SECTION 1.1 | THE STUDY OF LIFE
Study Guide

KEY CONCEPT
Biologists study life in all its forms.

VOCABULARY
| biosphere | biology | metabolism |
| biodiversity | organism | DNA |
| species | cell |

MAIN IDEA: Earth is home to an incredible diversity of life. Take notes about the diversity of life on Earth in the chart below.

1. In the box labeled **The Biosphere**, list examples of environments on earth in which life is found.

2. In the box labeled **Biodiversity**, write a definition of the term in your own words.

3. In the box labeled **Species**, briefly explain what a species is.

4. How is biodiversity related to the biosphere?

5. In general, how does biodiversity vary across the biosphere?

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Unit 1 Resource Book
McDougal Littell Biology
STUDY GUIDE, CONTINUED

MAIN IDEA: All organisms share certain characteristics.

6. Before reading, take a quick look at the headings in this main idea. What are the four characteristics that identify something as living?

7. As you read, take notes on how the four basic characteristics help define what is a living thing.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Summary Sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cells</td>
<td></td>
</tr>
<tr>
<td>Energy and metabolism</td>
<td></td>
</tr>
<tr>
<td>Response to environment</td>
<td></td>
</tr>
<tr>
<td>Reproduction and development</td>
<td></td>
</tr>
</tbody>
</table>

Vocabulary Check

8. The word biosphere is made up of two word parts: bio- and sphere. How can these two word parts help you to remember the definition of biosphere?

9. What is an organism?

10. The term metabolism is based on a Greek word that means “change.” How is this meaning related to the meaning of metabolism?

11. How is DNA related to reproduction?
SECTION 1.1 THE STUDY OF LIFE

Power Notes

Biosphere:

Biodiversity:

Species:

Organism:

<table>
<thead>
<tr>
<th>Characteristics Shared by Organisms</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
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<tr>
<td>3.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
</tr>
</tbody>
</table>
SECTION 1.1

THE STUDY OF LIFE

Reinforcement

KEY CONCEPT  Biologists study life in all its forms.

**Biology** is the scientific study of all forms of life. Living things are found almost everywhere on Earth, from very hot environments to very cold environments and from the dry deserts to the ocean floor. The types of living things found in a particular region depend on which can survive there. Those living things that can survive in an environment can differ greatly in size and shape.

All of the living things on Earth, and all of the places in which they live, make up the **biosphere**. The variety of living things in a certain area, or across the entire biosphere, is called **biodiversity**. Biodiversity can be measured in terms of the number of species in an area or across the biosphere. Although there are several definitions of the term **species**, you can think of a species as a certain type of living things that can reproduce by interbreeding.

At least two million species exist on Earth. Each individual living thing, no matter the species, is an **organism**. Every organism, from any species, shares certain characteristics of life.

- All organisms are made of one or more cells. A **cell** is the basic unit of life on Earth.
- All organisms need chemical energy to carry out all of their cell functions. Energy is used for **metabolism**, which is all of the chemical processes that build up or break down materials.
- All organisms respond to physical factors, or stimuli, in their environment.
- Members of a species must be able to reproduce so that the species will survive. When organisms reproduce they pass on their genetic material, which is called **DNA**, to their offspring.

1. Where do all living things on Earth exist?

2. What is one way in which biodiversity can be measured?

3. List the four characteristics of living things.

4. What is metabolism?
UNIFYING THEMES OF BIOLOGY

KEY CONCEPT
Unifying themes connect concepts from many fields of biology.

VOCABULARY

<table>
<thead>
<tr>
<th>System</th>
<th>Homeostasis</th>
<th>Adaptation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecosystem</td>
<td>Evolution</td>
<td></td>
</tr>
</tbody>
</table>

MAIN IDEA: All levels of life have systems of related parts.

1. What is a system?

2. What are some examples of systems?

Complete the table by writing either the level of life or an example of a system at that level of life.

<table>
<thead>
<tr>
<th>Level</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>Cells</td>
</tr>
<tr>
<td></td>
<td>Chemicals and processes interact in a precise way so that a cell can function properly.</td>
</tr>
<tr>
<td>4.</td>
<td>Ecosystem</td>
</tr>
<tr>
<td>5.</td>
<td>Different parts of a living thing work together so that the living thing can survive.</td>
</tr>
</tbody>
</table>

MAIN IDEA: Structure and function are related in biology.

7. What are structure and function?

8. Give an example of how structure and function are related on the cellular level.
MAIN IDEA: Organisms must maintain homeostasis to survive in diverse environments.

9. What is homeostasis?

10. Why is homeostasis important to the survival of an organism?

11. In the space below, draw a sketch to help you remember what negative feedback is.

   Body temperature decreases. \( \rightarrow \) \( \rightarrow \) Body systems send messages.

MAIN IDEA: Evolution explains the unity and diversity of life.

12. What is evolution?

13. Over the course of time, evolution \( \underline{\text{____________}} \) the genetic makeup of a population.

14. \( \underline{\text{____________}} \) are genetic traits that give an advantage to an individual and can be passed on to offspring.

Vocabulary Check

15. A system in which living and nonliving things in a certain area interact is called a(n) \( \underline{\text{____________}} \).

16. The maintenance of constant internal conditions in an organism is called \( \underline{\text{____________}} \).
Biology has unifying themes.

- **Systems:**
  - Examples:

- **Homeostasis:**
  - Examples:

- **Structure and function:**
  - Examples:

- **Evolution:**
  - Examples:
UNIFYING THEMES OF BIOLOGY

Reinforcement

KEY CONCEPT Unifying themes connect concepts from many fields of biology.

Several major concepts run through all of biology. These underlying ideas, or unifying themes, demonstrate the relationships among all organisms and help to connect one field of biology to others.

- **Systems:** A system is a group of related parts that interact to form a whole. Groups of molecules can interact to form the cellular machinery for a particular process. Groups of cells can interact to form an organ, such as the heart. Groups of organisms can interact within an ecosystem. An ecosystem is a certain area in which living and nonliving things interact.

- **Structure and Function:** The biological function of a part of an organism is directly related to that part’s structure. This relationship is found in molecules within cells, among different types of cells, and across different species. Different organisms have different specialized structures that perform functions specialized to that species.

- **Homeostasis:** All organisms must keep their internal conditions stable in order to stay alive. Homeostasis is the maintenance of these conditions. Homeostasis is necessary because the cells of all organisms function best within a particular range of conditions. If conditions vary too far from the ideal set, cells will not be able to function normally. When internal conditions change, a negative feedback system often acts to return the condition to normal.

- **Evolution:** Evolution is the process by which the genetic makeup of a population changes over time. One way in which evolution occurs is through the natural selection of genetic traits that give an individual an advantage in a particular environment. Individuals with these advantageous traits, or adaptations, are more likely to survive and reproduce.

1. What are the parts that interact to form a whole ecosystem?

2. How does structure affect function in biology?

3. How does homeostasis help to keep an organism alive?

4. What is evolution?
KEY CONCEPT
Science is a way of thinking, questioning, and gathering evidence.

VOCABULARY
| observation | hypothesis | independent variable | constant
| data | experiment | dependent variable | theory |

MAIN IDEA: Like all science, biology is a process of inquiry.
Complete the table below by giving a brief description and a brief example of each of the scientific process terms.

<table>
<thead>
<tr>
<th>Scientific Process</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td>1.</td>
<td>2.</td>
</tr>
<tr>
<td>Data</td>
<td>3.</td>
<td>4.</td>
</tr>
<tr>
<td>Hypothesis</td>
<td>5.</td>
<td>6.</td>
</tr>
</tbody>
</table>

7. How do scientists use statistics when they test a hypothesis?

8. Why is it important that a scientist’s results are evaluated by other scientists?

________________________________________________________________________

________________________________________________________________________
9. Look at Figure 1.10. Beginning with observation, what are the five parts of scientific thinking?

   ____________________________________________________________
   ____________________________________________________________

MAIN IDEA: Biologists use experiments to test hypotheses.
10. In _______________ studies, scientists do not interfere with what is going on.

11. Scientists can test hypotheses through _______________

12. A(n) _______________ variable is one which is observed and not manipulated by the scientist.

13. How are constants different from independent variables?

   ____________________________________________________________
   ____________________________________________________________

MAIN IDEA: A theory explains a wide range of observations.
14. What is the difference between a theory and a hypothesis?

   ____________________________________________________________

15. Why are theories never proven?

   ____________________________________________________________

Vocabulary Check
16. What is a hypothesis?

   ____________________________________________________________

17. How can you remember the difference between an independent variable and a dependent variable? Think about what the words independent and dependent mean.

   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
SECTION 1.3

SCIENTIFIC THINKING AND PROCESSES

Power Notes

Observing

Evaluating results

Forming hypotheses

Analyzing data

Testing hypotheses

Experiment

Independent variables

Dependent variables

Constants

Theory:
SECTION 1.3

Reinforcement

KEY CONCEPT  Science is a way of thinking, questioning, and gathering evidence.

Scientists do not use one scientific method, but all science is based on the same principles: curiosity, critical and logical evaluation of evidence, and the open and honest exchange of data. In any scientific inquiry, scientists

- Make observations: Scientists use their senses and various measurement tools to collect information, or make observations, about the world.
- Form hypotheses: Scientists propose answers to scientific questions, or form hypotheses, based on observations they, or other scientists, made.
- Test hypotheses: Scientists devise methods of observing and experimenting to test their predictions.
- Analyze data: Scientists use statistics to analyze data. This analysis tells a scientist whether a hypothesis is supported or not supported by the data.
- Evaluate results: Scientists evaluate both their own results and the results from other scientists.

Scientists use experiments to test hypotheses. A scientific experiment uses tightly controlled conditions to test a possible cause-and-effect relationship between variables. In an experiment, there are constants and two types of variables: the independent variable and dependent variables.

- Independent variables: An independent variable is a condition that is manipulated by a scientist to determine its effect on a dependent variable. An independent variable is the “cause.”
- Dependent variables: A dependent variable is measured by a scientist to study the effect of the independent variable. It is the “effect” and depends on the independent variable.
- Constants: Factors that are controlled so that they do not change are constants.

A hypothesis is a proposed explanation for a single observation. A scientific theory, however, is a proposed explanation for a wide range of observations and experimental results, and is supported by a wide range of evidence.

1. How do scientists use hypotheses? ________________________________
   ________________________________

2. What is the difference between independent variables and dependent variables? ________________________________
   ________________________________

3. What is a theory? ________________________________
   ________________________________
### KEY CONCEPT
Technology continually changes the way biologists work.

### VOCABULARY
- **microscope**
- **molecular genetics**
- **gene**
- **genomics**

### MAIN IDEA: Imaging technologies provide new views of life.

Compare and contrast the different types of microscopes and medical imaging techniques.

<table>
<thead>
<tr>
<th>Type of Technology</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light microscope (LM)</td>
<td>1.</td>
</tr>
<tr>
<td>Scanning electron microscope (SEM)</td>
<td>2.</td>
</tr>
<tr>
<td>Transmission electron microscope (TEM)</td>
<td>3.</td>
</tr>
<tr>
<td>X-ray</td>
<td>4.</td>
</tr>
<tr>
<td>Magnetic resonance imaging (MRI)</td>
<td>5.</td>
</tr>
</tbody>
</table>
STUDY GUIDE, CONTINUED

MAIN IDEA: Complex systems are modeled on computers.
6. What is a model?

7. Why might scientists use computer models in research instead of conducting an experiment on the real system they would like to study?

MAIN IDEA: The tools of molecular genetics give rise to new biological studies.
8. What is a gene?

9. How are computers used in genomics?

10. How does a gene differ from a genome?

Vocabulary Check
11. The term genomics is related to the term genome. How does the definition of genome give you a clue about what genomics means?

12. The term molecular genetics is made up of two words: molecular and genetics. What are the meanings of these two words, and how can these words help you to remember what molecular genetics is?
## BIOLOGISTS’ TOOLS AND TECHNOLOGY

### Power Notes

<table>
<thead>
<tr>
<th>Tool or Technology</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light microscope (LM)</td>
<td>1.</td>
</tr>
<tr>
<td>Scanning electron microscope (SEM)</td>
<td>2.</td>
</tr>
<tr>
<td>Transmission electron microscope (TEM)</td>
<td>3.</td>
</tr>
<tr>
<td>X-ray imaging</td>
<td>4.</td>
</tr>
<tr>
<td>Magnetic resonance imaging (MRI)</td>
<td>5.</td>
</tr>
<tr>
<td>Functional magnetic resonance imaging (fMRI)</td>
<td>6.</td>
</tr>
<tr>
<td>Computer modeling</td>
<td>7.</td>
</tr>
<tr>
<td>Molecular genetics</td>
<td>8.</td>
</tr>
</tbody>
</table>
The invention of the microscope in the late 1600s played a major role in the development of biology as a science. Because microscopes could greatly magnify very tiny things, scientists discovered microscopic organisms, or microorganisms, and recognized the cell as the basic unit of life. Light microscopes are still used by many biologists, and they are still based on the same principles. Other types of microscopes, called electron microscopes, are also commonly used today.

- **Light microscope (LM):** Light microscopes use light and glass lenses to magnify objects. Both living and preserved specimens can be observed with light microscopes. These microscopes can clearly magnify specimens about 1500 times.
- **Scanning electron microscope (SEM):** Scanning electron microscopes use electrons to magnify objects. Electrons that bounce off a specimen are detected and interpreted by a computer to form a three-dimensional image of the specimen. An SEM cannot be used to study a living specimen, but it can clearly magnify a specimen more than 100,000 times.
- **Transmission electron microscope (TEM):** Transmission electron microscopes are similar to SEMs. They use electrons to magnify specimens, they cannot be used to study living specimens, and they can clearly magnify specimens more than 100,000 times. Unlike SEMs, TEMs use electrons that pass through a specimen. The images are two-dimensional.

Other computer-based technologies are very important in many areas of biology. Computer models are used to study things that would otherwise be impossible to study directly, such as the possible effects of medicines and the potential spread of diseases. Computers are used in genetics research. They can be used to study a single gene, which is a stretch of DNA that stores genetic information, or they can be used to study an organism’s genome, which is all of its DNA.

1. What are the differences between light microscopes and electron microscopes?

2. When are computer models most useful?

3. What is a gene? What is a genome?
**SECTION 1.5 | BIOLOGY AND YOUR FUTURE**

**Study Guide**

**KEY CONCEPT**
Understanding biology can help you make informed decisions.

**VOCABULARY**
- biotechnology
- transgenic

**MAIN IDEA:** Your health and the health of the environment depend on your knowledge of biology.

1. Briefly describe three ways in which biology can help you make informed decisions about your health.

2. Briefly describe why biology and scientific thinking can help you make informed decisions related to the world around you.

**MAIN IDEA:** Biotechnology offers great promise but also raises many issues.

3. What is biotechnology?

Use the chart below to list the benefits of biotechnology, as well as the risks and ethical concerns about biotechnology.

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Risks and Ethical Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.</td>
<td>5.</td>
</tr>
</tbody>
</table>

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STUDY GUIDE, CONTINUED

MAIN IDEA: Biology presents many unanswered questions.

6. Most of our knowledge about DNA was discovered during the past _______________ years.

7. Many questions go _______________ because we don’t know enough about biology to even come up with those questions.

8. Before the invention of the microscope, people did not know about cells and bacteria. With this in mind, why do you think many questions go unanswered and unasked?

Vocabulary Check

Each of the vocabulary words has been divided into its root words. Define the roots. Then use the definitions to define the vocabulary word.

9. Transgenic organism can be divided into trans- and genic.

10. Biotechnology can be divided into bio- and technology.

Any Questions?

11. What questions do you have about biology or scientific research? List three topics in biology that you want to learn more about, and why they interest you.
SECTION 1.5 BIOLOGY AND YOUR FUTURE

Power Notes

Personal health and lifestyle choices:

Environment and society:

Biotechnology

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Risks</th>
<th>Ethical Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>
An understanding of biology is important for understanding many issues, both on a personal level and on a societal level. Choices that you make about your personal lifestyle and about the environment around you are often related to biology in some way. Your knowledge of biology can help you make informed decisions.

Your health can depend on your knowledge of biology. Knowing the nutrients you need, the causes of diseases, and the things you should avoid, such as cigarettes, can help you lead a longer, healthier life. For example, obesity has been linked to an increased risk of diabetes, stroke, heart disease, and various types of cancer. Similarly, cigarettes have been linked to an increased risk of stroke, heart disease, and cancer. The choices you make affect your health.

Biology can also help you address issues that affect the world around you.

- The environment: The environment around you affects you, and you affect the environment. Biologists study environmental issues such as pollution, biodiversity, habitat preservation, land conservation, and natural resource use, but they don’t make decisions about these issues. Instead, all people can use scientific research to help form their own opinions and make their own choices.

- Biotechnology: As we have learned more about living things and how they function, many advances in biotechnology have taken place. Biotechnology is the use and application of living things and biological processes. Biotechnology presents both great potential benefits and risks, which you may have to consider throughout your lifetime. Biotechnology is very useful in developing medical treatments and in improving agriculture. However, the long-term effects of many biotechnology applications are unknown.

1. How can a knowledge of biology help you make informed decisions about your health?

2. Why is an understanding of the environment important?

3. What is biotechnology?
Two different types of data can be collected during scientific investigations: qualitative data and quantitative data.

The following data were collected by scientists studying the feeding habits of the purple-throated carib hummingbird, *Eulampis jugularis*. This hummingbird is found on several Caribbean islands including Dominica and St. Lucia. It feeds on both nectar and insects. In this study, scientists observed the birds in two different locations on the island of Dominica. One area was a landscaped garden with red ginger and several species of *Heliconia*. The other was a forested area dominated by *Heliconia* (spp.). A summary of the data collected is listed below.

- The males of the species are larger than the females.
- The males’ bills are shorter and less curved than those of the female.
- The hummingbirds in the landscaped garden spent 21% of the time feeding. Of that time, 20% was spent feeding on insects and 80% was spent feeding on nectar.
- The males get nectar from a species of *Heliconia* in which the flowers have shorter and less curved petals.
- The females get nectar from a species of *Heliconia* in which the flowers have longer and more curved petals.
- The hummingbirds in the forested area spent 23% of the time feeding. Of that time, 92% was spent feeding on insects and 8% was spent feeding on nectar.

1. **Identify** Which are the quantitative data in the example above? Explain.

2. **Identify** Which are the qualitative data in the example above? Explain.

3. **Synthesize** For each of the qualitative observations, give an example of how it could be transformed to quantitative data.
Chapter 1 introduces evolution as a process of species adaptation. It is important to understand that evolution is often a relatively slow process. Most adaptations arise over the course of many generations, not suddenly. The process by which this occurs is called natural selection.

**MUTATION**

DNA is the molecule that stores genetic information in organisms. A change in the DNA of an organism is called a mutation. Some mutations cause an organism to bear a trait that is new or different from the traits of its predecessors. Were it not for mutation, life as we know it—with its millions of species and the variety and diversity we see on Earth today—could not have evolved. If the effect of a mutation helps an organism survive and thus reproduce in its environment, we call this effect an adaptation. It usually takes a long time for adaptations to evolve, and even longer for an adaptation to become common or prevalent in a population.

The cicada’s basic shape resembles many other flying insect species. The thorn bug, a close relative of the thorn mimic tree hopper on page 10 of your book, has a distinct shape that allows this insect to blend in with real thorns on the stems of plants.

**ADAPTATION AND NATURAL SELECTION**

When it comes to nature and evolution, we tend to focus our attention on the most striking examples of adaptation, such as the thorn bug’s distinctly thornlike shape. Keep in mind that the cicada is just as well adapted to its environment as the thorn bug is to its environment. How did natural selection lead to the evolution of these two bugs?

Imagine that, long ago, the common ancestor of the thorn bug and the cicada was a small flying insect similar in shape to the cicada. A mutation in the DNA of one of these ancestral insects resulted in a slight extension on its exoskeleton just above and behind the head. Because the extension was in no way detrimental to the insect, the insect reproduced, passing on this trait to its offspring. Now imagine that the insects moved into an environment
where thorny trees and bushes were prevalent. Birds preyed upon the insects as they fed on the sap of the plants.

1. With mutations occurring and accumulating over generations, birds preying on insects, and surviving insects reproducing, describe how the modern thorn bug might have evolved.

2. In what form is a trait passed on from parent to offspring, and, in effect, what is natural selection “selecting” for?

3. In what sense is natural selection a process of elimination?

4. Draw two examples of intermediate descendants that show how a cicada-like insect might have evolved into a thorn bug.
You have learned in Chapter 1 that the simple light microscope is still one of the most important tools in biology. In this activity you will learn about the optics of a microscope, and how the interplay of its lenses allows us to see the microscopic aspects of our world.

**FORMING AN IMAGE**

For you to see, light must be reflected off an object and bent, or refracted, through the lenses in your eye. These lenses, like those in a microscope, are converging lenses. Light is refracted to the focal point \(F\), where all the rays meet. The distance from the center of a lens to its focal point is the focal length \(f\). A converging lens has two focal points \(F'\) and \(F''\) because it is curved equally on both sides. Where an object is in relation to the focal point determines the size and orientation of the image produced.

**RAY DIAGRAMS**

A ray diagram is used to trace the light rays that form an image. Three rules apply. We will use the special case of an object located \(2f\) from a lens to explain the rules. As is customary, we will show the rays originating from a single point at the top.

**Rule 1** A ray reflected from the object, traveling parallel to the axis, is refracted through the focal point \(F\) on the far side of the lens.

**Rule 2** A ray reflected through the focal point \(F'\) on the near side of the lens is refracted parallel to the axis.

**Rule 3** A ray reflected through the lens center goes straight through without refraction.

For an object placed \(2f\) from the center of a lens, the image formed is the same size as the object. An image that forms directly from the refracted rays is the real image.
1. The example just given shows an object that is placed outside the focal point of a lens. What is the orientation of the image formed?

2. Draw a ray diagram for the object shown in the diagram below, first placed at point A and then point B. Only two rays are needed to create the image; use Rules 1 and 2. Which image is larger and how do you account for the difference?

3. A magnifying glass uses a converging lens, with the object placed inside the focal point. The image created is a virtual image that appears as if behind the object on the same side of the lens. Draw the virtual image for the object shown below. Use Rules 1 and 3 to trace the rays back to the point where they meet behind the object; use a dashed line to represent the virtual image. What is its orientation?

4. Draw the ray diagram for the compound microscope shown below. A compound microscope uses two lenses placed in a connecting barrel. Each produces an image: an objective image and an eyepiece image. Why is the object being magnified placed behind the focal point of the objective lens and not in front, as with the magnifying glass? What is the orientation of each image? Is the final image real or virtual? (Hint: The image of one lens can serve as the object of another.)
biosphere  ecosystem  dependent variable
biodiversity  homeostasis  constant
species  evolution  theory
biology  adaptation  microscope
organism  observation  gene
cell  data  molecular genetics
metabolism  hypothesis  genomics
DNA  experiment  biotechnology
system  independent variable  transgenic

A. Categorize Words  For the terms below, write L next to words that can describe living things. Write T next to words that can describe technology. Write B next to words that can describe both.

1. _____ organism  _____ species  _____ biotechnology
   _____ cell  _____ transgenic  _____ molecular genetics

For the terms below, write E next to words that can describe the external environment of living things. Write I next to words that can describe the internal environment of living things. Write B next to words that can describe both.

2. _____ homeostasis  _____ system  _____ ecosystem
   _____ biosphere  _____ metabolism  _____ biology

For the terms below, write G next to words that are related to groups of living things. Write I next to words that describe individual living things. Write B next to words that can describe both.

3. _____ biodiversity  _____ cell  _____ biosphere
   _____ organism  _____ adaptation  _____ evolution
B. Vector Vocabulary  Define the words in the boxes. On the line across each arrow, write a phrase that describes how the words in the boxes are related to each other.

**OBSERVATION**
1. ____________
   ____________

2. ____________
3. ____________

**THEORY**
4. ____________
   ____________

5. ____________
   ____________

**HYPOTHESIS**
6. ____________

**EXPERIMENT**
7. ____________
   ____________

8. ____________
9. ____________
10. ____________

**DEPENDANT VARIABLE**
11. ____________
   ____________

**INDEPENDENT VARIABLE**
12. ____________
   ____________

**CONSTANT**
13. ____________
   ____________

**DATA**
14. ____________
15. ____________
C. Stepped-Out Vocabulary  Define each word. Then write two additional facts that are related to the word.

<table>
<thead>
<tr>
<th>WORD</th>
<th>DEFINITION</th>
<th>MORE INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example metabolism</td>
<td>all chemical processes that build up or break down materials in living things</td>
<td>chemical energy is needed</td>
</tr>
<tr>
<td>1. biology</td>
<td></td>
<td>animals eat other organisms to get their chemical energy</td>
</tr>
<tr>
<td>2. microscope</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. evolution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. adaptation</td>
<td></td>
<td></td>
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<td>5. DNA</td>
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<td>6. gene</td>
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<td>7. genomics</td>
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D. Words in Context  Answer the questions to show your understanding of the vocabulary words.

1. If I use a microscope, do I see things too small to be seen or things too far away to be seen?

2. Is homeostasis the maintenance of constant conditions or all of the chemical processes that build up and break down materials?

3. Which is the independent variable in an experiment, the cause or the effect?

4. Is a gene all of an organism’s DNA or only a segment of DNA?

5. Is an adaptation in biology made by choice or is it inherited?

6. Would a constant be manipulated or kept the same in an experiment?

7. Does a theory answer one scientific question or does it explain many observations?

8. When I am in an ecosystem, do I interact with living things, nonliving things, or both living and nonliving things?

9. Where would more biodiversity be found, near Earth’s equator or near Earth’s poles?

10. Which is a species, a group of parts that interact to form a whole or a type of living things that can reproduce by interbreeding?

11. Does a transgenic organism travel a lot or does it have genes from a different type of living thing?

12. If I form a hypothesis, do I propose an answer to a question or do I use negative feedback?