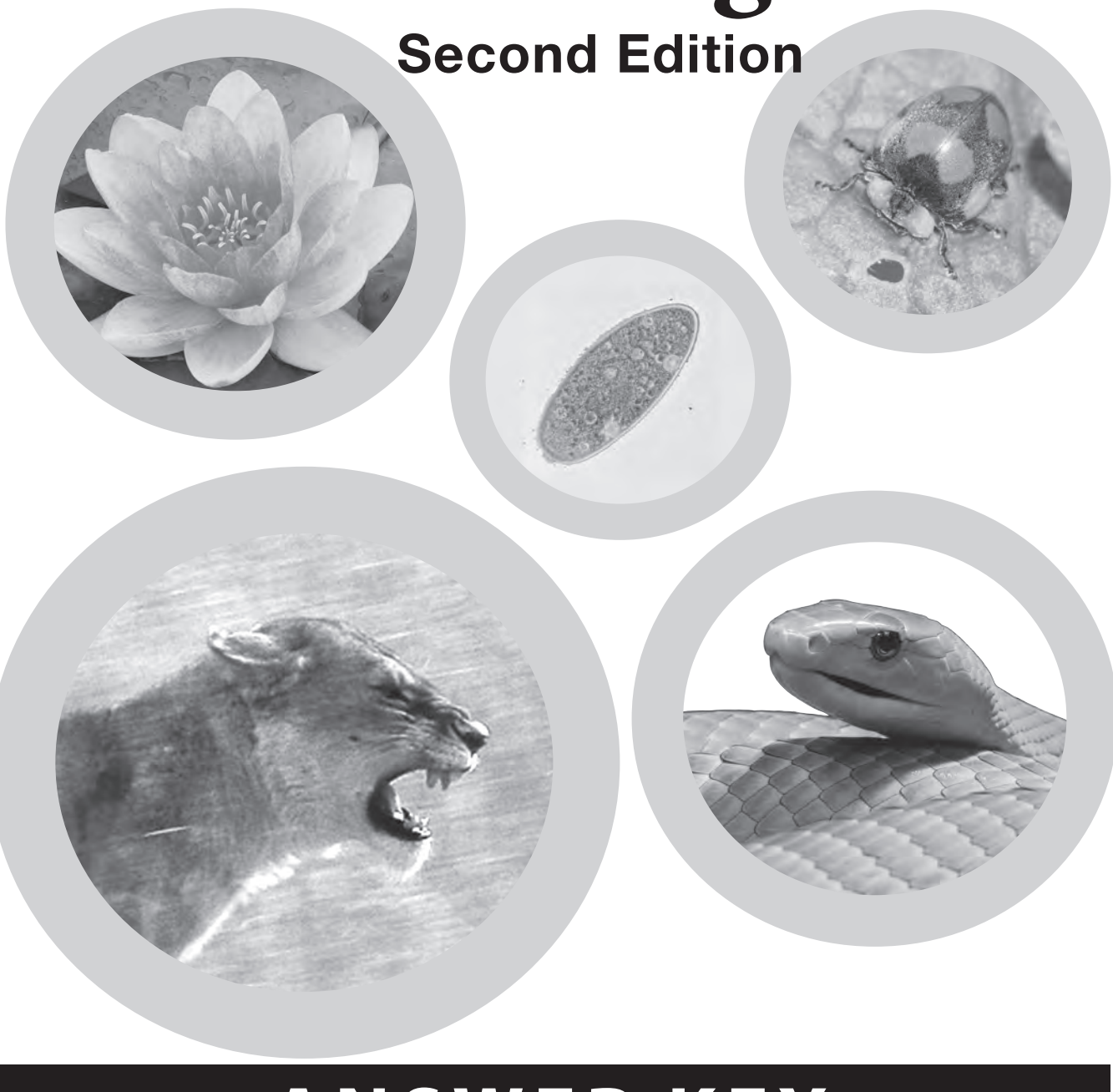
Science: Order & Design

Second Edition



ANSWER KEY

CHRISTIAN LIBERTY PRESS ARLINGTON HEIGHTS, ILLINOIS
60376 4/19

Second Edition

A publication of
Christian Liberty Press
502 West Euclid Avenue
Arlington Heights, Illinois 60004
www.christianlibertypress.com

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Printed in the United States of America

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Introduction

This answer key for *Science: Order & Design, Second Edition* (copyright © 2017 by Abeka®) was developed by the staff of Christian Liberty Press to help the instructor be as successful as possible in teaching this course on science.

We have provided sample answers for the "Section Review" questions found at the end of each section within a given chapter and the "Chapter Review" questions at the end of each chapter.

This key should only be used by the instructor to review the student's daily work. Answers are given in complete sentences and should be considered as examples; students do not have to use the same wording in their sentences, as long as they give the same information. Some answers may have additional information; however, students are not expected to include it in their responses. This information has been incorporated to elucidate the concepts that are being taught.

May God grant you wisdom and diligence as you seek to teach your children the laws and realities of God's marvelous universe.

Staff of Christian Liberty Press
Arlington Heights, IL

TEXT KEY

Chapter 1
Invitation to Science

Section Review 1.1, Page 6

1. The purpose of science is to carefully observe nature and to discover the laws of creation so these laws can be put to work for the benefit of mankind.
2. Biology (or life science) is the study of living things.
3. The term *organisms* refers to living things.
4. Anatomy is the branch of biology that studies the shape and structure of organisms.
5. The five main characteristics found in all living things are that they have organized structure, they grow, they respond to changes, they reproduce, and they perform metabolism.
6. Homeostasis is the stable internal condition of an organism.
7. Cellular respiration is the first step in metabolism for humans and many other organisms.

Thought Provoker

Answers will vary.

Section Review 1.2, Page 10

1. *Flora* is defined as any plant life. *Fauna* is defined as any animal life.
2. An environment found on land is called terrestrial.
3. *Habitat* is the term for an organism's home in an environment.
4. Night is the best time of day for observing nocturnal animals.

Thought Provoker

Bilateral symmetry means that something can be divided in only one way to create similar right and left halves. Radial symmetry means that something can be divided in multiple ways to create similar halves. Something that is asymmetrical (not having symmetry) cannot be divided into mirrored halves. *Examples will vary.*

Section Review 1.3, Page 15

1. Animals that live in trees have arboreal habitats.
2. Trackers can observe the size of the tracks, the number of toes, any claw marks, and changes due to movements to identify tracks.
3. *Aquatic* means watery.
4. Three freshwater environments are ponds, lakes, and rivers (and streams).
5. Another term for the hot springs found on the ocean floor is hydrothermal vents.

Thought Provokers

1. *Answers may vary.*
2. The limpets live in the intertidal zone.

Section Review 1.4, Page 21

1. Taxonomy is the science of classification.
2. John Ray was the first to define the idea of a species.
3. Body structure is the primary basis for classifying living things.
4. Carolus Linnaeus is considered the Father of Taxonomy.
5. Linnaeus used Latin and Latinized Greek in his classification system.
6. Because common or popular names vary by locality, scientists prefer the scientific name in order to be universal and specific.

Thought Provoker

Passer is the house sparrow's genus name.

Section Review 1.5, Page 28

1. Sir Francis Bacon is the Father of the Scientific Method.
2. *Hypothesis* is the scientific term for a sensible explanation to a problem.
3. The three main parts of the scientific method are hypothesizing, observing, and experimenting.
4. Controlled variables are the factors in an experiment that are the same in all groups.
5. The independent variable is observed to determine the results of an experiment.
6. The only difference between the experimental and control groups is the single independent variable that is present in the experimental group, which is being tested. All the other conditions in both groups are constant.

7. "A single experiment cannot provide enough evidence to support a conclusion" (p. 25). The results of an experiment must be reproducible in order to draw a conclusion. In other words, truth is always truth. If the hypothesis is true, the results will always support it.

Thought Provoker

If your experiment is well designed and another person performs it, his results should be the same as yours.

Section Review 1.6, p. 32

1. A scientist must use reasoning (logic) to develop a hypothesis, design an experiment, report on an experiment, and draw conclusions based on the evidence.
2. Inductive reasoning, reasoning from specific evidence to a more general conclusion, is used to develop hypotheses. Deductive reasoning, reasoning from evidence to a more specific conclusion, is used to make predictions based on hypotheses.
3. A model is anything that provides a partial representation of something else.

Thought Provokers

1. The prediction was that the beans would not absorb water if the scar and spot were sealed. *Answers will vary as to further predictions.*
2. *Answers will vary*. Possible models would be various types of pictures, computer graphics, physical models, and so forth.

Chapter 1 Review, Page 33

Define

1. Biology (or life science) is the study of living things (p. 2).
2. An organism is a living thing (p. 2).
3. Homeostasis is the stable internal condition of an organism (p. 4).
4. Metabolism is the sum of all the chemical processes of life. Cellular respiration is the first step in metabolism. The cells produce ATP by combining nutrients with oxygen (p. 4).
5. Flora is any plant life, and fauna is any animal life (p. 6).
6. An environment is everything surrounding an organism that is being studied (p. 8).
7. A terrestrial environment is found on land (p. 8).
8. The place that an organism lives is called its habitat (p. 8).
9. Diurnal organisms are active mainly during the day. Nocturnal are active mainly at night (p. 9).
10. An arboreal environment is found in trees (p. 11).
11. Aquatic environments are watery environments. Freshwater environments consist of ponds, lakes, rivers, and streams; and marine environments are in the seas (p. 14).
12. The intertidal zone is the marine environment that exists between high and low points of the tide. A tide pool is a collection of salt water and sea life that could not escape when the tide went out (p. 14).
13. A hydrothermal vent is a hot spring found on the ocean floor (p. 15).
14. Taxonomy is the science of classification (p. 17).
15. The scientific method is a way for scientists to gather and pursue scientific knowledge. The three main parts of any scientific method are hypothesizing, observing, and experimenting (p. 22).
16. Hypothesis is the scientific term for a sensible explanation to a problem. Data is facts gathered by observation. A theory is a way of explaining an object or event by using a set of facts. A law is a theory that has never been proven false (pp. 22–23).
17. An experimental group is a group on which a test is performed. A control group is a group in which the independent variable is absent. It is the group used as a standard for comparison (p. 24).
18. An inference is a conclusion based on reasoning from evidence (p. 28).

Identify

1. The five main branches of biology are zoology (study of animals), botany (study of plants), microbiology (study of organisms too small to see without a microscope), ecology (study of organisms interacting with each other and their environment), and human anatomy and physiology (pp. 2–3).
2. The five main characteristics found in all living things are that they have organized structure, they grow, they respond to changes, they reproduce, and they perform metabolism (p. 3).

3. Rules to follow during science labs are as follows: (1) know the location of safety equipment in your lab or classroom; (2) always handle glassware carefully; (3) wear protective clothing as necessary; (4) follow the safety precautions given for any chemicals or equipment used in the lab; and (5) if an object breaks during lab, immediately notify your teacher. Do not attempt to clean it up yourself. Other rules are: (6) no eating or drinking is allowed in the lab; (7) keep your work area clean; (8) clean up after lab; and (9) never perform any unauthorized experiments (p. 16). *The student should name five of these.*
4. John Ray was the pioneer in taxonomy who was the first to develop a modern definition for the word *species* (p. 17).
5. The seven main levels of taxonomy are Kingdom, Phylum, Class, Order, Family, Genus, and Species (p. 18).
6. Sir Francis Bacon was the scientist who introduced the scientific method (p. 22).
7. The three main parts of any scientific method are hypothesizing, observing, and experimenting (p. 22).

Explain

1. The purpose of science is to carefully observe nature and to discover the laws of creation so these laws can be put to work for the benefit of mankind (p. 2).
2. Nutrients are essential to metabolism because of the law of conservation of energy, which states that energy cannot be created or destroyed, only changed in form. The organism must have nutrients in order to obtain energy from them through metabolism. Water is an essential ingredient because the body must maintain a certain percentage of water in order to survive (pp. 4-5).
3. *Exo* (outside) *therm* (heat) *ic* involves a release of heat.

   Macro (large) *phage* (eat) would be something large that eats. In this case, it is a large white blood cell that digests harmful substances in the body.

   Hypo (under) *dermis* (skin) is the under layer of the skin.

   Cyto (cell) *skeleton* is the network of filaments that gives shape to a cell.
4. Bilateral symmetry means that something can be divided in half only one way to create similar right and left halves. Radial symmetry means that something can be divided in multiple ways to create similar halves. Something that is asymmetrical (not having symmetry) cannot be divided into mirrored halves (p. 7).
5. Identifying animal tracks allows a person to know what animals are in the area, even if he does not see those animals directly. The track patterns can help in studying animal behavior (p. 12).
6. After completing your experiments, you should record the results, which may help someone else to further the investigation (p. 25).
7. If many scientists separately test a hypothesis, then the conclusions will be supported by more accurate results. "A single experiment cannot provide enough evidence to support a conclusion" (p. 25). The results of an experiment must be reproducible in order to draw a conclusion. In other words, truth is always truth. If the hypothesis is true, the results will always support it.
8. Deductive reasoning uses evidence to draw a more specific conclusion. Inductive reasoning uses specific evidence to form a more general conclusion (pp. 28-29).

Apply

1. Linnaeus set up a classification system based on body structure. Classification gives man a way to organize and study creation (pp. 17, 20).
2. The eastern white pine is in Kingdom Plantae ("plants") (p. 18).
3. The American black bear's species name is *americanus* (p. 18).
4. The experiment would involve having two groups of cows, one group eating commercial feed and one eating freshly cut grass. The dependent variable (the factor observed) would be the amount of milk each produces. The independent variable (the factor being changed) is the type of feed. The controlled variables would be factors such as environment (temperature, humidity, and so forth), any other intake (amount of water drunk), and any other treatment that the animals receive.
5. *Answers may vary*. Types of models possible would include any of various types of pictures, computer models, or physical models (p. 31).

Chapter 2
Plants: Provision for Life

Section Review 2.1, Page 36

1. Green plants are the most important of God's provisions for life on earth.
2. Sprengel's goal in his botanical studies was to bring glory to his Redeemer for the wise design, purpose, and provision placed in God's living creation.
3. The primary purpose of a flower is the reproduction of the plant.
4. The four main parts of a flower are the sepals, petals, stamens, and pistil.
5. The pistil consists of three main parts: (1) the stigma is the top of the pistil; (2) the style is the stalk that connects the stigma and ovary, and (3) the ovary is the rounded bottom of the pistil.
6. The anther (part of the stamen) produces pollen.

Thought Provokers

1. The plum flower has a superior ovary (above the sepals and petals).
2. A staminate flower would not produce seeds since it has no pistil to become a seed.

Section Review 2.2, Page 41

1. Pollination and fertilization are two processes that must occur before seeds can form.
2. Pollination is the transfer of pollen from the anther to the stigma. Fertilization is the uniting of a sperm cell from a pollen grain to an egg cell, resulting in the formation of a seed.
3. The seed is the structure that contains the embryo of a plant.
4. The three parts of a typical seed are the embryo, endosperm, and seed coat.
5. A radicle is the root of an embryo.
6. The scientific definition of a fruit is the ripened ovary of a flower, whether it is edible or not.
7. Dispersal is the scattering or distributing of seeds after they are mature.
8. Mechanical dispersal occurs when the ripened fruit bursts open and scatters the seeds some distance from the plant. However, agent dispersal occurs when seeds are carried away from the plant by animals, water, or wind.

Thought Provoker

A dicot would germinate faster than a monocot because it has already digested the endosperm and is ready to grow by the time it leaves the parent plant. A monocot does not absorb the endosperm until germination.

Section Review 2.3, Page 45

1. Moisture, favorable temperature, and oxygen are the three things required for a seed to germinate.
2. The major events that occur in each of the three stages of germination are: (1) the seed begins to swell by absorbing or soaking up water, (2) the embryo pushes the radicle through the softened seed coat and into the ground, and (3) the plumule emerges above the surface of the ground and the radicle grows into a root system.
3. A seedling is a plant that no longer depends on the cotyledons for nourishment.
4. An annual produces seeds in one growing season.
5. Biennials live through two growing seasons in order to complete their life cycles, whereas perennials live from year to year and bloom each season.

Thought Provoker

A coconut would not be likely to germinate on the shores of Alaska because the cold temperature would not be suitable for it.

Section Review 2.4, Page 53

1. Botanists classify angiosperms (flowering plants) into families according to the structure of their flowers and fruits.
2. Members of the composite family have ray and disk flowers.
3. Members of the pea family (or legumes) help return nitrogen to the soil.
4. The stems of the mint family are square and stout.
5. Umbel is the term for an arrangement of flowers having stems of nearly equal length emerging from a common point on the main stem.

Thought Provoker

The rose and buttercup families are compared and contrasted in the table below:

Plant Part	Rose Family	Buttercup Family
Blossoms	cup-shaped	cup-shaped
Petals	petals (or flower parts) in multiples of 5	typically 5 petals (or petal-like sepals)
Stems	typically woody stems	typically herbaceous (non-woody) stems
Fruits	typically fleshy fruits	typically dry fruits

Section Review 2.5, Page 59

1. The differences between monocots and dicots are shown in the table below:

Plant Part	Monocots	Dicots
Leaf shape	long, slender leaves	broad leaves
Venation	parallel veins	branching veins
Number of Cotyledons	one	two
Flower Petals	in multiples of 3	in multiples of 4 or 5

2. Grasses, lilies, and palm trees belong to the monocotyledons or monocots.
3. The purpose of the lily's bulb is to store food during the growing season, allowing the plant to live after its flowers and above-ground leaves and stems have died.
4. Corms are thick, underground stems that grow vertically, whereas rhizomes are thick, underground stems that grow horizontally.
5. The leaf is attached to the stem of a grass plant at the node (or joint).
6. The creeping stem of a grass plant is called a stolon.
7. Grasses are important for several reasons, but the greatest reason is the food they provide for humans and animals alike. Some of the high-yielding food crops that literally feed the world today are wheat, barley, rye, oats, rice, and corn. Indirect benefits of livestock feeding on grains and grasses include meat, milk, and dairy products. Two other useful types of grasses are sugar canes and bamboos. Grasses are considered the most important group of plants on earth and cover one third of the land area of the earth.

Thought Provoker

a. monocot
b. dicot
c. dicot
d. dicot

Section Review 2.6, Page 62

1. The three basic leaf shapes are: (1) broad, flat leaves; (2) narrow leaves; and (3) needlelike or scalelike leaves.
2. The petiole is the stalk that attaches the leaf blade to the node.
3. The various shapes and arrangements of leaves, which allow for maximum exposure to light, illustrate the great variety and efficiency of God's wise design.
4. The three most common leaf arrangements around the stem are opposite, alternate, and whorled.
5. Plants with simple leaves have only one blade attached to a petiole; a compound leaf has more than one blade joined to a petiole. To tell the difference between a simple leaf and a leaflet, look for a bud. A simple leaf will have a bud, but a leaflet will not.
6. The three major patterns of leaf veins are parallel (most monocots), pinnate (one main vein—dicots), and palmate (two or more main veins—dicots).

Thought Provoker

The noni leaves in the picture appear to be in an opposite arrangement. The margins are entire. The venation is pinnate.

Section Review 2.7, Page 69

1. Photosynthesis is the food-making process of plants. It occurs in the chloroplasts.
2. Chlorophyll is the green pigment of plants used in photosynthesis.
3. The tiny holes or pores located on the underside of the leaf, which allow the air to enter, are called stomata.
4. Excess glucose is converted into starch, which is stored for later use.
5. Cellular respiration is an important process in which glucose (food made from photosynthesis) combines with oxygen to produce energy for other plant functions.
6. Photosynthesis occurs when the light energy is absorbed by the chloroplasts. Therefore, during the night, when the sun is not shining, photosynthesis cannot occur.