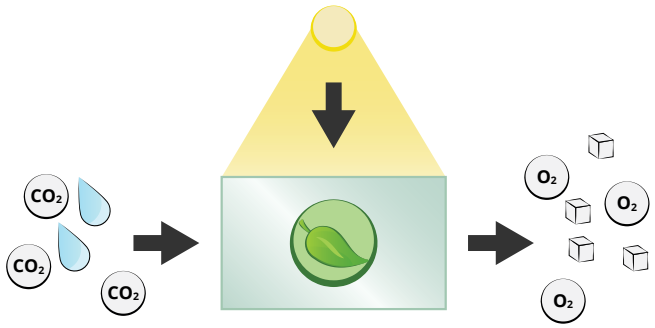
PLANT SYSTEMS

God created a great variety of plants. Yet, many plants have common systems that help them live, grow, and reproduce. There are three systems common to many plants: the *photosynthesis* system, the *transport* system, and the *regulatory* system. Let's review the components and processes involved in each one of these plant systems.

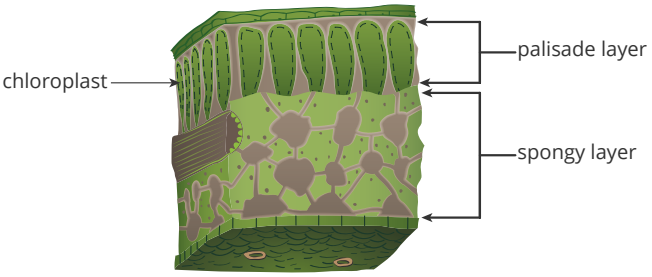
Photosynthesis system. *Photosynthesis* is a process in green plants where food is produced with the help of sunlight. The primary location of photosynthesis in green plants is the leaves. That is why we call this location the "leaf factory." Just as industrial factories produce goods in the industrial world, the "leaf factory" takes raw materials and combines them with sunlight to produce food. Green stems in plants can also produce food. In fact, any cell that contains *chlorophyll* can make food.

All factories need a source of energy to produce finished products. This energy could come in the form of electricity, oil and gas, or even water and wind power. The leaf factory also needs a source of energy. Its source of energy is light from the sun. Utilizing the sun's energy, it makes food from water, minerals and other nutrients from the soil, and carbon dioxide, and releases oxygen as a by-product. The oxygen is used by animals for breathing. The "food" produced is initially a sugar called *glucose*. This sugar can be changed into other foods within the plant such as fats, oils, proteins, and vitamins. Some of it gets stored as starch.

As mentioned previously, the primary location of the photosynthesis process within green plants is in the leaf. Within the leaf, photosynthesis takes place primarily in the *palisade* layer. This layer consists of cells lined up like fence posts. These cells are called *chloroplasts* and contain chlorophyll. Cells arranged in this manner get more exposure to sunlight. The



| Photosynthesis process in the leaf factory



spongy layer in the leaf has some chlorophyll and can make food. It does not make nearly as much food as the palisade layer. The spongy layer has many holes and open spaces which allow gases (carbon dioxide and oxygen) to be exchanged. Generally, water vapor, carbon dioxide, and oxygen are found within the spaces between the cells. Small openings known as *stomata* are located on the underneath side of the leaf. These openings allow gases to enter the spongy layer. The most important function of the spongy layer is the exchange of gases.

The leaf is covered with a protective layer of cells known as the *epidermis*. The cells of the epidermis are covered with a thin waxy layer known as the cuticle. The cuticle is a waxy coat which prevents the loss of water. All of these structures are parts of the *photosynthesis system* within plants.

Complete the following statements.

1.1 The photosynthesis system is located primarily in the _____ .

1.2 The green substance necessary for photosynthesis is called _____ .

1.3 A product made during photosynthesis is a carbohydrate (simple sugar) known as _____ .

1.4 Sugar is transported to parts of the plant and stored as _____ .

1.5 An important by-product of photosynthesis is _____ .

1.6 The energy for photosynthesis comes from the _____ .

1.7 In addition to glucose and starch, plants can also make other foods such as

a. _____ , b. _____ ,

c. _____ , and d. _____ .

Match the following items.

1.8 _____ the waxy protective coating on leaves

1.9 _____ openings that are most frequently foundon the underside of a leaf

1.10 _____ the outer layer of cells of a leaf that has a waxy coating

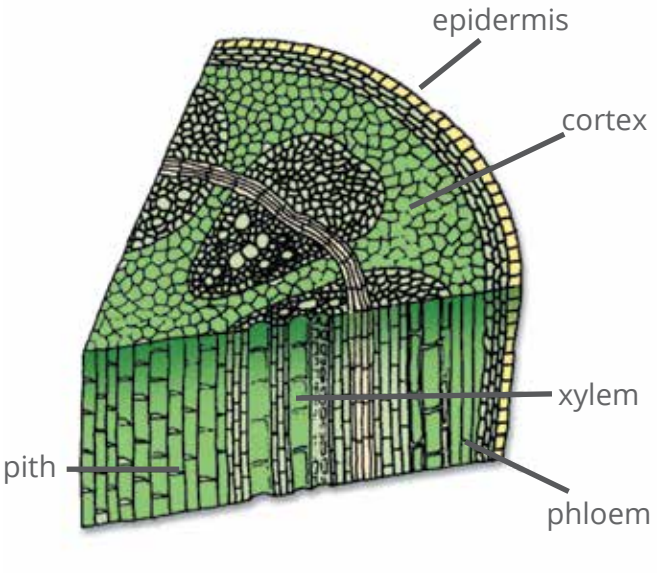
1.11 _____ the layer within the leaf that has many holes and spaces for gases to exchange

1.12 _____ the layer in the leaf that is the primary location of photosynthesis

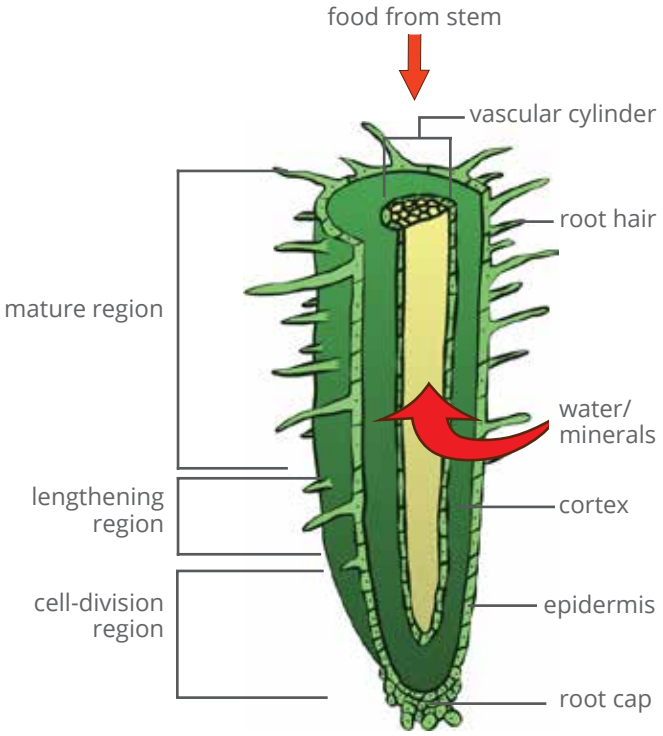
a. spongy layer
b. palisade layer
c. epidermis
d. stomata
e. cuticle
f. chlorophyll

Transport system. The *transport system* of plants involves three main structures: the roots, the stems, and the leaves. These three structures have a system of tubes which make up the transport system. The tubes that transport water and minerals in this system are known as *xylem*. Tubes that transport food to various parts of the plant are called *phloem*. Together in the stem, the xylem and the phloem are known as a *vascular bundle*. In the root, the xylem and phloem together are known as the *vascular cylinder*. In the leaf, this bundle is called the *vein*. The vascular tissues, regardless of whether they are called the vascular bundle, the vascular cylinder, or the vein, are all composed of xylem and phloem.

Plants must have a continuous supply of water and minerals. Their root hairs take in water and minerals from the soil. These minerals go up the xylem to the stem and leaves. Food is manufactured in the leaves and then transported down the phloem to various parts of the plant. There, it is converted to starch and stored. Storage of foods is an important function of roots. Plants, such as yams, carrots, beets, radishes, and turnips, store food in their roots. Stems and leaves may also act as storage places for food. Storage materials are not limited to starch. Plants may also store fats, oils, vitamins, and proteins.



| Stems



| Roots

Complete the following statements.

1.13 Plants frequently convert glucose into _____ (for storage).

1.14 Plants can also make and store other foods such as a. _____ ,

b. _____ , c. _____ , and d. _____ .

1.15 The three main structures of the plant which are involved in transport are the

a. _____ , b. _____ , and the

c. _____ .

Match the following items.

1.16 _____ the tubes that transport water and minerals

1.17 _____ the tubes that transport food

1.18 _____ one of the important functions of roots

1.19 _____ the name of the xylem and phloem in the stem

1.20 _____ the name of the xylem and phloem in roots

a. vascular cylinder

b. vascular bundle

c. vein

d. phloem

e. xylem

f. storage of food

Regulatory system. The *regulatory system* of a plant has to do with the processes and chemicals (*regulators*) that help the plant grow. The two types of regulatory chemicals are natural and artificial.

Natural regulators are chemicals normally produced by plants. At just the right time and in just the right place, the plant makes these growth chemicals. For example, when a new root is needed, just the right chemicals are produced to start a new root. When a bud or a flower is needed, just the right chemicals are made by the plant in that spot. *Auxins*, *gibberellins*, and **cytokinins** are three "families" of these regulator chemicals.

Artificial regulators are chemicals produced by humans. Through their use over the years, it has been found that some artificial chemical regulators are helpful to plant growth and have no harmful side effects, while others help regulate plant growth but have harmful effects to humans or the environment. For example, the regulator *2,4-D* can be used to control weeds and dandelions in other crops and breaks down to form harmless chemicals. But other regulators contain chemicals, such as arsenic and lead, that can have long-term harmful effects in the environment or to humans.

Scientists are exploring and investigating ways to care for and protect the environment. People must use the information learned by scientists to help protect the planet we live on.

Answer true or false.

1.21 _____ The *regulatory system* of a plant has to do with the processes and chemicals (*regulators*) that help the plant grow.

1.22 _____ The two types of regulators for plants are (1) natural and (2) artificial.

1.23 _____ Three "families" of natural regulator chemicals are *auxins*, *gibberellins*, and *cytokinins*.

1.24 _____ Artificial chemical regulators are found naturally in plants.

1.25 _____ Artificial chemical regulators have both helpful and harmful effects.

1.26 _____ We need to use science and the information we learn from it to take better care of the environment we live in.

Complete the following activity.

1.27 Write a half-page report on a natural or artificial chemical regulator for plants. You may choose one of those mentioned in this section, or you may write about another regulator that you discover while doing your research. You may find the information contained in Section 3 of the Science 601 LIFEPAC to be helpful. You should also use information that you can find on the Internet, in a library, or from other resources to help you. Be sure to mention the effects that the chemical has on plants and how it is used. Also discuss whether or not the regulator may have any harmful effects.

TEACHER CHECK _____ initials _____ date

Tropisms. Chemical regulators, especially *auxins*, affect *tropisms* in plants. A *tropism* is the name given to the plant's response that causes it to grow either toward or away from a stimulus. If the plant grows *toward* something, it is a *positive tropism*. If the plant grows *away* from something, it is called a *negative tropism*. There are three basic types of tropisms: (1) *phototropisms*, (2) *geotropisms*, and (3) *hydrotropisms*.

Plants show positive *photo*tropisms because they turn toward *light*. Plants show both positive and negative *geo*tropisms in relation to the *earth*. The roots show a positive geotropism in growing toward the earth. The leaves show a negative geotropism by growing away from the earth. Finally, *water* causes a *hydro*tropism in plants. The roots of plants show a positive hydrotropism because they grow toward water.

Complete the following statements.

1.28 A plant that grows toward a stimulus has a _____ tropism.

1.29 A plant that grows away from a stimulus has a _____ tropism.

1.30 A hydrotropism is a plant's response to _____ .

1.31 A geotropism is a plant's response to _____ .

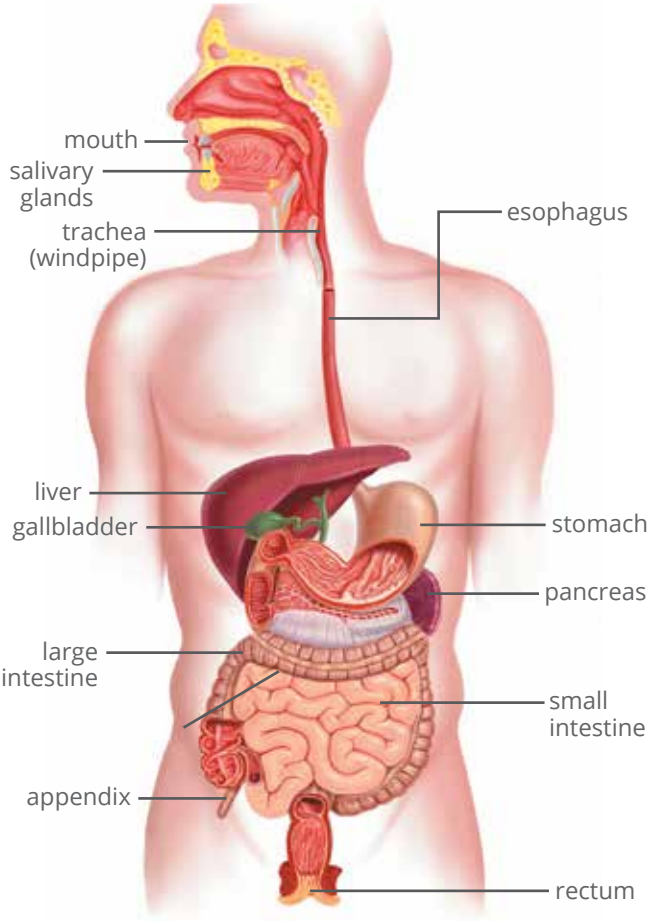
1.32 A phototropism is a plant's response to _____ .

ANIMAL AND HUMAN SYSTEMS

Plants are designed in a marvelous way. You have reviewed some of the main "systems" that make up most plants. Animals have been created with various body parts that **interrelate** in a complex fashion. We call these various related parts of animal bodies "animal systems." For example, there is a way for animals to eat and digest food in their bodies. We call this the "digestive system." All animals have a digestive system. Human beings have a digestive system, too. In fact, if we examine the various "systems" within the human body, we can get a good idea of the basic operation of most of the "animal systems."

The human body is among the most wonderful parts of nature. The various parts of the human body are very complex and orderly. In this part of the LIFEPAC, we will explore four major "systems" of the human body. They are the digestive system, the excretory system, the skeletal system, and the nervous system. By examining these four systems of the human body in some detail, you will learn about the main body systems common to all animals.

Digestive system. The digestive system acts like a chemical laboratory. It breaks down food into simple chemicals that can be absorbed by other parts of the body. These chemical substances are used as energy sources and building materials for the body. Animals such as worms, insects, mammals, birds, fish, and



| The digestive system

people all have digestive systems. Their digestive systems have similar parts and purposes. For the sake of our discussion, we will cover the human digestive system, shown in the illustration. Study this illustration and be sure that you

can identify the parts of the digestive system and the pathway of food through the system.

The *alimentary canal* is composed of the parts of the digestive system through which food passes. It consists of the mouth, esophagus, stomach, small intestine, large intestine, and rectum. As food moves through the body, digestive juices are added. This addition of juices helps break down the food into substances that can be absorbed by the body.

Each part of the alimentary canal has a special task to perform. The mouth has two functions. They are to chew and grind the food and to add saliva to help digestion. The esophagus is a tube that allows food to pass from the mouth to the stomach.

The stomach churns the food and adds digestive juices. Digestive juices are rich in *enzymes* that help break down the food into chemicals that can be absorbed.

The liver and pancreas are located close to the small intestine. They open into the small intestine and add substances that aid in the breakdown of food. The pancreas adds enzymes. The gallbladder adds *bile* to the process of digestion. Bile turns fats into an *emulsion*. This is very important in the process of breaking fats into smaller particles.

The small intestine functions to absorb food. Fingerlike projections on the small intestine are able to absorb food. These fingerlike projections are known as *villi*. Villi have an abundance of capillaries, which pick up the nutrients from the food and circulate them to the cells. The large intestine and rectum carry away undigested waste materials from the body. Any excess water is absorbed by the large intestine.

Complete the following activities.

1.33 List these parts of the digestive system or alimentary canal in their proper order: rectum, esophagus, small intestine, mouth, large intestine, and stomach.

a. _____ b. _____ c. _____

d. _____ e. _____ f. _____

1.34 Define the *alimentary canal*. _____

_____

1.35 What are the main functions of the stomach in digesting food? _____

_____

_____

Write the correct letter and answer in each blank.

1.36 The main function of the large intestine is to _____ .

a. absorb food
b. absorb water
c. add digestive juices
d. secrete bile

1.37 The main function of the small intestine is to _____ .

a. absorb food
b. absorb water
c. add digestive juices
d. secrete bile

1.38 The function of bile is to _____ .

a. break down sugar
b. digest protein
c. add enzymes to the stomach
d. make an emulsion of fats

1.39 The pancreas functions in digestion by _____ .

a. producing bile
b. absorbing fat
c. producing enzymes
d. helping the liver

1.40 Which one of the following is not part of the alimentary canal? _____

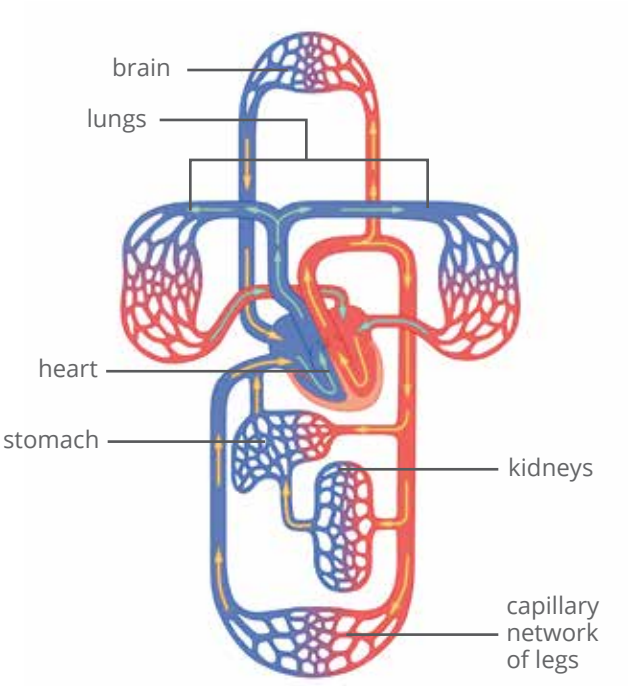
a. mouth b. small intestine c. liver d. rectum

Excretory system. There are four main parts to the human *excretory system*. They are the blood circulation system, the lungs, the kidneys, and the skin. All of these parts must work together to get rid of the body's waste materials. The *blood circulation system* carries nutrients and oxygen to all of the body's cells. At the same time, it picks up waste materials and carbon dioxide.

In the blood circulation system, the blood takes oxygen from the lungs and carries it to each cell in the body. It also carries nutrients from the villi of the small intestine to feed each body cell. Villi is explained in LIFEPAC 602, Section 1. At the same time, it removes all excess wastes such as water, carbon dioxide, poisons, and urea. The blood disposes of the excess water, urea, poisons, and other liquid wastes through the kidneys. The carbon dioxide gas is removed through the lungs.

Your blood circulation system contains about 12 pints of blood. Your heart beats about 72 times per minute to pump blood through your blood circulation system. Your heart is the finest pump in the world. Nothing that human beings have developed can compare with the reliability of the heart pump.

Arteries are tubes that carry fresh blood away from the heart. They have thick muscular walls that help to force the blood along its path.



| Blood circulation system

Veins are tubes that carry used blood back to the heart. Veins have thin walls. They also have valves that prevent the blood from flowing backward. Capillaries are very thin tubes, which are only about one cell thick. These tiny tubes unite the arteries and veins. Capillaries make contact with the body's cells. Here, the nutrients and oxygen are supplied to the cells and the wastes removed.

SELF TEST 1

Match the following items (each answer, 2 points).

1.01 _____ the location of most photosynthesis

1.02 _____ a by-product of photosynthesis

1.03 _____ openings found on the underside of a leaf

1.04 _____ a common storage product of plants

1.05 _____ the first stable product made during photosynthesis

1.06 _____ the name of the tubes that transport food in plants

1.07 _____ the name of the tubes that transport water and minerals in plants

1.08 _____ the name of the vascular bundle in the leaf

1.09 _____ a natural plant regulator

1.010 _____ a response to gravity

1.011 _____ the main function of the large intestine

1.012 _____ the main function of the small intestine

1.013 _____ an iron-rich protein that carries oxygen to the cells

1.014 _____ a liquid waste product eliminated from the blood

1.015 _____ a change in a gene that forms a new trait that can be inherited

a. hemoglobin
b. urine
c. mutation
d. absorbs food
e. absorbs water
f. geotropism
g. xylem
h. phloem
i. starch
j. glucose
k. stomata
l. leaf
m. oxygen
n. vein
o. vascular cylinder
p. auxin
q. carbon dioxide

Answer true or false (each answer, 2 points).

1.016 _____ Bacteria on legumes are able to release nitrogen into the air.

1.017 _____ Carl Correns devised the Punnett Square.

1.018 _____ Mitosis results in new cells with the same number of chromosomes as the parent cell from which they came.

1.019 _____ The tundra biome does not have trees.

1.020 _____ Bile breaks down proteins for digestion.

1.021 _____ A characteristic common to all biomes is the presence of cycles such as the nitrogen cycle.

1.022 _____ The DNA molecule has a sugar-phosphate structure.

1.023 _____ The cerebellum is the location of intelligence and thought.

1.024 _____ The brain stem controls breathing and heartbeat.

1.025 _____ A dendrite is the "sending end" of a neuron.

1.026 _____ The cerebrum controls the coordination of muscles.

1.027 _____ The bone marrow makes red blood cells.

1.028 _____ The skin acts as a cooling system by means of evaporation.

1.029 _____ Digestive juices are rich in enzymes.

1.030 _____ Gibberellin is an artificial plant regulator made by man.

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

1.031 The patella is a bone located in the _____ .

1.032 The energy for photosynthesis comes from the _____ .

1.033 Food tubes that make up the transport system of plants are called _____ .

1.034 Phototropism is a response to _____ .

1.035 Hydrotropism is a response to _____ .

1.036 The gallbladder secretes a substance known as _____ , which emulsifies fat.

1.037 Arteries are tubes that carry blood _____ (direction) the heart.

1.038 The kidneys purify the liquid part of the _____ .

1.039 The collar bone is known as the _____ .

1.040 The gastrocnemius muscle is located in the _____ region.

1.041 The cranium is a bone located in the _____ .

1.042 The name given to the nerve cell is a _____ .

1.043 The area between the axon and dendrite that carries nerve impulses is known as the _____ .

1.044 The person who discovered the principle of dominance was _____ .

1.045 The special molecule which is able to store and recover information about genetic traits is _____ .

Complete the following activities (each answer, 5 points).

1.046 Distinguish between voluntary and involuntary muscles. _____

_____

_____

_____

_____

1.047 Describe how plants, animals, and humans benefit each other in the carbon-oxygen-hydrogen cycle. _____

_____

_____

_____

_____

80/100 **SCORE** _____ **TEACHER** _____ _____
initials date

Alpha Omega
PUBLICATIONS

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

800-622-3070
www.aop.com

SCI0610 – Apr '15 Printing

ISBN 978-1-58095-540-9