Study Guide

Georgia End-Of-Course Tests
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INTRODUCTION

This study guide is designed to help students prepare to take the Georgia End-of-Course Test (EOCT) for Biology. This study guide provides information about the EOCT, tips on how to prepare for it, and some suggested strategies students can use to perform their best.

What is the EOCT? The EOCT program was created to improve student achievement through effective instruction and assessment of the standards in the Quality Core Curriculum specific to the eight EOCT core high school courses. The EOCT program also helps to ensure that all Georgia students have access to a rigorous curriculum that meets high performance standards. The purpose of the EOCT is to provide diagnostic data that can be used to enhance the effectiveness of schools’ instructional programs.

The Georgia End-of-Course Testing program is a result of the A+ Educational Reform Act of 2000, O.C.G.A. §20-2-281. This act requires that the Georgia Department of Education create end-of-course assessments for students in grades nine through twelve for the following core high school subjects:

Mathematics
- Algebra I
- Geometry

Social Studies
- United States History
- Economics/Business/Free Enterprise

Science
- Biology
- Physical Science

English Language Arts
- Ninth Grade Literature and Composition
- American Literature and Composition

Getting started: The HOW TO USE THE STUDY GUIDE section on page 2 outlines the contents in each section, lists the materials you should have available as you study for the EOCT, and suggests some steps for preparing for the Biology EOCT.
HOW TO USE THE STUDY GUIDE

This study guide is designed to help you prepare to take the Biology EOCT. It will give you valuable information about the EOCT, explain how to prepare to take the EOCT, and provide some opportunities to practice for the EOCT. The study guide is organized into three sections. Each section focuses on a different aspect of the EOCT.

The OVERVIEW OF THE EOCT section on page 4 gives information about the test: dates, time, question format, and number of questions that will be on the Biology EOCT. This information can help you better understand the testing situation and what you will be asked to do.

The PREPARING FOR THE EOCT section that begins on page 5 provides helpful information on study skills and general test-taking skills and strategies. It explains how to prepare before taking the test and what to do during the test to ensure the best test-taking situation possible.

The TEST CONTENT section that begins on page 11 explains what the Biology EOCT specifically measures. When you know the test content and how you will be asked to demonstrate your knowledge, it will help you be better prepared for the EOCT. This section also contains some test-taking strategies for successfully answering questions on the EOCT.

With some time, determination, and guided preparation, you will be better prepared to take the Biology EOCT.

GET IT TOGETHER

In order to make the most of this study guide, you should have the following:

Materials:
✓ This study guide
✓ Pen or Pencil
✓ Highlighter
✓ Paper

Resources:
✓ Dictionary
✓ Biology textbook
✓ A teacher or other adult

Study Space:
✓ Comfortable (but not too comfortable)
✓ Good lighting
✓ Minimal distractions
✓ Enough work space

Time Commitment:
✓ When are you going to study?
✓ How long are you going to study?

Determination:
✓ Willingness to improve
✓ Plan for meeting goals
SUGGESTED STEPS FOR USING THIS STUDY GUIDE

1. Familiarize yourself with the structure and purpose of the study guide. (You should have already read the INTRODUCTION and HOW TO USE THE STUDY GUIDE. Take a few minutes to look through the rest of the study guide to become familiar with how it is arranged.)

2. Learn about the test and expectations of performance. (Read OVERVIEW OF THE EOCT.)

3. Improve your study skills and test-taking strategies. (Read PREPARING FOR THE EOCT.)

4. Learn what the test will assess by studying each domain and the strategies for answering questions that assess the standards in the domain. (Read TEST CONTENT.)

5. Answer the sample questions at the end of each domain section. Check your answers against the annotated answers to see how well you did. (See TEST CONTENT.)
OVERVIEW OF THE EOCT

Good test takers understand the importance of knowing as much about a test as possible. This information can help you determine how to study and prepare for the EOCT and how to pace yourself during the test. The box below gives you a “snapshot” of the *Biology* EOCT.

THE EOCT AT A GLANCE

**Administration Dates:**
The EOCT will be given three times a year: once in the spring, once in the summer, and once in the winter.

**Administration Time:**
Each EOCT is comprised of two sections; each section will take 45 to 60 minutes to complete. You will have 100 to 135 minutes to complete each EOCT. You will be given a 5-minute stretch break between the two sections of the test.

**Question Format:**
All the questions on the EOCT are multiple choice.

**Number of Questions:**
Each section of the EOCT contains 45 questions; there are a total of 90 questions on the EOCT.

If you have additional administrative questions regarding the EOCT, please visit the Georgia Department of Education website at [www.doe.k12.ga.us](http://www.doe.k12.ga.us), see your teacher, or see your school test coordinator.
In order to do your best on the Biology EOCT, it is important that you take the time necessary to prepare for this test and develop those skills that will help you take the EOCT.

First, you need to make the most of your classroom experiences and test preparation time by using good study skills. Second, it is helpful to know general test-taking strategies to ensure that you will achieve your best score.

Study Skills

A LOOK AT YOUR STUDY SKILLS

Before you begin preparing for this test, you might want to consider your answers to the following questions. You may write your answers here or on a separate piece of paper.

1. How would you describe yourself as a student?
   Response: _________________________________

2. What are your study skills strengths and/or weaknesses as a student?
   Response: _________________________________

3. How do you typically prepare for a biology test?
   Response: _________________________________

4. Are there study methods you find particularly helpful? If so, what are they?
   Response: _________________________________

5. Describe an ideal study situation (environment).
   Response: _________________________________

6. Describe your actual study environment.
   Response: _________________________________

7. What can you change about the way you study to make your study time more productive?
   Response: _________________________________

WARNING!

You cannot prepare for this kind of test in one night. Questions will ask you to apply your knowledge, not list specific facts. Preparing for the EOCT will take time, effort, and practice.
Effective study skills for preparing for the EOCT can be divided into three categories.

- **Time Management**
- **Organization**
- **Active Participation**

### Time Management

Do you have a plan for preparing for the EOCT? Often students have good intentions for studying and preparing for a test, but without a plan, many students fall short of their goals. Here are some strategies to consider when developing your study plan. (See Appendices A–D for SAMPLE STUDY PLAN SHEETS that you can use to help you create your study plan.)

- Set realistic goals for what you want to accomplish during each study session and chart your progress.
- Study during your most productive time of the day.
- Study for reasonable amounts of time. Marathon studying is not productive.
- Take frequent breaks. Breaks can help you stay focused. Doing some quick exercises (e.g., sit-ups or jumping jacks) can help you stay alert.
- Be consistent. Establish your routine and stick to it.
- Study the most challenging test content first.
- For each study session, build in time to review what you learned in your last study session.
- Evaluate your accomplishments at the end of each study session.
- Reward yourself for a job well done.

### Organization

You don’t want to waste your study time. Searching for materials, trying to find a place to study, and debating what and how to study can all keep you from having a productive study session. Get organized and be prepared. Here are a few organizational strategies to consider.

- Establish a study area that has minimal distractions.
- Gather your materials in advance.
- Develop and implement your study plan (see Appendices A–D for SAMPLE STUDY PLAN SHEETS).
Active Participation

Students who actively study will learn and retain information longer. Active studying also helps you stay more alert and be more productive while learning new information. What is active studying? It can be anything that gets you to interact with the material you are studying. Here are a few suggestions.

♦ Carefully read the information and then DO something with it. Mark the important points with a highlighter, circle them with a pen, write notes on them, or summarize the information in your own words.
♦ Ask questions. As you study, questions often come into your mind. Write them down and actively seek the answers.
♦ Create sample test questions and answer them.
♦ Find a friend who is also planning to take the test and quiz each other.

Test-taking Strategies

There are many test-taking strategies that you can use before and during a test to help you have the most successful testing situation possible. Below are a few questions to help you take a look at your test-taking skills.

**A LOOK AT YOUR TEST-TAKING SKILLS**

As you prepare to take the EOCT, you might want to consider your answers to the following questions. You may write your answers here or on your own paper.

1. How would you describe your test-taking skills?
   Response: ____________________________

2. How do you feel when you are taking a test?
   Response: ____________________________

3. List the strategies that you already know and use when you are taking a test.
   Response: ____________________________

4. List test-taking behaviors you use when preparing for and taking a test that do not contribute to your success.
   Response: ____________________________

5. What would you like to learn about taking tests?
   Response: ____________________________
Suggested Strategies to Use to Prepare for the EOCT

Learn from the Past. Think about your daily/weekly grades in your science classes (past and present) to answer the following questions.

• In which specific areas of science were you or are you successful?
  Response: ______________________________________________________

• Is there anything that has kept you from achieving higher scores?
  Response: ______________________________________________________

• What changes should you implement to achieve higher scores?
  Response: ______________________________________________________

Before taking the EOCT, work toward removing or minimizing any obstacles that might stand in the way of your performing your best. The test preparation ideas and test-taking strategies in this section are designed to help guide you to accomplish this.

Be Prepared. The best way to perform well on the EOCT is to be prepared. In order to do this, it is important that you know what standards/skills will be measured on the Biology EOCT and then practice understanding and using those standards/skills. The standards that will be measured in this EOCT are located in the Biology Quality Core Curriculum (QCC). The OVERVIEW OF THE EOCT and TEST CONTENT sections of this study guide are designed to help you understand which specific standards are on the Biology EOCT and give you suggestions for how to study the standards that will be assessed. Take the time to read through this material and follow the study suggestions. You can also ask your science teacher for any suggestions he or she might offer on preparing for the EOCT.

Start Now. Don’t wait until the last minute to start preparing. Begin early and pace yourself. By preparing a little bit each day, you will retain the information longer and increase your confidence level. Find out when the EOCT will be administered, so you can allocate your time appropriately.
Suggested Strategies to Use the Day Before the EOCT

✓ Review what you learned from this study guide
1. Review the general test-taking strategies discussed in the TOP 10 SUGGESTED STRATEGIES TO USE DURING THE EOCT on page 10.
2. Review the content domain-specific information discussed in the section, TEST CONTENT beginning on page 11.
3. Focus your attention on the domain, or domains, that you are most in need of improving.

✓ Take care of yourself
1. Try to get a good night’s sleep. Most people need an average of 8 hours, but everyone’s sleep needs are different.
2. Don’t drastically alter your routine. If you go to bed too early, you might lie in bed thinking about the test. You want to get enough sleep so you can do your best.

Suggested Strategies to Use the Morning of the EOCT

Eat a good breakfast. Eat some food that has protein in it for breakfast (and for lunch if the test is given in the afternoon). Some examples of foods high in protein are peanut butter, meat, and eggs. Protein gives you long-lasting, consistent energy that will stay with you through the test to help you concentrate better. Some people believe it is wise to eat some sugar before a test, claiming it gives them an energy boost. In reality, the energy boost is very short lived, and you actually end up with less energy than before you ate the sugar. Also, don’t eat too much. A heavy meal can make you feel tired. So think about what you eat before the test.

Dress appropriately. If you are too hot or too cold during the test, it can affect your performance. It is a good idea to dress in layers, so you can stay comfortable, regardless of the room temperature, and keep your mind on the EOCT.

Arrive for the test on time. Racing late into the testing room can cause you to start the test feeling anxious. You want to be on time and prepared.
TOP 10
Suggested Strategies to Use During the EOCT

These general test-taking strategies can help you do your best during the EOCT.

1. **Focus on the test.** Try to block out whatever is going on around you. Take your time and think about what you are asked to do. Listen carefully to all the directions.

2. **Budget your time.** Make sure that you allocate an appropriate amount of time to work on each question on the test.

3. **Take a quick break if you begin to feel tired.** To do this, put your pencil down, relax in your chair, and take a few deep breaths. Then, sit up straight, pick up your pencil, and begin to concentrate on the test again. Remember that each test section is only 45 to 60 minutes.

4. **Use positive self-talk.** If you find yourself saying negative things to yourself like, “I can’t pass this test,” it is important to recognize that you are doing this. Stop and think positive thoughts like, “I prepared for this test, and I am going to do my best.” Letting the negative thoughts take over can affect how you take the test and your test score.

5. **Mark in your test booklet.** Mark key ideas or things you want to come back to in your test booklet. Remember that only the answers marked on your answer sheet will be scored.

6. **Read the entire question and the possible answer choices.** It is important to read the entire question so you know what it is asking. Read each possible answer choice. Do not mark the first one that “looks good.”

7. **Use what you know.** Draw on what you have learned in class, from this study guide, and during your study sessions to help you answer the questions.

8. **Use content domain-specific strategies to answer the questions.** In the TEST CONTENT section, there are a number of specific strategies that you can use to help improve your test performance. Spend time learning these helpful strategies, so you can use them while taking the test.

9. **Think logically.** If you have tried your best to answer a question but you just aren’t sure, use the process of elimination. Look at each possible answer choice. If it doesn’t seem like a logical response, eliminate it. Do this until you’ve narrowed down your choices. If this doesn’t work, take your best educated guess. It is better to mark something down than to leave it blank.

10. **Check your answers.** When you have finished the test, go back and check your work.

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**A WORD ON TEST ANXIETY**

It is normal to have some stress when preparing for and taking a test. It is what helps motivate us to study and try our best. Some students, however, experience anxiety that goes beyond normal test “jitters.” If you feel you are suffering from test anxiety that is keeping you from performing at your best, please speak to your school counselor who can direct you to resources to help you address this problem.
TEST CONTENT

Up to this point in this study guide, you have been learning various strategies on how to prepare for and take the EOCT. This section focuses on what will be tested. It also includes a section of sample questions that will let you apply what you have learned in your classes and from this study guide.

The Georgia End-of-Course Test (EOCT) for Biology is designed to test seven major areas of knowledge, called content domains. The content domains are broad categories. Each of the content domains is broken down into smaller ideas. These smaller ideas are called content standards, or just standards. Each content domain contains standards that cover different ideas related to its content domain. Each question on the EOCT measures an individual standard within a content domain.

The seven content domains for the Biology EOCT are important for several reasons. Together they represent the ability to understand and communicate biological concepts. Another, more immediate reason that the content domains are important has to do with test preparation. The best way to prepare for any test is to study and know the material measured on the test. Since the Biology EOCT covers the seven content domains and nothing else, isn’t it a good idea to learn as much about these domains as you can? The more you understand about these domains, the greater your opportunity to be successful on the EOCT.

The chart below lists the seven content domains for the Biology EOCT.

**CONTENT DOMAINS**

I. Scientific Processes and Nature of Biology  
II. Cellular Basis of Life  
III. Chemical Basis of Life  
IV. Genetics and Patterns of Change  
V. Viruses, Monerans, Protists, and Fungi  
VI. Plants and Animals  
VII. Ecology and the Environment
Studying the Content Domains

You should plan to study/review the standards for ALL the content domains. To learn what the EOCT will cover, work through this TEST CONTENT section. It is organized by the content domains into the following areas:

- **A Look at the Content Domain:** an overview of what will be assessed in the content domain
- **Spotlight on the Standards:** information about the specific standards that will be assessed (Note: The names of the standards may not be the exact names used by the Georgia Department of Education. Some of the names in this study guide may have been modified to reflect the fact that this book is designed for students and not for professional educators.)
- **Sample Questions:** sample questions similar to those that appear on the EOCT
- **Answers to the Sample Questions:** in-depth explanations of the answers to the sample questions

**Read All About It**

Biology is a very broad subject. To provide you with most of the information related to biology would take hundreds of pages. Instead, this guide will provide you with some specific information that you will need to know for the Biology EOCT and help to direct your study efforts. Your biology textbook will be your best source of additional information.

**Content Domain I: Scientific Processes and Nature of Biology**

**A LOOK AT CONTENT DOMAIN I**

Test questions in this content domain will measure your ability to understand and apply the knowledge and skills used in scientific inquiry and the nature of biology. Your answers to the questions will help show how well you can perform on the following standards:

- Describe the terms and processes used in scientific research
- Use reference sources
- Explain the significance of biology
- Apply classification systems to group living things
Spotlight on the Standards

Describe the Terms and Processes Used in Scientific Research

Scientists try to understand and explain the natural world. Biology is a branch of science that deals with living things. Biologists and scientists use common processes when asking and answering questions during their scientific studies. Their answers are based on the same kinds of reasoning and problem solving processes you use to answer questions in your daily life. When you observe, classify, communicate, measure, predict, and infer, you are thinking like a scientist. Something as simple as changing from one type of shampoo to another in hopes of an improved effect is a type of simple experiment.

For the Biology EOCT, it is important that you understand the processes used in scientific research. Test questions will measure your ability to understand and apply the knowledge and skills needed to do and interpret scientific investigations. Although the same set of procedures are not used for every investigation, every investigation begins with a question. But before any scientific investigation is designed and conducted, background information is gathered on what is already known about the topic in question. Scientists will use the information to form a hypothesis, a possible answer to the question that can be tested by an experiment.

To test a hypothesis, an investigation is designed. When designing an investigation, variables are identified. These include the variable that is being tested or manipulated also known as the independent variable, the variable that is responding also known as the dependent variable, and the variables that need to remain constant also known as the controlled variables. Data are gathered and recorded from the experiment.

If the data collected involve observations without measurements or numbers, then they are referred to as qualitative data. Quantitative data involve numbers or measurements. Scientists use the metric system when representing data. The questions that address this standard may ask you to identify appropriate metric measurements or convert from one metric measurement to another.

<table>
<thead>
<tr>
<th>Metric Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each type of measurement has a base unit.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Base Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>length/distance</td>
<td>meter</td>
</tr>
<tr>
<td>mass</td>
<td>gram</td>
</tr>
<tr>
<td>time</td>
<td>second</td>
</tr>
<tr>
<td>temperature</td>
<td>degrees Celsius</td>
</tr>
<tr>
<td>volume</td>
<td>liter</td>
</tr>
</tbody>
</table>

Common prefixes used in measurements:

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Symbol</th>
<th>Multiple of base unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>kilo</td>
<td>k</td>
<td>1000</td>
</tr>
<tr>
<td>hecto</td>
<td>h</td>
<td>100</td>
</tr>
<tr>
<td>deka</td>
<td>da</td>
<td>10</td>
</tr>
<tr>
<td>deci</td>
<td>d</td>
<td>0.1</td>
</tr>
<tr>
<td>centi</td>
<td>c</td>
<td>0.01</td>
</tr>
<tr>
<td>milli</td>
<td>m</td>
<td>0.001</td>
</tr>
</tbody>
</table>

You can convert from one unit to the next by multiplying or dividing by 10.
On the *Biology EOCT*, you may be given a laboratory situation and be asked to identify the different types of variables or an appropriate hypothesis. You may also be asked to identify the data as qualitative or quantitative.

Data can be gathered with a variety of tools. Microscopes, meter sticks, balances, stopwatches, etc., can all be used to gather data. Scientists make repeated measurements to increase the validity and reliability of the results.

To make data meaningful, it must be analyzed and interpreted. Displaying the data in a graph to understand and communicate is an effective method of organization. Types of graphs include the *line graph* when showing how variables are related, the *bar graph* when comparing groups in terms of one characteristic, and the *pie or circle graph* when showing percentages or fractions. Patterns in the data are identified. Mathematical relationships may be established and predictions can be made. A model may even be created that explains the results. On the *Biology EOCT*, you may be asked to identify appropriate ways to display different types of data, to find information in tables or graphs, or interpret a graph.

After analyzing and interpreting the data, scientists draw conclusions, explanations based on scientific data and observations. Conclusions can answer the question as to whether the data and observations support the hypothesis. Conclusions may or may not support the hypothesis. Sometimes the conclusions may be that more information is needed which creates more questions to investigate. Occasionally, inferences are made to reach a conclusion. An *inference* is an explanation of the data based on facts but not on direct observation.

In order for others to understand and evaluate the experiment, the results need to be shared. Communication gives others an opportunity to learn from the experiment and gain new knowledge. It may give them or you new ideas to study. Communication also allows the investigator to see if any errors were made in the experimental design, the calculations, or the analysis and interpretation of the data.
Not only will learning the various process skills help you understand more about the natural world, but it will also help you answer questions on the *Biology EOCT* like:

**When leaving a movie theater, a person notices that the sidewalk is now wet. If the person assumes it rained during the movie, the person is making**

A a hypothesis  
B an inference  
C an observation  
D a prediction

The answer is B. If you know the meaning of the various process skills, then you know that you are making an inference. An inference is an explanation of an event that is not based on direct observation. A hypothesis is a possible explanation that can be tested by an experiment. Since an experiment cannot be used to determine if it rained, then choice A is not possible. An observation involves using your senses. Since you did not actually see it raining, you could not make an observation, so choice C is incorrect. A prediction is the foretelling of a future event. Since the event has already occurred, choice D is incorrect.

**Laboratory Report.** One way scientists communicate their findings to others is to write a laboratory report, a summary of how the experiment was conducted and the results. The lab report should be detailed and clear enough so others can easily repeat the experiment.

The laboratory report will include sketches to show how materials were set up, as well as graphs and calculations to help the reader analyze the data. Any limitations of the experiment would be included with the conclusions. Knowing what components will be included in a laboratory report will help you answer a question like this:

**In a laboratory report on the study of the effects of different fertilizers on the growth of marigolds, where would you MOST likely find a graph that shows how the variables are related?**

A hypothesis  
B procedure  
C data  
D conclusions

Since graphs are used to analyze data, then C is the correct answer. A hypothesis is a testable answer to a question. The procedure shows how the laboratory equipment is set up and the procedures to be followed, while conclusions are explanations based on scientific data and direct observation. Therefore, choices A, B, and D are incorrect.
Safety. Hands-on activities and investigations are an integral and exciting part of learning science. They provide an opportunity to explore and actively study scientific principles. For the Biology EOCT, it is important that you are familiar with safe laboratory practices while using lab equipment. Some areas of laboratory safety are listed in the box at the right.

Microscope. One of the tools biologists use is the microscope. For the Biology EOCT, you may be asked to identify the use and proper care of the microscope. The compound light microscope uses two or more lenses to allow very small things to be seen. It can magnify as much as 1500 times the actual size of the specimen. A list of the parts of the compound light microscope can be found in the box. Use your textbook to review the parts of the microscope and the function of each part.

Microscopes are expensive and should be handled and used with great care. They should be carried with both your hands, one holding the arm of the microscope and the other supporting the base of the microscope. Use only lens paper when cleaning or drying the lenses. The microscope should be covered before storing it. The proper way to use a microscope is first to observe the specimen under low power using the coarse adjustment for focusing, then switch to high power and only use the fine adjustment for focusing. This procedure prevents damage to slides and lenses.

On the Biology EOCT, you may also be asked questions about preparing microscope slides. Before a scientist can observe a specimen using the compound light microscope, the specimen has to be placed on a microscope slide and covered with a coverslip. The following basic steps are typically used when preparing microscope slides:

1. Clean the glass slide and coverslip with lens paper.
2. Place the specimen in the center of the slide.
3. Place a drop of water on the specimen.
4. Lower the coverslip so that one edge is touching the drop of water. Slowly lower the coverslip without trapping any air bubbles.
5. Remove any excess liquid on the slide surface with the corner of a paper towel.
6. The specimen may be stained by placing a drop of the appropriate stain next to the edge of the coverslip. Using the corner of a paper towel on the opposite side, touch the water under the coverslip to draw the stain across the specimen.

**Strategy Box – Take a Closer Look**

Ask your teacher if you can use a microscope so you can practice naming its parts. If possible, make a prepared microscope slide and look at the specimen using the microscope.

If it’s not possible to use a microscope, look at diagrams of a microscope to become familiar with the parts.

**Use Reference Sources**

The *Biology EOCT* will require you to know how to use references sources that may be used for scientific research. You should be familiar with encyclopedias, dictionaries, and scientific magazines. These may be available in either print or electronic form. Knowing the appropriate use of reference sources will help you find quality information related to research problems. Questions on this standard may ask you to analyze small quantities of information from a reference source.

When investigating the answer to a question, scientists gather information to determine what is already known about the subject. Sometimes you need to research a particular science topic for a report or class presentation. Information can be found at the school library, at your community library, or even the Internet. However, not all information may be relevant or useful to your particular science topic. When evaluating scientific information, ask yourself some questions regarding the information.

- Is the information outdated?
- Is the information from a reputable source?
- Is the information scientifically accurate or just someone’s opinion?
- Who is the intended audience?
- Can this be verified elsewhere?
- Why is this the best source to use?
- How can the information be used?

**Explain the Significance of Biology**

Biology is a broad subject that is concerned with living things. There are many different kinds of biologists. A few of the branches of biology are listed in the box. Biology is studied to learn more about the living world. Some people study biology to specifically
learn more about humans. Other people study biology to promote human welfare through medicine, agriculture, or nutrition, while some study biology to understand the future of Earth. Regardless of the reasons for studying biology, biology impacts your life on a daily basis. A question for this standard may look something like this:

A biologist studying the mechanisms of inheritance in wheat would MOST likely have a strong background in

A botany  
B ecology  
C genetics  
D zoology

Although the biologist is using plants, the study involves knowing about genetics, so choice C is the correct answer rather than A. Ecology involves the interrelationships between organisms and the environment, while zoology is the study of animals; therefore, choices B and D are incorrect.
In addition to appearance, behavior and molecular structure (e.g., DNA) are also considered when classifying organisms. Organisms that share more similarities are more closely related and are grouped together.

**Strategy Box – Call to Order**

A good way to remember a list of words in order is to create a nonsense phrase where the first letter of each word begins with the first letter of each word in the list. To remember the levels of classification, you might use the following example:

- **King Philip Came Over For Graduation Speeches**
- Kingdom, Phylum, Class, Order, Family, Genus, Species

In the box that follows is the classification of the largemouth bass, the official state fish of Georgia. It begins with the broadest level in the hierarchical system—the kingdom, which includes organisms with very general characteristics. In this example, the largemouth bass is in Kingdom Animalia because it is a multicellular organism that eats food. All other animals would also be classified in this kingdom. As you continue to the next level, more specific traits are considered. Since the largemouth bass has a backbone, it is classified in the Phylum Chordata with other organisms that possess a backbone. Each level is broken down into smaller levels, which contain fewer types of organisms than the previous level. The species level will include only one type of organism. In this example, the largemouth bass is the only organism with this species name. Review your textbook for more examples of the classification of organisms.

Taxonomic systems are periodically modified to reflect advances in biological information. Depending on your resource, a five- or six-kingdom system of classification may be used. The five kingdoms are Monera, Protista, Fungi, Plantae, and Animalia. Refer to your textbook for the characteristics of each kingdom and examples of representative organisms. A question on the **Biology EOCT** for this standard might look something like this:

**A multicellular organism that obtains its food by absorbing nutrients from the soil belongs to the kingdom**

A Animalia  
B Fungi  
C Plantae  
D Protista
Kingdom Fungi includes multicellular organisms that lack chlorophyll, so they absorb their nutrients from the soil. That makes choice B the correct answer. Organisms in Kingdom Animalia are multicellular and get their food by eating other organisms, so A is incorrect. Organisms in Kingdom Plantae are multicellular organisms and make their own food (photosynthesize), so C is incorrect. Organisms in Kingdom Protista are unicellular, which makes D incorrect.

Because scientists speak many different languages and common names for organisms may vary from place to place, a universal system for naming organisms is used. The scientific name of an organism is based on a two-word system called binomial nomenclature. The two words, genus and species, are always italicized (or underlined). The first word in a scientific name, genus, is always capitalized and the second word, species, is never capitalized. For example the scientific name of the largemouth bass would be Micropterus salmoides (or Micropterus salmoides).

A tool to identify organisms is called a dichotomous key. It is made from pairs of contrasting characteristics (e.g., has wings/does not have wings). When you use a dichotomous key, you select one statement from each pair that applies to the organism. After each selection, you are directed to the next pair of characteristics that you should use. The process continues until you end with the name of the organism or the group to which it belongs depending on the type of dichotomous key you are using. You may be asked to use a dichotomous key on the Biology EOCT.

**Sample Questions for Content Domain I**

This section has some sample questions for you to try. After you have answered all of the questions, check your answers in the “Answers to the Content Domain I Sample Questions” section that follows. This section will give you the correct answer to each question, and it will explain why the other answer choices are incorrect.

1. A scientist is testing the efficiency of various microwaves by measuring the temperature of water after being heated at high power for one minute. The temperature measured in this test is an example of
   
   A. a controlled variable
   B. an independent variable
   C. qualitative data
   D. quantitative data

2. A student asks, “Why don’t people get goosebumps on their faces?” Where would the student MOST likely find the answer to this question?
   
   A. an almanac
   B. a dictionary
   C. the Internet
   D. a thesaurus
3 The study of animals is known as
A botany
B ecology
C taxonomy
D zoology

4 In 1988, the tiger swallowtail, *Papilio glaucus*, was proclaimed Georgia’s state butterfly. The tiger swallowtail shares the most characteristics with members of which taxonomic level?
A class
B family
C order
D phylum

5 A student wants to determine the effect of a certain brand of liquid fertilizer on the growth of ivy. Ivy plants of the same length are planted in the same amount of soil in three identical containers. To one container, 5 mL of the fertilizer is added; in the second container, 10 mL of the fertilizer is added; and in the third container no fertilizer is added. The containers are placed in front of the same window. The length of the ivy is measured every five days, and the observations are recorded in a data table. What was the independent variable in this experiment?
A The amount of fertilizer added
B The amount of growth measured
C The type of plant used
D The type of container used

Answers to the Content Domain I Sample Questions

1. Answer: D Standard: *Describe the terms and processes used in scientific research*
Since the temperature is the response to the heating, it would be the responding variable. Therefore, A and B are incorrect. Answer choice C, qualitative data, refers to descriptive data. Since the data collected (temperature) is a numerical value, then D, quantitative data, is the correct answer.

2. Answer: C Standard: *Use reference sources*
The reference materials in A, B, and D are sources of facts, words, or short phrases. Since the question requires a longer explanation, C would be the correct answer.

3. Answer: D Standard: *Explain the significance of biology*
Choices A, B, and C are incorrect since botany is the study of plants, ecology is the study of the interrelationships of organisms with their environment, and taxonomy is the study of classification. Zoology is the study of animals, so D is the correct answer.

4. Answer: B Standard: *Apply classification systems to group living things*
As you move from kingdom to species in the classification levels, the organisms share more characteristics until you get one species isolated. Therefore B is correct since family is a lower level than the other classification levels. Choices A, C, and D are incorrect.
5. Answer: A  
Standard: *Describe the terms and processes used in scientific research*

The independent, or manipulated, variable is the variable that is being changed; therefore, A is the correct answer. Choice B is the variable that is responding to the change, or the dependent variable. Choices C and D are variables that are not being changed, or the controlled variables.
Content Domain II: Cellular Basis of Life

A LOOK AT CONTENT DOMAIN II
Test questions in this content domain will measure your ability to explain the important aspects of cellular biology. Your answers to the questions will help show how well you can perform on the following standards:

* Explain the cellular basis of life
* Explain homeostasis and describe the transport of materials through cell membranes

Spotlight on the Standards

* Explain the Cellular Basis of Life *

With the development of the microscope, scientists were able to view and study cells. Their studies are summarized into three parts called the cell theory (see box at right). You may be asked to identify the main ideas of the cell theory on the Biology EOCT.

Because the cell exhibits the same characteristics as living things, it is considered alive. But what does it mean to say something is alive? A closer look shows you that all living things (also known as organisms) share some common characteristics such as:

- Organisms require food for energy to carry out life processes.
- Organisms use energy to maintain homeostasis, a balance of internal conditions.
- Organisms respond to stimuli in their environment.
- Organisms grow and develop.
- Organisms reproduce similar offspring.
- Organisms pass genetic information to their offspring.
- Organisms are made of cells.

Some living things exist as a single cell, while others consist of billions of cells. An organism that exists as a singular, independent cell is called unicellular. A good example of this would be the microscopic amoeba that live in pond water. Organisms that exist as specialized groups of cells are called multicellular. You are a multicellular organism. In MOST multicellular organisms, cells are organized into tissues that perform the same function. Tissues are organized into organs and a group of organs that have related functions make up an organ system.
The cell is enclosed by a plasma membrane. In the central region of the cell is the nucleus. Between the plasma membrane and the nucleus is the cytoplasm, a fluid-like substance that contains various membrane-bound structures (organelles) that perform various functions.

Cells that contain a clearly defined nucleus enclosed by a nuclear membrane and membrane-bound organelles are called eukaryotic cells. Eukaryotic cells are found in plants and animals. A prokaryotic cell has nuclear material in the center of the cell, but it is not enclosed by a nuclear membrane. There are no membrane-bound organelles in the prokaryotic cell. Prokaryotic cells are found in bacteria and blue-green bacteria.

Some organelles like plastids are found only in plant cells. Chloroplasts are a type of plastid that gives plants their green color. The plant cell is also enclosed by a cell wall.

Refer to your textbook for a complete list of cell organelles and the functions of each. Look at labeled diagrams of plant and animal cells to identify the various cell structures found in each kind of cell.

For the Biology EOCT, it is important that you are able to recognize common organelles and their functions or to distinguish plant cells from animal cells. It is also important that you are able to explain the difference between living and nonliving things, between unicellular and multicellular organisms, and between eukaryotic and prokaryotic. This will help you answer questions like this:

Which of the following is a characteristic of all living things?

A cellular structure  
B nervous system  
C chlorophyll  
D hemoglobin

Not all living things have the ability to move from one place to another. For example, a tree is a non-moving living thing; therefore, A is the correct answer. Choices B, C, and D are incorrect because they are all characteristics of living things.

Organisms maintain their internal equilibrium by responding and adjusting to their environment. For example, when you experience a frightening situation, your body prepares for action. Your heart beats faster. Your body produces adrenalin in case you have
to fight or flee. These are signs that reflect your body’s efforts to maintain its internal equilibrium. Cells continuously respond to the environment by exchanging substances with their surroundings. The maintenance of an internal equilibrium is called **homeostasis**. Questions on the **Biology EOCT** may ask you to identify descriptions of homeostasis in living things.

In order to maintain an internal equilibrium, the plasma membrane regulates what enters and leaves the cell. When a membrane only allows certain substances to pass through, it is called a selectively permeable membrane. Various transport mechanisms allow the passage of substances across the plasma membrane. For the **Biology EOCT**, you may be asked to identify different transport mechanisms such as passive transport and active transport. These are described below.

**Passive transport** is the movement of substances across the plasma membrane without the use of the cell’s energy. The following are examples of passive transport:

- **Diffusion** is the movement of substances across the plasma membrane from an area of high concentration to an area of lower concentration.
- **Osmosis** is the diffusion of water across the plasma membrane from areas of high concentration to areas of lower concentration.
- **Facilitated transport** occurs when a carrier molecule embedded in the plasma membrane transports a substance across the plasma membrane following the high-to-low concentration gradient (i.e., from an area of high concentration to an area of lower concentration).

**Active transport** requires the use of the cell’s energy and carrier molecules to move substances across the plasma membrane. This is because the substances are moving from an area of low concentration to an area of higher concentration. Sometimes the cell needs to move large particles across the plasma membrane. This is accomplished by means of two processes. Both of these processes require cellular energy.

- **Endocytosis** is the process by which large particles are brought **into** the cell.
- **Exocytosis** is the process by which large particles **leave** the cell.

---

**Strategy Box Revisited – Analyze the Word by Its Parts**

Remember to look for familiar word parts when faced with an unknown term. Look at the following word parts:

- *endo-* means “inside”  
- *exo-* means “outside”  
- *cyto-* means “cell”  
- *osis* means “process or action”

Knowing these meanings will help you determine the meaning of words like **endocytosis** and **exocytosis**.
A question for this standard may look like this:

**Substances that are too large to be moved across the plasma membrane can be engulfed through the process of**

A  diffusion  
B  endocytosis  
C  exocytosis  
D  osmosis

If you recall, endocytosis is the transport of large substances into a cell, so B is the correct answer. Exocytosis is the transport of large substances out of the cell, while diffusion and osmosis both involve the movement of molecules across a membrane, so A, C, and D are incorrect.

Osmosis is important to the survival of a cell. If too much water moves into a cell then the cell will burst. If the cell loses too much water, the cell will shrivel and possibly die. So how do you tell which way the water will move? The answer is found in the concentration of substances.

On the *Biology EOCT* you may be asked to predict the effect of concentration on a cell placed in a given solution. Consider the following situations:

- If an animal cell is placed in a solution that has a lower concentration of the dissolved substance than the cell, then water moves into the cell faster than it can leave, and the cell may burst. This type of solution is called a **hypotonic** solution.
- If an animal cell is placed in a solution that has a higher concentration of the dissolved substance than the cell, then the cell loses water and shrivels. This type of solution is called a **hypertonic** solution.
- If an animal cell is placed in a solution that has the same concentration of the dissolved substance as the cell, then there is no net movement across the plasma membrane. This type of solution is called an **isotonic** solution.

**Sample Questions for Content Domain II**

This section has some sample questions for you to try. After you have answered all of the questions, check your answers in the “Answers to the Content Domain II Sample Questions” section that follows. This section will give you the correct answer to each question, and it will explain why the other answer choices are incorrect.

**1 Which of the following is an example of a prokaryotic cell?**

A  an animal cell  
B  a bacterial cell  
C  a fungal cell  
D  a plant cell

**2 Which of the following is a correct statement concerning tissues?**

A  Tissues hold organs together.  
B  Tissues form plasma membranes.  
C  Tissues are composed of organs with several functions.  
D  Tissues are composed of cells with the same function.
3. Which of the following statements BEST demonstrates homeostasis?

A. The intestines have a large surface area.
B. Humans tend to have five fingers on each hand.
C. Humans sweat when they get hot.
D. Cells have a maximum attainable size.

4. In an animal cell, in which cell part does cellular respiration occur?

A. part 1
B. part 2
C. part 3
D. part 4

Answers to the Content Domain II Sample Questions

1. Answer: B  Standard: Explain the cellular basis of life
A prokaryotic cell does not have a membrane-bound nucleus, which is a characteristic of bacterial cells; therefore, B is the correct answer. Choices A, C, and D are incorrect because the cells in animals, fungi, and plants contain membrane-bound nuclei (i.e., eukaryotic cells).

2. Answer: D  Standard: Explain the cellular basis of life
A group of similar cells that work together for the same function are called tissues; therefore, D is the correct answer and C is incorrect. Choices A and B are incorrect because tissues work together to form organs.

3. Answer: C  Standard: Explain homeostasis and describe the transport of materials through cell membranes
The ability of the human body to maintain an internal temperature is an example of homeostasis. Humans sweat when they get hot to maintain their body temperature;
therefore, C is the correct answer. In A, the large surface area in the intestines increases the absorption of nutrients. In B, the presence of five fingers helps manual dexterity. In D, cells have a maximum attainable size to insure their surface area is large enough to supply materials to the cell and get rid of wastes. Choices A, B, and D are not physiological adjustments made to maintain an internal steady state (homeostasis).

4. Answer: A Standard: Explain the cellular basis of life
Part 1 is a mitochondrion, the site for cellular respiration; therefore, A is the correct answer. Choices B, C, and D show cell organelles with different cell functions. Part 2 is the nucleus, the control center of the cell. Part 3 is the endoplasmic reticulum, which transports materials throughout the cell. Part 4 is a ribosome, the site for protein synthesis.

5. Answer: C Standard: Explain homeostasis and describe the transport of materials through cell membranes
During osmosis, water moves from an area of higher concentration to lower concentration. If the bean is to shrivel, then it must lose water. Therefore, the bean must be put in a solution that has a low concentration of water (and a high concentration of solute). This is a hypertonic solution; therefore, C is the correct answer. Choices A and B refer to the pH of a solution and do not apply to this scenario. A swollen bean placed in a hypotonic solution would not cause the bean to lose water. So D is incorrect.
Content Domain III: Chemical Basis of Life

A LOOK AT CONTENT DOMAIN III

Test questions in this content domain will measure your ability to explain the important aspects of the chemistry of life. Your answers to the questions will help show how well you can perform on the following standards:

- Recognize that life has a chemical basis
- Explain the processes of photosynthesis and respiration
- Explain the structure of DNA and RNA and their role in protein synthesis

Spotlight on the Standards

* Recognize that Life Has a Chemical Basis *

Chemistry is an essential part of all biological processes. For the Biology EOCT, it is important that you understand simple chemical principles as they relate to living things. For instance, living things contain a certain amount of matter. Matter is anything that takes up space and has mass. The three common phases of matter are solid, liquid, and gas.

Atoms are the building blocks of all matter. Each atom consists of a central nucleus containing protons and neutrons, which is surrounded by a cloud of electrons. Electrons are arranged in shells (or orbitals) at different distances from the nucleus and at different energy levels. An outer shell containing the maximum number of electrons indicates a stable electron configuration. Look at the box. For example, a neon atom has 10 protons and 10 neutrons in its nucleus and 10 electrons surrounding the nucleus. Two of the 10 electrons are located in the first shell while the remaining eight electrons are located in the second shell. Because neon’s outer shell has the maximum number of electrons, neon is a stable atom. The outer electrons are also known as valence electrons.

<table>
<thead>
<tr>
<th>Electron Configuration</th>
</tr>
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<tbody>
<tr>
<td>Maximum number of electrons for each electron shell:</td>
</tr>
<tr>
<td>shell #</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
</tbody>
</table>

There are many different kinds of atoms. A substance that has identical atoms is called an element.
The most abundant elements in living things are carbon, hydrogen, oxygen, nitrogen, sulfur, and phosphorus. Although present in lesser amounts, other elements include magnesium, iodine, iron, calcium, chlorine, and potassium. Atoms can combine to form molecules or compounds depending on the types of bonding that occur between the atoms. Types of chemical bonding include ionic, covalent, and hydrogen.

An **ionic bond** is a chemical bond formed by the transfer of electrons from one atom to another resulting in one atom with a positive charge and a second atom with a negative charge. For example, the oppositely charged atoms of sodium and chlorine are attracted to one another to make table salt, NaCl, an ionic compound.

In a **covalent bond**, a chemical bond is formed when two atoms share valence electrons. For example, a carbon atom will share electrons with two oxygen atoms forming carbon dioxide, CO₂.

A **hydrogen bond** is a weak electrostatic attraction between oppositely charged portions of neighboring polar molecules. Hydrogen bonds help hold molecules, like the opposite strands of a DNA helix, together.

When chemical bonds are formed or broken, chemical reactions occur and new substances are formed. The chemical reactions needed to maintain life occur in the cells. For example, humans use oxygen to convert their food to energy, carbon dioxide, and water. The reaction would look like this:

\[
C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{energy}
\]

**Strategy Box – What’s the Connection?**

One way to help you remember the types of bonding is to think about similar words. A coworker is someone who shares work with you. A covalent bond is a bond that shares valence electrons.

Ionic bonds form from ions combining. To form an ion, an atom has to lose or gain electrons: make a transfer rather than share.

Scientists discovered that many substances made by organisms contain carbon. In general, carbon-containing compounds were classified as organic. Compounds made with everything else were considered inorganic. Current classifications have yielded these definitions:

- **Organic compounds** are a class of compounds made of a carbon-hydrogen base.
- **Inorganic compounds** are a class of compounds whose major component is a metal. As might be expected, there are some exceptions to this definition (e.g., pure carbon, carbon dioxide).
Water (H₂O) is the most important inorganic compound for living things. Because water is a polar molecule, it is an excellent solvent, and many cellular activities occur in water solutions. Water also plays a key role in certain chemical reactions. Water may be required for the reaction to occur or it may be released as a by-product of the reaction.

Certain compounds, called acids, release hydrogen ions (H⁺) in water increasing the H⁺ concentration of the solution. Bases release hydroxide ions (OH⁻) or accept hydrogen ions decreasing the concentration of H⁺ in the solution. The pH scale measures the relative concentration of hydrogen ions in solution. A neutral solution has a pH of 7 and the concentrations of H⁺ and OH⁻ are the same. Pure water is neutral.

\[ H₂O \rightarrow H^+ + OH^- \]

Acids have a pH less than 7, while bases have a pH greater than 7. The higher the concentration of H⁺, the lower the pH. Look at the box. Living organisms are highly sensitive to changes in pH levels.

Learning basic chemical principles will help you answer questions on the Biology EOCT like this:

**What is the main inorganic solvent in cells?**

A  alcohol  
B  carbon  
C  salt  
D  water

A solvent is a substance that can dissolve other substances. Carbon and salt cannot dissolve other substances, so B and C are incorrect. Since most of the chemical processes of living things take place in water solutions, water is the principal inorganic solvent in cells, so D is the correct answer. Alcohols contain both carbon and hydrogen and are classified as organic compounds, so A is incorrect.

Organic compounds consist primarily of carbon and hydrogen. There are four basic types of organic compounds in living things. For the Biology EOCT, it is important that you are able to describe the four basic types of organic compounds and their functions in the cell. A brief overview of each organic compound follows. Don’t forget to review your textbook for additional details and the generalized structure of each.

**Organic Compounds**
- Carbohydrates
- Lipids
- Proteins
- Nucleic Acids

**Carbohydrates** are the major source of energy for most living things and include sugars, like glucose and sucrose, and starches. Starches are long chains of sugars. Carbohydrates are made up of carbon, hydrogen, and oxygen, with a 2:1 ratio of hydrogen to oxygen. Plants and some animals use carbohydrates for structural purposes. An example of this is
Biology EOCT

TEST CONTENT – CONTENT DOMAIN III

A Quick Look at Enzymes

Enzymes are special proteins that regulate nearly every biochemical reaction in the cell. Different reactions require different enzymes. Enzymes provide energy to cells, help build new cells, and aid in digestion. Enzymes are catalysts, a substance that speeds up chemical reactions without being used up or altered. Without enzymes, biochemical reactions would occur too slowly to sustain life.

Lipids are water-insoluble compounds made up of carbon, hydrogen, and oxygen, but hydrogen and oxygen are not in a 2:1 ratio. Lipids provide insulation, store energy, cushion internal organs, and are found in biological membranes. The waterproof, waxy surface of some leaves contains lipids. The structural building block of a lipid is the fatty acid combined with glycerol (a type of alcohol). Examples of lipids include fats and oils.

Proteins are nitrogen-containing compounds made up of chains of amino acids. The 20 amino acids can be combined to form a great variety of protein molecules in living things. Enzymes, some hormones, antibodies, and various structural parts of organisms are proteins. These protein molecules differ in the number, kinds, and sequence of amino acids they contain.

Nucleic acids are large organic compounds that contain all the information that an organism needs to live. Nucleic acids direct the construction of proteins. The genetic information an organism receives from its parents is in the form of nucleic acids. The two types of nucleic acids, deoxyribonucleic acid (DNA) and ribonucleic acid (RNA), are composed of chains of nucleotides. Nucleotides consist of a sugar, a phosphate group, and a nitrogen-containing base.

A question on the Biology EOCT for this standard might look something like this:

Which of these molecules are used to store energy in living things?

A carbohydrates and lipids
B carbohydrates and proteins
C lipids and proteins
D lipids and nucleic acids

Carbohydrates and lipids both function to store energy, so A is correct.

* Explain the Processes of Photosynthesis and Respiration *

Living things need energy to survive and function. You get your energy from the food you eat. Chemical reactions convert the food molecules to energy in a process called cellular respiration. Since plants don’t eat, how do they get energy? Plant cells capture energy from the Sun and convert it into food molecules (e.g., carbohydrates) in a process called photosynthesis. The cells of plants then convert the carbohydrates to energy.
during cellular respiration. Cellular respiration and photosynthesis are both complex sets of reactions that involve energy and food molecules at the cellular level. In many ways, cellular respiration is the opposite of photosynthesis. Let’s take a closer look at how cells store energy. The biological processes that require energy use adenosine triphosphate or ATP. ATP is a special molecule that stores and releases the energy in its bonds when the cell needs it. By removing a phosphate group (P), energy is released for chemical reactions to occur in the cell and ATP becomes ADP (adenosine diphosphate). Consider the following reaction:

$$\text{ATP} \rightleftharpoons \text{ADP} + P + \text{energy}$$

When the cell has energy, the energy is stored in the bond when the phosphate group is added to the ADP. The double arrow indicates that the reaction occurs in both directions in a cyclic manner.

### Strategy Box – The Cell’s Energy Bank

Think of ATP as the cell’s energy bank. The chemical bonds of ATP represent the vaults and the valuable energy represents the money. So when the cell has extra energy, the energy is deposited in the chemical bonds of ATP. When the cell needs energy, it is withdrawn from the chemical bonds of the ATP.

The ultimate source of energy for all living things is the Sun. Through photosynthesis, chlorophyll-containing plants trap energy from the Sun and use it to convert carbon dioxide gas (CO₂) and water (H₂O) into chemical energy stored in the bonds of glucose (C₆H₁₂O₆). Oxygen (O₂) is released in the process. The following chemical equation summarizes photosynthesis:

$$6 \text{CO}_2 + 6 \text{H}_2\text{O} + \text{energy from sunlight} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$$

As stated earlier, cellular activities need energy in order to work. This energy is released from the bonds of glucose through cellular respiration. In cellular respiration, glucose is oxidized in the cell to release energy. Carbon dioxide (CO₂) and water (H₂O) are produced as waste products. Consider the following chemical equation, which summarizes cellular respiration:

$$\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{energy}$$

Does this equation look familiar? It’s because the reactants for cellular respiration are the end products of photosynthesis. Consider the following chemical equations:

$$6\text{CO}_2 + 6\text{H}_2\text{O} + \text{energy} \xrightarrow{\text{photosynthesis}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \quad \xrightarrow{\text{respiration}}$$

The Biology EOCT will require you to list the reactants and products of photosynthesis and respiration as well as describe the ATP-ADP cycle. A question for this standard might look like this:
Which process converts CO₂ and H₂O to glucose?

A fermentation  
B photosynthesis  
C respiration  
D glycolysis

Since plants take in carbon dioxide (CO₂) to make glucose during photosynthesis, B is the correct answer. Fermentation is a cellular process that produces ethyl alcohol or lactic acid not glucose, so A is incorrect. Respiration produces CO₂ and H₂O from the conversion of glucose, so C is incorrect. Remember, cellular respiration is a series of complex steps. Glycolysis is the first step of cellular respiration when glucose is broken down, so D is incorrect.

* Explain the Structures of DNA and RNA and their Role in Protein Synthesis *

Remember that DNA and RNA are nucleic acids and are composed of nucleotides. A nucleotide is made of three parts—a phosphate group, a sugar, and a nitrogen-containing base. Let’s take a closer look at the structure of DNA.

Imagine a ladder. Now imagine the ladder twisted to form a spiral. This is the shape of the DNA molecule—a double helix. DNA contains two strands of nucleotides, each held together by weak hydrogen bonds between the nitrogen-containing bases. These make up the “rungs” of the ladder. The sides of the ladder consist of alternating phosphate groups with the five-carbon sugar. In DNA, deoxyribose is the sugar.

There are four different bases in DNA nucleotides: adenine, cytosine, guanine, and thymine. The hydrogen bonding allows only certain base pairings. In DNA, adenine and thymine pair with one another and guanine and cytosine pair with one another.

DNA has the unique ability to make an exact copy of itself in a process called replication. During DNA replication, the two DNA strands unravel, then, following the rules of base-pairing, produce two new strands. Each strand helps make a matching strand, so each new DNA molecule contains half of the original strand with the other half newly assembled.

DNA is found inside the cell’s nucleus coiled into chromosomes. Tiny sections of DNA are called genes. The sequence of the DNA nucleotides determines the sequence of amino acids in enzymes and other proteins. In addition to DNA, the genetic control of protein synthesis also involves RNA.
Let’s take a closer look at RNA. Remember that molecules of RNA are made up of nucleotides like DNA. However, in the RNA nucleotides the sugar is ribose instead of deoxyribose and the nitrogen-containing base uracil replaces thymine. Uracil pairs with adenine. RNA is usually single-stranded. There are three major types of RNA: ribosomal RNA (rRNA), messenger RNA (mRNA), and transfer RNA (tRNA). All three types of RNA are made in the nucleus, but mRNA and tRNA move into the cytoplasm to perform their functions.

The sequence of the nucleotides in the DNA determines the sequence of the nucleotides in mRNA which is copied in a process called transcription. Messenger RNA carries the message of the genetic code from the DNA in the nucleus to the ribosomes in the cytoplasm. At the ribosomes, the mRNA sequence is translated into a protein in a process called translation. Transfer RNA transfers amino acids in the cytoplasm to the ribosomes. The amino acids are lined up in the coded sequence to form a specific protein.

This is a brief overview of DNA, RNA, and protein synthesis. Don’t forget to refer to your textbook for additional information and diagrams. The questions for this standard will measure your ability to describe the structures of DNA and RNA and explain their roles in protein synthesis. You might see a question like this:

A DNA nucleotide and an RNA nucleotide both contain

A an amino acid, a phosphate group, and a base
B an amino acid, a base, and a sugar
C a sugar, a phosphate group, and a base
D a sugar, a phosphate group, and an amino acid

The nucleotide in a DNA molecule or an RNA molecule contains a sugar, a phosphate group, and a nitrogen-containing base, so C is the correct answer.

Sample Questions for Content Domain III

This section has some sample questions for you to try. After you have answered all of the questions, check your answers in the “Answers to the Content Domain III Sample Questions” section that follows. This section will give you the correct answer to each question, and it will explain why the other answer choices are incorrect.

1 It has been observed that the proportions of adenine and thymine bases in a DNA molecule are equal, as are the proportions of cytosine and guanine. This is BEST explained by

A helical base structure
B antiparallel base arrangement
C identical base substitution
D complementary base pairing

2 Which statement explains what happens when two atoms form a chemical bond?

A The atoms fit together like a lock and key.
B The atoms combine into a new, larger atom.
C The atoms share or transfer electrons.
D The atoms have like charges that stick together.
3. Which of these statements is true of cellular respiration?

A. It breaks down glucose to release stored energy.
B. It makes oxygen from energy and carbon dioxide.
C. It helps plants carry out photosynthesis.
D. It occurs only in nonphotosynthetic organisms.

4. Hereditary information is determined by molecules of

A. carbohydrates
B. lipids
C. nucleotides
D. proteins

5. The process by which messenger RNA is made from a DNA molecule is called

A. replication
B. transcription
C. translation
D. translocation

Answers to the Content Domain III Sample Questions

1. Answer: D  Standard: Explain the structures of DNA and RNA and their role in protein synthesis
According to the base-pairing rules, adenine pairs with thymine and cytosine pairs with guanine; therefore, A and B are incorrect. Since adenine is not identical to thymine or cytosine to guanine, then C is incorrect. Therefore, D is the correct answer.

2. Answer: C  Standard: Recognize that life has a chemical basis
Chemical bonds do not result in atoms fitting or sticking together, nor do chemical bonds cause atoms to make new atoms. Therefore, A, C, and D are incorrect. Chemical bonds are a result of sharing or transferring electrons, so C is the correct choice.

3. Answer: A  Standard: Explain the processes of photosynthesis and respiration
Cellular respiration breaks down glucose to release energy stored in the bonds of glucose, so A is the correct answer. Plants as well as animals carry out cellular respiration, so B and D are incorrect. Although plants carry out cellular respiration, it is not a prerequisite for plants to photosynthesize, so C is incorrect.

4. Answer: C  Standard: Recognize that life has a chemical basis
The sequence of nucleotides determines the hereditary information (genetic code) of the cell, so C is the correct answer. Carbohydrates, lipids, and proteins serve functions other than a hereditary basis in the cell, so choices A, B, and D are incorrect.

5. Answer: B  Standard: Explain the structures of DNA and RNA and their role in protein synthesis
Transcription is the process of making messenger RNA from a DNA molecule, so B is the correct answer. Replication is the process of copying a DNA molecule. Translation is the process in which the information in messenger RNA is used to make a protein. Translocation is a plant process in which food produced by photosynthesis is transferred from the leaves to the rest of the plant. Choices A, C, and D are incorrect.
Cells, like all living things, grow, reproduce, and eventually die. This is part of the cell cycle, a time when a cell grows, prepares for division, and then divides to form two new daughter cells.

The cell cycle consists of interphase, mitosis, and cytokinesis. Interphase is the longest part of the cell cycle—during which growth, metabolism, and preparation for division occur. Mitosis is the division of the nucleus of the cell. Cytokinesis is the division of the cytoplasm. Remember the cytoplasm is the fluid-like substance between the nucleus and the plasma membrane. Cytokinesis results in two daughter cells. The daughter cells then enter interphase and begin the cell cycle again. The process of copying and dividing the entire cell is called cell division.

Mitosis. At the end of interphase, the cell prepares to divide by duplicating its chromosomes (DNA replication). The cell then enters mitosis. Mitosis can be broken into four phases: prophase, metaphase, anaphase, and telophase. These are briefly described below.

- During prophase, the duplicated chromosomes become distinct and spindle fibers radiate across the cell.
- During metaphase, the duplicated chromosomes line up randomly in the center of the cell between the spindles.
- During anaphase, the duplicated chromosomes are pulled to opposite ends of the cell. The number of chromosomes at each end of the cell will be the same as the original number.
During **telophase**, a nuclear membrane forms around the chromosomes at each end of the cell. The spindle fibers disappear and the chromosomes disperse and become less distinct.

**Cytokinesis.** At the end of telophase, the cytoplasm begins to divide. In animal cells, the plasma membrane forms a groove and “pinches in” at the middle of the cell, separating the two new nuclei and splitting the cell in half. In plant cells, the rigid cell wall prevents a groove from forming. Instead, a cell plate forms along the center of the cell and cuts the cell in half. The cell plate forms new cell walls. Two daughter cells are formed as a result of cytokinesis. They are identical to their parent cell. For the **Biology EOCT**, it is important that you are able to identify the phases of mitosis and the process of cytokinesis.

Cell division allows unicellular organisms to duplicate themselves in a process called asexual reproduction. In multicellular organisms, cell division allows them to grow (i.e., increase the size of the organism), develop from a single cell into a multicellular organism, and make other cells to repair and replace worn out cells. Questions on the **Biology EOCT** may ask you to state the significance of cell division to unicellular and multicellular organisms. A question for this standard might look like this:

**In unicellular organisms, mitosis is essential for**

A  diffusion  
B  excretion  
C  metabolism  
D  reproduction

The correct answer is D since unicellular organisms reproduce by cell division, which consists of mitosis (division of the nucleus) and cytokinesis (division of the cytoplasm). Diffusion, excretion, and metabolism are not affected by mitosis; therefore, choices A, B, and C are incorrect.

Cell division produces two new cells, each with the same number of chromosomes as the original cell. These cells are called diploid cells. In humans, the diploid number is 46. Most of your body cells are produced by cell division and contain 46 chromosomes or 23 pairs of **homologous** (similar) chromosomes. A few cells are produced differently through a process called **meiosis**. The cells that are produced as a result of meiosis are called **gametes** or **sex cells**.

Meiosis occurs only in sex cells and consists of two cell divisions but only one chromosome replication. In other words, the cell divides two times to form four cells.

- The first meiotic division produces two cells containing half the number of double stranded chromosomes.
- The second meiotic division results in the formation of four cells, each containing half the number of single-stranded chromosomes.
Mitosis and meiosis sound somewhat similar but are quite different processes.

The prefix hap- means “half” so haploid cells contain only one half of each of the pairs of similar chromosomes. In humans, haploid cells contain 23 chromosomes. These cells are called sperm and egg cells.

On the Biology EOCT, you may be asked to compare meiosis in sperm and egg cell formation. The following are overviews of sperm and egg formation.

♂ During sperm formation, each primary sperm cell develops into four haploid cells of equal size. As they mature, the cells lose most of their cytoplasm and develop a long whip-like tail used in movement.

♀ During egg formation, each primary egg cell that undergoes meiosis develops into one large haploid cell and three smaller haploid cells called polar bodies. The first meiotic division produces one large cell and the first polar body. After the second meiotic division, the large cell forms an egg cell and another polar body. The first polar body may undergo a second meiotic division to produce two more polar bodies. The polar bodies disintegrate. So what is the advantage of uneven cytokinesis? The final egg cell is provided with a larger supply of stored nutrients.

Genetics is the branch of biology that deals with heredity. A great deal of what we know about genetics began with the work of Gregor Mendel, who experimented with sweet pea plants in the 1800s. In order to explain genetic principles on the Biology EOCT, you need to know some of the terminology used in genetics. See the box that follows. The following is a brief overview of how these terms apply to genetics.
A trait is a characteristic an individual receives from its parents. Genes carry the instructions responsible for the expression of traits. A pair of inherited genes controls a trait. One member of the pair comes from each parent. Alternative versions of genes are known as alleles.

If the two alleles in the pair are identical, then the trait is called homozygous. But if the two alleles are different, then the trait is called heterozygous. The term “hybrid” is sometimes used to refer to heterozygous. Alleles are located in the same position on homologous chromosomes and there are two main types of alleles, dominant and recessive.

Mendel’s work can be summarized in three laws:

- **Law of Dominance** states that the dominant allele will prevent the recessive allele from being expressed. The recessive allele will appear when it is paired with another recessive allele in the offspring.
- **Law of Segregation** (separation) states that gene pairs separate when gametes (sex cells) are formed, so each gamete has only one allele of each gene pair.
- **Law of Independent Assortment** states that different pairs of genes separate independently of each other when gametes are formed.

An organism’s genetic makeup is called the genotype, while the phenotype is the physical appearance of the organism.

Genetic crosses that involve one trait are called monohybrid crosses while dihybrid crosses involve two traits. Outcomes of genetic crosses can be predicted using the laws of probability. The results of genetic crosses can be shown using Punnett squares. If you’re not familiar with Punnett squares, consider the following genetic cross and its corresponding Punnett square:

In rabbits, black fur (B) is dominant over white fur (b). If one parent rabbit is heterozygous (Bb) and the other parent rabbit is homozygous white (bb), what is the probability of producing an offspring with white fur? Use a Punnett square to determine your answer.

For this cross, the resulting Punnett square would look like this:

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>b</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td>Bb</td>
<td>bb</td>
</tr>
<tr>
<td>b</td>
<td>Bb</td>
<td>bb</td>
</tr>
</tbody>
</table>

From the Punnett square, you can determine that half of the possible offspring would be black (Bb) while the other half would be white (bb). Therefore, the probability of producing an offspring with white fur is 50%.

It is important that you can explain and apply the basic concepts of Mendelian genetics. A question on the Biology EOCT for this standard might look like this:
Earlobe shape is a human trait. Some people have free earlobes while others have attached earlobes. Two parents with free earlobes have four children. Three children have free earlobes and one child has attached earlobes. If these parents have another child, what is the probability that the child will have attached earlobes?

A 25%  
B 50%  
C 75%  
D 100%

Since the parents have a child with attached earlobes, then attached earlobes is the recessive trait (ee) since it was masked by the dominant allele (E). Therefore, the parents must be heterozygous (Ee). In a cross between these parents (Ee x Ee), the probability of producing a child with attached earlobes is 1 in 4 or 25%. Therefore, A is the correct answer and choices B, C, and D are incorrect.

Strategy Box Revisited – Analyze the Word by Its Parts

Remember to look for familiar word parts when faced with an unknown term. Look at the following word parts:

- *hetero-* means “different”  
- *homo-* means “same”  
- *zygous* means “join together”

- *geno-* means “gene”  
- *pheno-* means “to appear”  
- *type* means “representation”

Knowing these meanings will help you determine the meaning of *heterozygous*, *homozygous*, *genotype*, and *phenotype*.

Describe Patterns of Inheritance and Genetic Engineering

From the time of Mendel’s work, many advances in genetics have been made. It was discovered that one pair of chromosomes was different in males and females. These chromosomes were called the sex chromosomes. In males, the sex chromosomes are XY, while the sex chromosomes in females are XX. From that we have learned about traits associated with particular sexes, such as color blindness. For example, men are much more likely to be color blind than women. Traits associated with particular sexes are called sex-linked or X-linked traits.

Further studies indicated that genes are linked on chromosomes, which means that genes on the same chromosome are inherited together. In another study it was revealed that genes from one chromosome are exchanged with genes from another chromosome in a process called **crossing over**. Crossing over occurs regularly during meiosis and leads to greater genetic variation in organisms. This is why you do not look exactly like either one of your parents even though all of your genes came from them. Many different phenotypes are a result of the random assortment of genes that occurs during sexual reproduction.
Another source of genetic variation occurs when the genetic code gets damaged. A sudden change in the genetic code is called a **mutation**. Mutations may be passed from one cell to new cells. If mutations occur in the sex cells, they may be transmitted to the next generation. Most mutations have little or no effect on an organism. Unfortunately, some mutations are harmful. In a gene mutation, there is a change in a single gene. In a chromosome mutation, there is a change in many genes. Mutations can be spontaneous or may be caused by environmental factors called **mutagens**.

Occasionally, during meiosis, homologous pairs of chromosomes don’t separate. This failure to separate is called **nondisjunction**. Nondisjunction results in half the sex cells having an extra chromosome and the other half having one less chromosome. If fertilization occurs with one of these abnormal sex cells, the zygote formed will have either one additional chromosome (trisomy) or one less chromosome (monosomy) than the diploid number. For example, in humans, the presence of an extra chromosome produces a condition called Down’s syndrome, also known as trisomy 21.

Genetic recombination and mutations are types of genetic change that lead to genetic variation and genetic disorders. On the **Biology EOCT**, a question for this standard may look like this:

**What is a source of genetic variation?**

A  adaptation  
B  mutation  
C  replication  
D  transcription

Remember, the two basic sources of genetic variation are mutations and the random assortment of genes that occurs during sexual reproduction; therefore, B is the correct answer. Replication and transcription are both cellular processes.

What do insulin and oil-eating bacteria have in common? They are both benefits of genetic engineering. **Genetic engineering**, sometimes called biotechnology, is the process of transferring a gene (DNA) from one organism to another. Organisms with a transferred gene now produce the “recombined” genetic code. For example, the gene for human insulin is transferred into a bacterium. The bacterium will use the “recombined” genetic code to produce human insulin. This is how human insulin is mass-produced. This insulin has saved the lives of many people with diabetes. Prior to this process, diabetics used pig insulin for their treatment. Important to this process is knowing the sequence of an organism’s DNA and the functions of the different genes. Not only does genetic engineering have applications in medicine and the environment, it also has uses in industry and agriculture. In agriculture, selective breeding is used to increase genetic variation in a population. On the **Biology EOCT**, you may be asked to give examples of the benefits and dangers of genetic engineering.
Describe and Apply Concepts of Origins

As described in the previous standard, genetic variation comes from changes in genetic information. Crossing over, mutations, genetic engineering, and the random assortment of genes all contribute to genetic variation. Natural selection is another factor affecting genetic variation.

Proposed by Charles Darwin, natural selection is the process by which organisms that are best suited to their environment survive and pass their genetic traits on to their offspring. Adaptation is a key concept in natural selection. Natural selection can change the inherited characteristics in a population and possibly even result in a new species. Evolution is the change in a species over time. However, it is not a single organism that changes but the genetic material of the species that changes over time. Fossil records have provided information on organisms’ evolutionary change.

Prior to the theory of natural selection, some people believed that species were unchanged forms. Others believed the Earth to be extremely old, and that slow, slight processes produced big changes. Later it was proposed that an organism could adapt to its environment by changes within its lifetime.

Evolution that occurs within the species level is called microevolution. It results from genetic variation and natural selection within a population of organisms. Macroevolution is evolution that occurs between different species. It focuses on how groups of organisms change (i.e., the splitting of a species into two species). Refer to your textbook for additional information about natural selection and the various patterns of evolution (e.g., convergent evolution, adaptive radiation, etc.).

For the Biology EOCT, it is important that you are able to explain how the concepts of genetics provide the basis for explaining natural selection and evolution. This will help you answer questions like this:

**What is the end result of natural selection?**

A. increased number of offspring of a given phenotype that survive  
B. changes in the frequency of alleles in a population  
C. fossil formation through extinction  
D. environmental changes of a habitat

Since natural selection can change the frequency of inherited characteristics (alleles) in a population, then B is the correct answer. Natural selection has no effect on increased production of offspring, fossil formation, or changes in habitat, so choices A, C, and D are incorrect.

New species arise from existing species. But where and when did the first species appear? On the Biology EOCT, you may be asked to identify and describe historical
ideas that led to modern thinking on theories of origins. Refer to your textbook for additional information regarding this topic.

Remember that scientific theories are subject to change. As more information is collected, theories sometimes change. Even so, not everyone will agree with any one theory.

Sample Questions for Content Domain IV

This section has some sample questions for you to try. After you have answered all of the questions, check your answers in the “Answers to the Content Domain IV Sample Questions” section that follows. This section will give you the correct answer to each question, and it will explain why the other answer choices are incorrect.

1  If a parent cell has 12 chromosomes, then the daughter cells following meiosis will have how many chromosomes?
   A  24  
   B  12  
   C  6  
   D  3

2  In humans, a widow’s peak is dominant over a continuous hairline. Mary’s father has a widow’s peak, but Mary and her mother have a continuous hairline. What is the genotype of Mary’s father?
   A  HH  
   B  Hh  
   C  hh  
   D  cannot be determined

3  Which of these is NOT a true statement about insulin produced through genetic engineering?
   A  It can be mass-produced.  
   B  It is less expensive.  
   C  There isn’t an allergic reaction.  
   D  It will cure diabetes.

4  What is nondisjunction?
   A  failure of chromosomes to separate during meiosis  
   B  failure of the cytoplasm to divide properly  
   C  the insertion of a gene into a different chromosome  
   D  the deletion of a gene from a chromosome

5  What is the formation of a new species called?
   A  macroevolution  
   B  microevolution  
   C  speciation  
   D  natural selection
Answers to the Content Domain IV Sample Questions

1. Answer: C  
   Standard: Describe the process of cell division
   Meiosis is also called reduction division because the chromosome number is reduced by one-half; therefore, C is the correct answer. Choices A, B, and D are incorrect.

2. Answer: B  
   Standard: Explain and use the basic Mendelian genetic principles
   Since Mary’s father has a widow’s peak, he has at least one “H” allele. Mary has a continuous hairline, so her genotype must be “hh”. Since she receives one allele from each parent, she received an “h” from her father. Therefore, his second allele must be an “h” and his genotype “Hh”. The correct answer is B. Choices A, C, and D are incorrect.

3. Answer: D  
   Standard: Describe patterns of inheritance and genetic engineering
   Unfortunately, genetic engineering does not cure the disorder, so D is the correct answer. Benefits of genetically engineered insulin include mass production, which makes it less expensive and nonallergenic (does not cause an allergic reaction), so A, B, and C are incorrect.

4. Answer: A  
   Standard: Describe patterns of inheritance and genetic engineering
   Nondisjunction, a type of chromosome mutation, is the failure of chromosomes to separate during meiosis, so A is the correct answer. Choices C and D are types of gene mutations and are incorrect. Choice B is incorrect since it has nothing to do with nondisjunction.

5. Answer: C  
   Standard: Describe and apply concepts of origins
   The formation of a new species is called speciation and may be a result of macroevolution, so C is correct and A is incorrect. Microevolution is evolution below the species level while natural selection is the process by which individuals adapted to an environment survive and reproduce, so B and D are incorrect.
Content Domain V: Viruses, Monerans, Protists, and Fungi

A LOOK AT CONTENT DOMAIN V

Test questions in this content domain will measure your ability to distinguish among viruses, monerans, protists, and fungi and describe their impact on living things. Your answers to the questions will help show how well you can perform on the following standards:

* Explain the structure and function of viruses
* Describe the characteristics and list examples of monerans
* Describe the characteristics and list examples of protists
* Describe the characteristics and list examples of fungi

Spotlight on the Standards

* Explain the Structure and Function of Viruses *

You’ve probably heard of viruses attacking computers and affecting the computers’ operating systems. Animal and plant viruses work the same way. They invade an organism at the cellular level and affect the organism’s body (i.e., operating system).

A virus is a nonliving particle with a simple structure. It is composed of a nucleic acid (DNA or RNA) surrounded by a protein coat. Viruses have very few of the characteristics of life. In fact, viruses use living cells to replicate the viral nucleic acid. A virus infects a living cell when the virus injects its nucleic acid into the host cell. Inside the host cell, the viral nucleic acid replicates and makes more viruses. There are two methods of infecting host cells: the lytic cycle and the lysogenic cycle.

All viruses have a lytic cycle. In the lytic cycle, a virus attached to a host cell injects its nucleic acid into the cell. The viral nucleic acid is immediately replicated, eventually causing the host cell to burst, releasing new viral particles. These new viruses then attack other cells.

Sometimes the viral nucleic acid enters the host cell but does not immediately kill the host cell. In the lysogenic cycle, after the virus embeds its nucleic acid into the chromosome of the host cell, the viral nucleic acid is replicated along with the host cell’s DNA. Then the virus becomes dormant, sometimes for years without the host knowing. The virus may suddenly become active, resuming the lytic cycle, which will eventually destroy the host cell.
Viruses affect animals, plants, and bacteria. But different viruses attack different cells. For example, animal viruses affect only animals. Examples of viral diseases affecting animals are listed in the box at the right. An example of a plant virus is the tobacco mosaic virus, which attacks tobacco plants.

Viral diseases usually do not respond to drug treatment. The body’s natural defenses are the best protection. Immunity can be acquired naturally or from outside sources like vaccinations. Refer to your textbook for information on treatment methods and ways to prevent the spread of viruses.

Knowing the characteristics of viruses and viral diseases will help you on the Biology EOCT. A question for this standard might look like this:

The outer layer of a virus is made of

A carbohydrates  
B lipids  
C nucleic acids  
D proteins

Viruses are particles of DNA or RNA surrounded by a protein coat, so D is the correct answer.

Describe the Characteristics and List Examples of Monerans

The members of Kingdom Monera are prokaryotic organisms. In other words, monerans lack a membrane-bound nucleus and membrane-bound organelles. Most members of the kingdom Monera are unicellular, including bacteria. Bacteria are found almost everywhere and are an important part of the living world. Whether in the air, water, soil, or in other organisms, bacteria are among the smallest organisms.

Most bacteria are heterotrophic (i.e., get their food from an outside source). Some, like the blue-green bacteria, make their own food through photosynthesis. There are also bacteria that get their food through chemosynthesis. In chemosynthesis, bacteria use chemicals like sulfur compounds to produce their energy.

Different kinds of bacteria have different shapes. Most bacteria have a single, circular chromosome, and the cell membrane is usually surrounded by a cell wall. Some monerans have a flagellum, a whip-like projection used to move the moneran.
Many bacteria are able to survive in poor environmental conditions by producing spores. The spores may remain dormant for years until conditions become favorable. In favorable conditions, the spore splits open and the bacteria rapidly reproduce. Reproduction of bacterial cells involves the duplication of the chromosome followed by the bacterial cell splitting into two cells. This process is called **binary fission**.

Many bacteria are beneficial—especially to the environment. For example, soil bacteria get their energy by decomposing dead organisms. Another way bacteria are beneficial to the environment is through nitrogen fixation, the process by which bacteria convert nitrogen in the soil into a form usable by plants.

Humans rely on bacteria in the human digestive system to help in the digestive process and to produce useful compounds like vitamins. Bacteria are also beneficial in various industries that use bacteria for processes like fermentation. In the food industry, bacteria are used to provide flavors to food or to prepare foods like cheese, yogurt, sauerkraut, and soy sauce.

Some bacteria can cause disease. Bacteria cause disease in one of two general ways. Some bacteria damage the tissues of the infected organism directly by breaking down the tissues for food. Other bacteria release poisons that harm the body. Strep throat is a familiar disease caused by bacteria. See the box to the right for other examples of bacterial diseases.

So how do bacteria enter the body? Bacteria are transmitted through the air, in food or water, through direct or indirect contact with an infected organism, or by vectors. Vectors are organisms that carry disease-causing microorganisms from one host to another. Fleas and ticks are types of vectors.

There are different ways to prevent a bacterial infection. For example, skin and surfaces that have been in contact with raw meat should be washed thoroughly, food should be cooked properly, and contaminated water should be boiled. Another way to prevent contracting a bacterial disease is to avoid contact with an infected organism or organisms that carry disease-causing microorganisms (i.e., vectors). When the plague swept across Europe in the Middle Ages, half of the population did not survive. If they had known that the cause of the disease was bacteria transmitted through the bite of a flea, it might have helped in preventing the spread of the disease.

Besides the body’s natural defense mechanisms, vaccines are also used to prevent a bacterial disease from invading the body. For example, childhood vaccinations provide protection against diseases like diphtheria and tetanus. If a bacterial infection does develop, antibiotics can be used to destroy the bacterial cells. A question on the **Biology EOCT** for this standard might look something like this:

**BACTERIAL DISEASES**
- cholera
- diphtheria
- leprosy
- Lyme disease
- meningitis
- plague
- pneumonia
- syphilis
- tetanus
- tuberculosis
- typhoid fever
Meningitis is an infection within the spinal fluid that may be caused by either viruses or bacteria. Which of the following would be a treatment for bacterial meningitis but NOT for viral meningitis?

A  vaccinations  
B  blood transfusions  
C  vitamin C  
D  antibiotics

Bacteria can be destroyed with antibiotics while viruses cannot, so D is the correct answer.

Strategy Box – What’s the Cure?

To distinguish between viruses and bacteria, remember that antibiotics work against living organisms (anti- means “against” and bio- means “life”). Since bacteria are living organisms, antibiotics are used to treat bacterial infections.

* Describe the Characteristics and List Examples of Protists *

The members of Kingdom Protista are eukaryotic organisms. There are a variety of protists, and while many are single-celled, there are a few multicellular representatives. Some protists are animal-like, while others are plant-like. On the Biology EOCT, you may be asked to compare the different groups of protists and identify examples of each.

Animal-like protists are called protozoa. Protozoa are single-celled and classified into four groups based on their method of locomotion. The following table provides a glimpse of the four groups of protozoa.

<table>
<thead>
<tr>
<th>Phylum name</th>
<th>Means of Locomotion</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciliophora (ciliophorans)</td>
<td>use cilia (hair-like projections)</td>
<td>Paramecium, Stentor</td>
</tr>
<tr>
<td>Sarcodina (sarcodinians)</td>
<td>use pseudopods (foot-like cytoplasmic projections)</td>
<td>Amoeba, Foraminiferans</td>
</tr>
<tr>
<td>Sporozoa (sporozoans)</td>
<td>do not move; parasitic</td>
<td>Plasmodium, Toxoplasma</td>
</tr>
<tr>
<td>Zooflagellata (zooflagellates)</td>
<td>use flagella (whip-like projections)</td>
<td>Trichonympha, Trypanosoma</td>
</tr>
</tbody>
</table>

Plant-like protists are called algae. Algae have chlorophyll and accessory pigments needed for photosynthesis. Algae can be found in lakes, streams, and oceans as well as in thin films of water on rocks or soil. Algae are classified into groups based primarily on the pigments they contain. The following table provides a brief look at the algae.
Strategy Box Revisited – Analyze the Word by Its Parts

Remember to look for familiar word parts when faced with an unknown term. Look at the following word parts:

- **proto-** means “first”
- **zoa-** means “animal”
- **pseudo-** means “false”
- **-podia** means “feet”

Knowing these meanings will help you determine the meaning of words like *protozoa* and *pseudopodia*.

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### Phylum name

<table>
<thead>
<tr>
<th>Phylum name</th>
<th>Pigments</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chlorophyta</strong>&lt;br&gt;(green algae)</td>
<td>chlorophylls <em>a</em> and <em>b</em>, carotenoids</td>
<td><em>Spirogyra</em>, <em>Chlamydomonas</em>, <em>Acetabularia</em></td>
</tr>
<tr>
<td><strong>Chrysophyta</strong>&lt;br&gt;(golden-brown algae)</td>
<td>chlorophylls <em>a</em> and <em>c</em>, carotenoids, xanthophylls, fucoxanthins</td>
<td><em>Thalassiosira</em>, diatoms</td>
</tr>
<tr>
<td><strong>Euglenophyta</strong>&lt;br&gt;(euglenoids)</td>
<td>chlorophylls <em>a</em> and <em>b</em></td>
<td><em>Euglena</em></td>
</tr>
<tr>
<td><strong>Phaeophyta</strong>&lt;br&gt;(brown algae)</td>
<td>chlorophyll <em>a</em> and <em>c</em>, fucoxanthin</td>
<td><em>Fucus</em>, <em>Sargassum</em>, diatoms</td>
</tr>
<tr>
<td><strong>Dinoflagellata</strong>&lt;br&gt;(dinoflagellates)</td>
<td>chlorophylls <em>a</em> and <em>c</em>, xanthophylls</td>
<td><em>Noctiluca</em>, dinoflagellates</td>
</tr>
<tr>
<td><strong>Rhodophyta</strong>&lt;br&gt;(red algae)</td>
<td>chlorophyll <em>a</em> and <em>d</em>, caroten, phycobilins</td>
<td><em>Chondrus</em>, coralline algae</td>
</tr>
</tbody>
</table>

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### Positive Effects of Protists

Protists are important in many ecosystems. Algae are beneficial as a source of food in aquatic ecosystems and as a major source of atmospheric oxygen. Humans use a type of red algae, called nori, in soups and salads. Substances extracted from red algae are used to thicken foods, like ice cream, pudding, and soups. Algae are also a source of chemicals used to treat health problems, like stomach ulcers, or to make compounds for scientific labs, like agar, which is used to grow bacteria. Chemicals from algae are even used in industry to make products like plastics and paints.

Some protozoa are beneficial to other organisms. For example, *Trichonympha* live inside the digestive tract of termites. When termites eat wood, *Trichonympha* digests the wood for the termite.

### Negative Effects of Protists

Protists can also have harmful effects. Some protozoa cause diseases in humans and other animals. Insects and water can spread the protozoa. For example, *Plasmodium* is carried in the body of a mosquito and causes malaria. Although some drugs and vaccines are partially effective against the disease, the best way to control malaria is to control the mosquitoes that carry it. African sleeping sickness is transmitted through the bite of a tsetse fly carrying the protozoan *Trypanosoma*. Because the disease is often fatal, controlling the tsetse fly is an important health-care goal in Africa.
Some algae can also have harmful effects. When algae rapidly reproduce, they create algal blooms. Algal blooms can quickly decrease the nutrients in the water. Without food, the algae die and decompose, which depletes the water of its oxygen. Without oxygen in the water, fish and other aquatic life soon die. Have you heard of “red tides?” Massive blooms of dinoflagellates cause red tides. Dinoflagellates produce toxins that become concentrated in shellfish. Eating contaminated shellfish can cause serious health issues.

In addition to knowing the characteristics of the different protists, questions on the Biology EOCT may ask you to describe the beneficial and harmful effects of protists. Refer to your textbook for additional information and examples.

Describe the Characteristics and List Examples of Fungi

What do mushrooms, athlete’s foot, yeasts, and penicillin all have in common? They are all types of fungi. Fungi are nonmoving, eukaryotic heterotrophs that absorb their food from organic material. Fungi can be saprophytic or parasitic. Saprophytes obtain their food from dead organic material, while parasites live in or on another organism causing harm to that organism. The bodies of fungi consist of filaments called hyphae, which intertwine into a thick mass called a mycelium. The cell walls of fungi are made of chitin.

Most fungi reproduce both asexually and sexually. Fungi are classified into groups based on the reproductive structures they contain. The following table provides a brief look at the fungi.

<table>
<thead>
<tr>
<th>Phylum name</th>
<th>Asexual Spores</th>
<th>Sexual Spores</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ascomycota (sac fungi)</td>
<td>conidia</td>
<td>ascospores produced in ascus (sac-like structure)</td>
<td>cup fungi, yeasts, mildew</td>
</tr>
<tr>
<td>Basidiomycota (club fungi)</td>
<td>conidia</td>
<td>basidiospores produced in basidium (club-like structure)</td>
<td>mushrooms, puffballs, shelf fungi, rusts</td>
</tr>
<tr>
<td>Deuteromycota (imperfect fungi)</td>
<td>conidia</td>
<td>no sexual phase known</td>
<td>Penicillium, ringworm, athlete’s foot fungus</td>
</tr>
<tr>
<td>Zygomycetes (common molds)</td>
<td>sporangia</td>
<td>conjugation (the fusion of two nuclei from different mating strains)</td>
<td>Rhizopus</td>
</tr>
</tbody>
</table>

Fungi have many beneficial effects. For the Biology EOCT, it is important that you can explain the beneficial effects of fungi. Fungi are found in almost every ecosystem where there is organic material and moisture. Fungi are beneficial to ecosystems because they break down the organic material, recycling the nutrients.

Without fungi, baked products would certainly look different. Yeast is used to make bread dough rise. Another way fungi are important is as a food source. For example, non-poisonous mushrooms, morels, and truffles are types of edible fungi. Fungi are also used to decompose foods to make them easier to use or store. For example, fungi are used to
ferment milk into cheese. Many medicines, such as antibiotics, are produced by the fermentation of certain fungi.

Fungi also have some negative effects. Sometimes fungi break down materials we don’t want broken down. Fungi can attack our food, clothing, and paper, causing it to become useless. Parasitic fungi cause serious plant diseases, like wheat rust and fruit mildews, and animal diseases, like athlete’s foot disease in humans.

For the Biology EOCT, it is important that you can explain the positive and negative effects of fungi. You may also be asked to describe the characteristics and list examples of fungi. A question might look like this:

What are the microscopic living threads that make up the body of a fungus called?

A cilia
B flagella
C hyphae
D spores

Remember, cilia are small, hair-like projections used in movement and flagella are long, whip-like projections used in movement, so A and B are incorrect. Hyphae are long filaments that make up the mycelium, or the body of the fungus, so C is correct. Spores are reproductive structures, so D is incorrect.

Sample Questions for Content Domain V

This section has some sample questions for you to try. After you have answered all of the questions, check your answers in the “Answers to the Content Domain V Sample Questions” section that follows. This section will give you the correct answer to each question, and it will explain why the other answer choices are incorrect.

1 Influenza, measles, and chickenpox are diseases caused by
   A bacteria
   B fungi
   C protozoa
   D viruses

2 Why is food preserved by canning in glass containers normally safe for later consumption?
   A The glass allows solar radiation to kill the bacteria that were in the food.
   B Bacteria are destroyed by extreme heat in the glass container.
   C Bacteria are removed from the food before it is placed in the glass container.
   D The glass container prevents oxygen from reaching the bacteria.
### Questions

**3** Which statement BEST describes protozoa?

- **A** They are autotrophic.
- **B** They are parasitic.
- **C** They are the simplest organisms.
- **D** They are unicellular organisms.

**4** Yeasts are a type of

- **A** algae
- **B** bacteria
- **C** fungi
- **D** protozoan

### Answers to the Content Domain V Sample Questions

1. **Answer:** **D**  
   **Standard:** *Explain the structure and function of viruses*  
   Influenza (flu), measles, and chickenpox are diseases caused by viruses, so **D** is the correct answer and choices **A**, **B**, and **C** are incorrect.

2. **Answer:** **B**  
   **Standard:** *Describe the characteristics and list examples of monerans*  
   Glass containers can withstand the extreme heat necessary to destroy bacteria, so **B** is the correct answer. Solar radiation does not provide the extreme heat necessary to destroy bacteria, so **A** is incorrect. Bacteria from the air can be introduced into the food when it is placed in the container, so **C** is incorrect. Some bacteria, called anaerobic bacteria, are able to survive and thrive without oxygen, so **D** is incorrect.

3. **Answer:** **D**  
   **Standard:** *Describe the characteristics and list examples of protists*  
   All protozoa are single-celled or unicellular organisms, so **D** is correct. Some protozoa are heterotrophic, so **A** is incorrect. Most protozoa are NOT parasitic, so **B** is incorrect. Bacteria, not protozoa, are the simplest organisms, so **C** is incorrect.

4. **Answer:** **C**  
   **Standard:** *Describe the characteristics and list examples of fungi*  
   Yeasts are an example of sac fungi, so **C** is the correct answer and choices **A**, **B**, and **D** are incorrect.
Content Domain VI: Plants and Animals

A LOOK AT CONTENT DOMAIN VI

Test questions in this content domain will measure your ability to understand the key aspects of plants and animals including human anatomy and physiology. Your answers to the questions will help show how well you can perform on the following standards:

♦ Describe the similarities and differences of spore-producing plants
♦ Describe the similarities and differences of seed-producing plants
♦ Describe the anatomy and physiology of each phylum of invertebrates
♦ Describe the anatomy and physiology of classes of vertebrates
♦ Analyze the overall organization of the human body
♦ Describe the anatomy of each system of the human body
♦ Describe the physiology of each system of the human body

Spotlight on the Standards

♦ Describe the Similarities and Differences of Spore-producing Plants ♦

Plants are multicellular eukaryotes that belong to the Kingdom Plantae. Recall that the cells of plants are surrounded by a cell wall that contains cellulose. Plants are classified according to the presence of a vascular system. A vascular system allows plants to move food and water in a system of tubes throughout the plant body. Nonvascular plants tend to be smaller than vascular plants. Plants are further classified by whether or not seeds are produced.

The simplest plants, bryophytes, are nonvascular, spore-producing plants. Since there is no vascular tissue to transport food and water, bryophytes must remain small so they can absorb water by osmosis. Examples of bryophytes include mosses and liverworts.

Because their sperm must swim to reach the eggs, bryophytes live in moist environments. Bryophytes also reproduce sexually. The life cycle of bryophytes alternates between haploid and diploid generations. In bryophytes, the gametophyte generation is the larger and more recognizable generation of the life cycle. This is the generation you see when you observe mosses. See the box that follows for a brief overview on the alternation of generations.
Unlike bryophytes, other groups of plants contain vascular tissue. There are two types of vascular tissue: **xylem**, which transports water and mineral, and **phloem**, which transports sugar produced by photosynthesis. In vascular plants, the sporophyte generation is the most recognizable generation. Like the bryophytes, all vascular plants produce spores. However, some vascular plants also produce seeds.

Spore-producing vascular plants include the club mosses, horsetails, and ferns. Although these spore-bearing, or seedless, plants are able to live in drier environments, they still require a thin film of water for reproduction. The sperm must swim to the egg for fertilization to occur. The resulting zygote develops into a sporophyte. When you see a fern plant, you are observing the sporophyte generation, the plant form that produces spores.

On the **Biology EOCT**, you may be asked to describe and identify the structures and reproductive cycles in spore-producing plants. A question may look like this:

**In a plant’s life cycle, a diploid stage followed by a haploid stage is called**

A  alternation of generations  
B  double fertilization  
C  generational cycling  
D  periodic reproduction

Alternation of generations is the alternating of the diploid stage with the haploid stage in a plant’s life cycle, so A is the correct answer.

♦ **Describe the Similarities and Differences of Seed-producing Plants** ♦

Seed-producing plants are the most common type of land plants. As the name suggests, they are characterized by the production of seeds. The **seed** is an embryo of a plant protected by a hard outer covering called a **seed coat**. The seed represents three generations—the new sporophyte (embryo), the old

![Structure of a Bean Seed](structure.png)
sporophyte (seed coat), and the old gametophyte (food supply or endosperm).

Seed-producing plants are divided into two groups based on their reproductive structures: **gymnosperms** and **angiosperms**. Gymnosperms, like pine trees and other conifers, are the cone-bearing plants that usually produce seeds in cones. Other gymnosperms include the cycads and ginkgoes.

Angiosperms are the flowering plants, which include the grasses, wildflowers, shrubs, and trees. **Flowers** are unique reproductive organs that produce seeds surrounded by a fruit. Angiosperms are divided into two groups—monocots and dicots—which are named for the number of seed leaves, or **cotyledons**, in the plant embryo. Monocots have one seed leaf while dicots have two.

Remember seed plants are vascular plants and, therefore, contain the vascular tissues xylem and phloem. These specialized tissues are part of three of the plants’ principal organs—roots, stems, and leaves. Here is a brief description of the function of each plant organ.

- **Roots** serve to anchor plants in the ground and absorb water and dissolved minerals from the soil. Some roots may store food. Two types of root systems are taproot and fibrous roots.
- **Stems** provide structural support for the plant and produce leaves, branches, and flowers. Stems also transport water and minerals between the roots and leaves.
- **Leaves** carry out photosynthesis, which produces food for the entire plant.

Seeds, pollen, flowers, and fruit are adaptations that allow angiosperms to survive in a wide variety of environments. Unlike bryophytes, seed plants do not need water for reproduction. Instead, pollen is transferred by wind, water, or animals to the female flower parts in a process called **pollination**. In **fertilization**, the sperm unites with the egg in a flower. The resulting embryo is surrounded by a seed coat to form a seed.

Seeds can tolerate unfavorable conditions by becoming dormant. When conditions become favorable, the seed sprouts into a new plant. The sprouting of a seed is called **germination**. Plants can also be reproduced asexually through cuttings and grafting.

Seed plants have important uses for food, medicine, and other products. Angiosperms produce flowers, fruits, seeds, and pollen that provide food essential to many organisms, including humans. Some food crops harvested by humans include cereal grains, legumes, and root crops. Trees provide food and shelter for many animals, as well as providing fuel, lumber, and paper products. Various types of fibers come from cotton and flax plants. Medicines and seasonings are also derived from plants.

On the **Biology EOCT**, you may be asked to describe and identify the characteristics of seed-producing plants. A question may look like this:
Which of these is NOT part of a typical seed?

A  cotyledon  
B  embryo  
C  seed coat  
D  zygospore

A typical seed consists of an embryo and cotyledon surrounded by a seed coat; therefore, D is correct.

Strategy Box – Picture Perfect

Remember to look carefully at diagrams, illustrations, and other graphics. Information might be provided to help you answer questions on the Biology EOCT.

If a visual aid is not provided, you might want to make a diagram to help summarize important information to help you answer a question.

♦ Describe the Anatomy and Physiology of Each Phylum of Invertebrates ♦

Animals are grouped according to the presence or absence of a backbone. Animals with backbones are called vertebrates while animals without backbones are called invertebrates.

This standard on invertebrates is fairly diverse. On the Biology EOCT, you will be asked questions that will assess your ability to demonstrate and apply an understanding of the characteristics of the different groups of invertebrates. You may be asked to do any of the following:

- List and describe characteristics of the different phyla of invertebrates, which include the sponges, cnidarians, flatworms, roundworms, segmented worms, mollusks, arthropods, and echinoderms.
- Identify major structures and their functions for common invertebrates in each phylum. For example, cnidarians have specialized stinging cells in their tentacles that are used to capture prey. Leeches, a type of annelid, have suckers that are used to remove blood and other body fluids from their host.
- Describe and discuss body plans in invertebrates with reference to symmetry. Symmetry is the arrangement of body parts around a central point or line. Sponges do not have symmetry but the other invertebrates exhibit radial or bilateral

Types of Body Symmetry

(sea anemone) radial symmetry

(butterfly) bilateral symmetry
symmetry. Animals with symmetry have either a solid body or a body with a cavity between the outer body wall and the gut. Flatworms are examples of invertebrates with a solid body. Roundworms have the beginning of a body cavity. The other invertebrates, as well as the vertebrates, have a true body cavity called a **coelom**.

- Describe and explain adaptations in invertebrates for life on land. One adaptation can be seen in the development of skeletal systems for support since the body would no longer be supported by water.
- Describe the life processes of selected organisms in each phylum. Invertebrates are specialized to carry out the various life processes, such as feeding, digestion, excretion, circulation, etc.
- Evaluate the economic significance of certain invertebrates. Some invertebrates are beneficial like earthworms, which serve as decomposers in the soil. Other invertebrates like crustaceans and mollusks are beneficial as a food source. While invertebrates like insects pollinate crops, some invertebrates can be harmful. For example, roundworms are parasites that infest crops, livestock, pets, and even humans causing economic hardship and diseases. Insects also cause human diseases and some destroy food crops and wood.

A question for this standard might look like this:

**Which of these BEST describe butterflies?**

A  Butterflies are heterotrophic arthropods that metamorphose.
B  Butterflies reproduce sexually in the pupae stage.
C  Butterflies rest during the larval stage and eat only as adults.
D  Butterflies do not carry on respiration as pupae but only as adults.

Since butterflies are animals that change (metamorphose) from one form to another, from egg to caterpillar to pupa to adult butterfly, then A is the correct answer. The butterfly’s adult form will take shape in the pupa stage. Respiration occurs but reproduction will not occur until the adult form, so B and D are incorrect. In the larval stage, which is characterized by a worm-like form known in butterflies as a caterpillar, the larva eats hungrily and rapidly grows, so C is incorrect.

---

**Describe the Anatomy and Physiology of Classes of Vertebrates**

A vertebrate is an animal with a strong, flexible backbone. You are an example of a vertebrate. All vertebrates exhibit bilateral symmetry and a true body cavity with an endoskeleton. Vertebrates are a diverse group of animals found in aquatic and terrestrial environments.

On the **Biology EOCT**, you will be asked questions that will assess your ability to apply an understanding of the characteristics of the different groups of vertebrates. You may be asked to do any of the following:
• Identify characteristics of the different classes of vertebrates, which include jawless fishes (e.g., lampreys), cartilaginous fishes (e.g., sharks), bony fishes, amphibians, reptiles, birds, and mammals.

• Identify and describe the major structural adaptations and their functions for common animals in the different classes. Each class of vertebrates is characterized by structures that make them unique. For example, bony fishes have scales, fins, and gills. Amphibians have moist skin that lack scales, have lungs as adults, and limbs that enable them to move on land. Reptiles have dry, scaly skin and terrestrial eggs. Feathers are unique to birds while mammals possess hair or fur.

• Identify and describe structural adaptations that make the different classes of vertebrates suitable for their environments. For example, different ways to feed, gills, and paired fins make fishes suitable to an aquatic life. Adaptations in reptiles, such as well-developed lungs and strong limbs, have contributed to their success as land-dwellers. Feathers, hollow bones, strong muscles, and more efficient heart and lungs enabled birds to take to the air.

• Describe and explain adaptations for nutrition and reproduction. For example, the development of the jaw was important to the choices of food available to vertebrates. With the development of a shelled egg, reptiles did not have to return to water to reproduce. Other reproductive adaptations were internal fertilization and internal development of the fertilized egg.

• Identify behavioral adaptations that have allowed vertebrates to survive. Behavior is an animal’s response to a stimulus. Innate behaviors are instinctive, like birds defending their nesting place, and are influenced by genes. Learned behaviors are changed by various experiences, such as training a family pet to come when its name is called. Social behaviors are interactions between members of the same species and include mating and caring for offspring. In territorial behaviors, organisms defend an area and keep out other organisms.

A question for this standard might look like this:

**Which is NOT an adaptation of both reptiles and birds?**

A terrestrial eggs  
B strong muscles  
C efficient lungs  
D moist skin

Although some reptiles and birds can be found near water, their skin is dry, so D is the correct answer. Reptiles and birds produce shelled eggs so water is not necessary for reproduction. Strong muscles and efficient lungs are another adaptation of reptiles and birds for living on land. So A, B, and C are incorrect.
Analyze the Overall Organization of the Human Body

Because humans are animals, specifically mammals, they also belong to Kingdom Animalia. Humans have well-developed body systems that function like those of other mammals. Refer to Content Domain II page 23. As you read, recall that each of these body systems consists of specialized cells, tissues, and organs that perform a similar function.

The human body is made up of eleven body systems. The following is a list of the body systems, the basic function of each system, as well as the basic organs and structural parts of each system.

<table>
<thead>
<tr>
<th>System</th>
<th>Function</th>
<th>Basic Organs and Structural Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circulatory</td>
<td>transports nutrients, fluids, and gases</td>
<td>heart, veins, arteries</td>
</tr>
<tr>
<td>Digestive</td>
<td>breaks down food into essential nutrients</td>
<td>mouth, esophagus, stomach, small intestine, large intestine</td>
</tr>
<tr>
<td>Endocrine</td>
<td>controls body functions through hormones</td>
<td>glands which secrete hormones</td>
</tr>
<tr>
<td>Excretory</td>
<td>removes cellular wastes from the blood</td>
<td>bladder, kidneys, urethra</td>
</tr>
<tr>
<td>Immune</td>
<td>protects the body against invading organisms</td>
<td>white blood cells</td>
</tr>
<tr>
<td>Integumentary</td>
<td>protects the body by forming the body's outer layer</td>
<td>skin, hair, nails</td>
</tr>
<tr>
<td>Muscular</td>
<td>moves the body with the help of the skeletal system</td>
<td>muscles</td>
</tr>
<tr>
<td>Skeletal</td>
<td>supports the body internally</td>
<td>bones, cartilage, ligaments, tendons</td>
</tr>
<tr>
<td>Nervous</td>
<td>coordinates sensory input with motor output</td>
<td>brain, spinal cord, sense organs</td>
</tr>
<tr>
<td>Reproductive</td>
<td>provides a means of producing offspring</td>
<td>testes, ovaries, uterus</td>
</tr>
<tr>
<td>Respiratory</td>
<td>controls the exchange of gases</td>
<td>nose, pharynx, larynx, trachea, bronchi, lungs</td>
</tr>
</tbody>
</table>

All the body systems work together to maintain homeostasis, which is a self-regulating mechanism that maintains internal conditions. (Refer back to page 25.) In order to maintain homeostasis, humans must have a sensor, a control unit, and an effector. For example, when your body temperature drops, a signal from temperature receptors (sensor) is passed to an integrator in the hypothalamus (control unit), which then directs the muscles (effectors) of blood vessels to constrict to conserve heat.

On the Biology EOCT, you may be asked questions about the basic functions of body systems and how they work together to maintain homeostasis. A question for this standard might look like this:
Blood cells are part of which body system?

A  skeletal  
B  respiratory  
C  integumentary  
D  circulatory  

Blood cells are part of the circulatory system, so D is the correct answer.

---

**Strategy Box – Set the Table**

On the Biology EOCT, a question might refer you to a table of information. When working with tables, carefully read the headings of the columns and rows. When you think you have the answer, double check the information given in the table.

---

**Describe the Anatomy of Each System of the Human Body**

*Anatomy* is the study of the structural characteristics of an organism. This standard focuses on the basic organs and structural parts of the human body systems (review the chart on page 60 in the last section).

On the Biology EOCT, you may also be asked to describe the basic structure of the major organ in each body system. The following table is a basic list of a few body systems, the major organ in each system, and the basic structures in each organ.

<table>
<thead>
<tr>
<th>System</th>
<th>Major Organ</th>
<th>Organ Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circulatory</td>
<td>heart</td>
<td>chambers, valves</td>
</tr>
<tr>
<td>Excretory</td>
<td>kidney</td>
<td>nephrons, cortex, medulla, renal pelvis</td>
</tr>
<tr>
<td>Integumentary</td>
<td>skin</td>
<td>epidermis, dermis</td>
</tr>
<tr>
<td>Muscular</td>
<td>muscle</td>
<td>muscle fibers</td>
</tr>
<tr>
<td>Skeletal</td>
<td>bone</td>
<td>osteocytes, periosteum, Haversian canals</td>
</tr>
<tr>
<td>Nervous</td>
<td>brain</td>
<td>cerebrum, cerebellum, brain stem</td>
</tr>
<tr>
<td>Respiratory</td>
<td>lung</td>
<td>bronchi, bronchioles, alveoli</td>
</tr>
</tbody>
</table>

You may be asked questions about the basic anatomy of body systems:

**Which is NOT a structure of the lungs?**

A  epidermis  
B  bronchi  
C  bronchioles  
D  alveoli
The bronchi, bronchioles, and alveoli are all structures of the lungs, so A is correct.

♦ Describe the Physiology of Each System of the Human Body ♦

Physiology is the study of how living things function. This standard focuses on the physiology of the human body systems. On the Biology EOCT, you may be asked questions that will assess your ability to explain the physiology of the different systems in the human body.

Different organs within a system perform different functions. Using the digestive system as an example, consider the following information. The mouth chews food and saliva adds enzymes to begin the digestive process. The esophagus moves the food to the stomach. Glands in the stomach secrete stomach acid and enzymes to digest any protein. The “food” then moves to the small intestine where the acid is neutralized by a substance produced by the pancreas. Substances produced by the liver break down any fat in the food. The basic components of the food are absorbed across the intestinal wall into the blood stream where they are carried to the liver and removed from the bloodstream. Any material that cannot be digested or absorbed moves into the large intestine. The remaining water is reabsorbed, and the remaining undigested material is eliminated from the body.

The different parts and organs of a system also interact with other parts of the system. Using the digestive system as an example again, the stomach and small intestine break down food molecules with the help of organs like the liver, pancreas, and gall bladder. The simpler molecules are absorbed in the small intestine, providing energy to the cells.

The different organ systems also interact to contribute to the well-being of the human body. For example, the endocrine and nervous systems control bodily activities by collecting information from the internal and external environment and then by responding to it.

A question for this standard might look like this:

Which system interacts with other systems by secreting hormones to maintain homeostasis?

A  circulatory  
B  digestive  
C  endocrine  
D  nervous

Since hormones are produced by the endocrine system, C is the correct answer.
Sample Questions for Content Domain VI

This section has some sample questions for you to try. After you have answered all of the questions, check your answers in the “Answers to the Content Domain VI Sample Questions” section that follows. This section will give you the correct answer to each question, and it will explain why the other answer choices are incorrect.

1 Communicating sensory information about the external environment to the brain is a function of the
   A nervous system
   B endocrine system
   C circulatory system
   D integumentary system

2 Which statement is typical of the fern gametophyte?
   A It is an independent plant and produces spores.
   B It is an independent plant and produces gametes.
   C It is a parasitic plant and produces spores.
   D It is a parasitic plant and produces gametes.

3 Which shows the correct order of the layers of the kidneys from the outside to the inside?
   A renal pelvis \(\rightarrow\) cortex \(\rightarrow\) medulla
   B renal pelvis \(\rightarrow\) medulla \(\rightarrow\) cortex
   C cortex \(\rightarrow\) renal pelvis \(\rightarrow\) medulla
   D cortex \(\rightarrow\) medulla \(\rightarrow\) renal pelvis

4 Which of these organisms exhibit bilateral symmetry?
   A a lobster
   B a sponge
   C a starfish
   D a sand dollar

5 Which phrase BEST describes the bones found in birds?
   A composed of keratin
   B thick and solid
   C composed of cellulose
   D thin and hollow
Answers to the Content Domain VI Sample Questions

1. Answer: A  Standard: *Analyze the overall organization of the human body*
   Although the integumentary system contains sense receptors, it is the nerve cells that conduct impulses between the sensory cells and the brain. Nerve cells are part of the nervous system, so A is the correct answer and D is incorrect. The endocrine system secretes hormones while the circulatory system transports blood, so B and C are incorrect.

2. Answer: B  Standard: *Describe the similarities and differences of spore-producing plants*
   Since the fern is not parasitic but an independent plant, and the gametophyte generation produces gametes, then B is the correct answer. Choices A, C, and D are incorrect.

3. Answer: D  Standard: *Describe the anatomy of each system of the human body*
   In the structure of the kidney, the cortex surrounds the medulla and the renal pelvis with the renal pelvis being at the center of the kidney. Therefore, D is the correct answer and A, B, and C are incorrect.

4. Answer: A  Standard: *Describe the anatomy and physiology of each phylum of invertebrates*
   A lobster exhibits bilateral symmetry; therefore, A is the correct answer. A sponge is asymmetrical so it exhibits no symmetry, while a starfish and a sand dollar exhibit radial symmetry. Choices B, C, and D are incorrect.

5. Answer: D  Standard: *Describe the anatomy and physiology of classes of vertebrates*
   In order for birds to fly, they must reduce the weight of their body. An adaptation that contributes to this is thin, hollow bones, so D is correct. Choices A, B, and C are incorrect.
Content Domain VII: Ecology and the Environment

A LOOK AT CONTENT DOMAIN VII

Test questions in this content domain will measure your ability to explain the interrelationships between organisms and their environments. Your answers to the questions will help show how well you can perform on the following standards:

- Explain the structure of an ecosystem
- List and describe the major biomes of the world
- Assess the impact of humans on the environment and describe ways to help solve ecological problems

Spotlight on the Standards

Explain the Structure of an Ecosystem

Life on Earth exists within a thin layer of land, water, and atmosphere. This part of Earth is called the biosphere. Within this layer are many types of ecosystems. An ecosystem is a self-sustaining unit of organisms and the physically distinct environment surrounding the organisms. Ecology is the study of the interrelationships between organisms and their environments.

Within an ecosystem, two types of environmental factors can be found: biotic factors and abiotic factors. Biotic factors comprise all the living organisms while abiotic factors are the nonliving factors. On the Biology EOCT, you may be asked to identify biotic and abiotic factors and describe how they interact within an ecosystem.

Groups of interacting populations within an ecosystem make up a community. Populations are smaller units of a single species. For example, all the live oak trees in a forest community are within the same population. The place where an organism lives is called its habitat. A niche is the organism’s role within its habitat. In other words, a niche is an organism’s “job” while its habitat is its “address.”

Sunlight is the main source of energy for living things. Energy flows through an ecosystem from the Sun to organisms within the ecosystem in one

<table>
<thead>
<tr>
<th>Some Examples of Environmental Factors</th>
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</thead>
<tbody>
<tr>
<td>Biotic</td>
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<tr>
<td>plants</td>
</tr>
<tr>
<td>animals</td>
</tr>
<tr>
<td>bacteria</td>
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<td></td>
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Energy Flow in an Ecosystem

Sun → grass → mice → hawk
direction. The two main groups of organisms in the ecosystem are the producers and consumers. The **producers**, also called autotrophs, use the Sun’s energy to make their own food. Grass and other plants are examples of producers. Because **consumers**, or heterotrophs, cannot make their own food, they must eat other living things to get their energy.

The path of energy from producer to consumer is a **food chain**. Each level of a food chain is called a **trophic level**. Only about 10 percent of the energy available within one trophic level of a food chain is transferred to organisms at the next trophic level. The transfer of energy through an ecosystem can be represented as an **energy pyramid**.

Ecosystems contain many interconnected food chains, which make up a **food web**. The loss of any part of a food chain will affect the food web it is connected to as well as the food chain itself. For example, if all the mice died off in an ecosystem, the hawks would die or have to move to a new area. On the **Biology EOCT**, you may be given a diagram of a food chain or web and be asked to describe the role of different organisms.

A question for this standard might look like this:

**In the food chain below, which is an herbivore?**

\[\text{grass} \rightarrow \text{grasshopper} \rightarrow \text{frog} \rightarrow \text{snake}\]

A. grass  
B. grasshopper  
C. frog  
D. snake

Since the grasshopper consumes the grass, B is the correct answer.

Unlike energy, matter gets recycled in an ecosystem. Matter cycles from one organism to another. For example, in the water cycle, water passes from the atmosphere to the land or water surfaces through precipitation and then eventually returns to the atmosphere. Other cycles include the carbon cycle, the nitrogen cycle, and the phosphorus cycle. Refer to your textbook for diagrams and additional information about each of these cycles. On the **Biology EOCT**, you may be asked to describe the interactions of biotic and abiotic factors in the various cycles.
Over time, as environmental conditions change, organisms and communities also change. Eventually, new communities replace past communities and the ecosystem changes. A series of community changes in an ecosystem is called **succession**. For example, after a forest fire changes an ecosystem, grasses and other small organisms are first to appear, forming a low layer of vegetation. This changes the burned area, allowing shrubs and small trees to become established. The shrubs and small tree species change the environment, and eventually larger tree species will become established. Two types of succession are primary succession and secondary succession.

Populations in communities change when new individuals are born and older ones die. If the number of individuals born exceeds the number of individuals that die, then the population increases. Growth of a population can also be affected by factors such as food, water, light, and living space. When food, water, or space is limited, competition occurs. If an individual cannot get the resources it needs, it may have to leave the population in order to survive. Individuals that leave or enter a population will affect the community.

A species that is new to an area initially experiences a slow growth of its population. If resources are readily available and conditions are favorable, the population will begin to grow exponentially. This pattern of exponential growth is in a J-shaped curve. However, as the population increases, the resources become limited, and the growth of the population slows and begins to stabilize. This pattern of logistic growth is in an S-shaped curve. The point at which the population becomes stable is called the **carrying capacity**. Carrying capacity is the maximum number of individuals of a population that can be supported by the environment. On the **Biology EOCT**, you may be given a chart or graph and be asked to identify different types of population growth.

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**Strategy Box – Graphs**

When working with graphs, carefully read the title and the label on each axis. Check for any other information that might be included on the graph. When you think you have the answer, double check the information given in the graph.

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**List and Describe the Major Biomes of the World**

A **biome** is a large climatic region with characteristic plants and animals. The abiotic factors of the biome determine the plants and animals that live in the biome.
Variation in major terrestrial biomes, which are grouped geographically, is determined by the amount of rainfall and temperature. Land biomes are usually described in terms of the dominant vegetation found. So what is a savanna if we’re not referring to a city in Georgia? A savanna is a type of grassland scattered with isolated trees. The best-known savanna is the Serengeti Plain of East Africa. In savannas, the temperatures are warm year-round and the rainfall is consistent year-round. Contrast this with temperate grasslands, which have a variety of grasses. Temperate grasslands, such as prairies or plains, cover the Midwestern United States. Winters are cold and summers are warm to hot. Rainfall is seasonal but the amount of rainfall is less than other grasslands.

Aquatic environments are determined primarily by flow, depth, temperature, and chemistry of the water. For example, lakes and ponds are standing bodies of freshwater, while rivers and streams are moving bodies of freshwater. With regard to chemistry, oceans are saltwater ecosystems. Estuaries are wetlands that form where rivers meet the ocean, so they are a mixture of saltwater and freshwater.

On the Biology EOCT, you may be asked to locate the major biomes on a map or identify the biotic and abiotic factors that distinguish the major biomes. A question for this standard might look like this:

**Which substance contributes to the variety of organisms in terrestrial ecosystems?**

- A. carbon dioxide
- B. nitrogen
- C. oxygen
- D. water

Temperature and precipitation contribute to the variety of organisms in land ecosystems. Since precipitation is the amount of rainfall, then D is the correct answer.

**Assess the Impact of Humans on the Environment and Describe Ways to Help Solve Ecological Problems**

Many of the ecological problems today are due to the activities of humans. Human activities have affected the quality and quantity of resources such as land, air, and water. Humans have caused the extinction of many species of organisms through hunting, fishing, agriculture, industry, and urban development. A growing human population has also placed greater demands on the environment. But humans are becoming more aware of the possible negative effects and are making efforts to offset past damage.
One of the major ways humans impact the environment is pollution, which is probably one of the greatest threats to living things. Pollution is an undesirable change in the environment and is a result of human activity. Any substance that is harmful or is a waste product is a pollutant. A pollutant can be a substance in the wrong place or in the wrong concentration. Although pollution has been around for many years, it has increased worldwide as more countries have become industrialized. Pollution affects living organisms, including humans, as well as the physical environment.

**Air pollution** is caused primarily by the burning of fossil fuels to produce electricity. However, the burning of fuel for other activities such as driving cars has also contributed to air pollutants. Examples of air pollutants include dust, smoke, ash, carbon monoxide, and sulfur oxides. A combination of smoke, gases, and fog is called smog. Smog containing sulfur oxides react with water vapor in the atmosphere to produce sulfuric acid. This sulfuric acid falls to the ground as acid rain, which damages crops, kills organisms in aquatic ecosystems, and erodes buildings and monuments.

Another form of air pollution is the increased production of carbon dioxide. When fossil fuels, like oil, coal, and natural gas, are burned, carbon dioxide is released into the atmosphere. Excess carbon dioxide in the air can contribute to the greenhouse effect, which is believed to cause global warming.

**Water pollution** is caused by pollutants from sewers, industries, farms, and homes, which contaminate water sources such as lakes, rivers, groundwater, and oceans. Sewage, chemical wastes, fertilizer, and dirty wash water can be carried to lakes, streams, rivers, and eventually the oceans. Pollutants that trickle down through the earth can make their way to the groundwater supply, which is the source of drinking water for some people.

Humans are, however, becoming more aware of the possible negative effect they have had on the environment and are trying to offset past damage. As a result, greater efforts are being made to conserve energy resources, protect and conserve material resources, and to control pollution. For example, wildlife conservation efforts protect species from habitat loss, over-hunting, and pollution.

People are making an effort to conserve energy by limiting the use of energy resources like fossil fuels through the increased use of public transportation and carpooling. Another way energy resources are being conserved is to reduce energy waste by making homes and buildings more energy efficient. Using alternative forms of energy can also conserve energy resources. For example, solar energy and wind energy provide an unlimited supply of energy with minimal impact on the environment.

You’ve probably heard of the “three R’s” of conservation: reduce, reuse, and recycle. Reducing, reusing, and recycling resources can decrease the amount of new material taken from the earth. For example, buying products in recyclable packages or products that can be recycled helps conserve material resources. Another way to conserve material resources is to reuse materials instead of throwing them away.
What happens to the materials that are not recycled or cannot be recycled or reused? They probably end up in the garbage, which is hauled to a landfill to be buried underground. In a sanitary landfill, layers of compacted garbage are spread between layers of soil and eventually covered with grass and other plants. New techniques of sanitation and waste disposal are also being developed.

Learning about the possible causes and solutions to certain ecological problems will help you answer a question like the following:

**Increasing the use of coal could cause additional sulfur oxides to be released into the atmosphere. Which environmental problem would be the result of these sulfur dioxides?**

A  acid rain  
B  greenhouse effect  
C  global warming  
D  ozone depletion

Acid rain is caused when sulfur oxides combine with the water vapor in the atmosphere, so A is the correct answer.

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**Strategy Box – Supporting Predictions**

Important information is provided in a test question. Use this information, any graphics, and your knowledge of biology to help you answer questions that ask you to make predictions.

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**Sample Questions for Content Domain VII**

This section has some sample questions for you to try. After you have answered all of the questions, check your answers in the “Answers to the Content Domain VII Sample Questions” section that follows. This section will give you the correct answer to each question, and it will explain why the other answer choices are incorrect.

1. **What might happen if a population of largemouth bass exceeds its carrying capacity?**

   A  death rates may decrease  
   B  death rates may increase  
   C  emigration rates may decrease  
   D  immigration rates may increase

2. **Coastal wetlands where saltwater and freshwater mix are called**

   A  ponds  
   B  marshes  
   C  estuaries  
   D  bogs
3. What would be the result of an increase in the use of recycled products?
   A. resources would be conserved
   B. resources would be wasted
   C. energy consumption would rise
   D. landfill space would dwindle

4. Which of these is a biotic factor in the ocean?
   A. depth
   B. light
   C. salinity
   D. squid

Answers to the Content Domain VII Sample Questions

1. Answer: B  Standard: Explain the structure of an ecosystem
   Carrying capacity is the point at which the population becomes stable. This is the result of resources becoming less available. If resources become limited, organisms may die, resulting in an increase in the death rate; therefore, B is the correct answer and A is incorrect. Emigration, the movement of individuals out of a population, might increase in this situation (not decrease), so C is incorrect. Immigration, the movement of individuals into a population, would likely decrease, so D is incorrect.

2. Answer: C  Standard: List and describe the major biomes of the world
   An estuary is an area of land where a river or stream meets an ocean, so C is the correct answer. Bogs, ponds, and marshes are various areas of land covered by freshwater, so A, B, and D are incorrect.

3. Answer: A  Standard: Assess the impact of humans on the environment and describe ways to help solve ecological problems
   An increased use of recycled products would conserve resources; therefore, A is the correct answer and B, C, and D are incorrect.

4. Answer: D  Standard: Explain the structure of an ecosystem
   A biotic factor is any living thing in an ecosystem. Since a squid is a living organism, then D is the correct answer. Depth, light, and salinity are all abiotic factors, so A, B, and C are incorrect.
Appendix A

EOCT Sample Overall Study Plan Sheet

Here is a sample of what an OVERALL study plan might look like. You can use the Blank Overall Study Plan Sheet in Appendix B or create your own.

Materials/Resources I May Need When I Study:
(You can look back at page 2 for ideas.)

1. This study guide
2. Pens
3. Highlighter
4. Notebook
5. Dictionary

Possible Study Locations:

- First Choice: The library
- Second Choice: My room
- Third Choice: My mom’s office

Overall Study Goals:

1. Read and work through the entire study guide
2. Answer the sample questions and study the answers
3. Do additional reading in a biology textbook

Number of Weeks I Will Study: 6 weeks

Number of Days a Week I Will Study: 5 days a week

Best Study Times for Me:

- Week Days: 7:00 p.m. – 9:00 p.m.
- Saturday: 9:00 a.m. – 11:00 a.m.
- Sunday: 2:00 p.m. – 4:00 p.m.
Appendix B

Blank Overall Study Plan Sheet

Materials/Resources I May Need When I Study:
(You can look back at page 2 for ideas.)
1. _______________________________
2. _______________________________
3. _______________________________
4. _______________________________
5. _______________________________
6. _______________________________

Possible Study Locations:
• First Choice: _______________________________
• Second Choice: _______________________________
• Third Choice: _______________________________

Overall Study Goals:
1. _______________________________
2. _______________________________
3. _______________________________
4. _______________________________
5. _______________________________

Number of Weeks I Will Study: _______________________________

Number of Days a Week I Will Study: _______________________________

Best Study Times for Me:
• Week Days: _______________________________
• Saturday: _______________________________
• Sunday: _______________________________
Appendix C

EOCT Sample Daily Study Plan Sheet

Here is a sample of what a DAILY study plan might look like. You can use the Blank Daily Study Plan Sheet in Appendix D or create your own.

Materials I May Need Today:

1. Study Guide
2. Pen
3. Notebook

Today's Study Location: the desk in my room

Study Time Today: From 7:00 p.m. to 8:00 p.m. with a short break at 7:30 p.m.
(Be sure to consider how long you can actively study in one sitting. Can you sit for 20 minutes? 30 minutes? An hour? If you say you will study for three hours, but get restless after 40 minutes, anything beyond 40 minutes may not be productive—you will most likely fidget and daydream your time away. “Doing time” at your desk doesn’t count for real studying.)

If I start to get tired or lose focus today, I will do some sit-ups.

Today’s Study Goals and Accomplishments: (Be specific. Include things like number of pages, sections, or standards. The more specific you are, the better able you will be to tell if you reached your goals. Keep it REALISTIC. You will retain more if you study small “chunks” or blocks of material at a time.)

<table>
<thead>
<tr>
<th>Study Task</th>
<th>Completed</th>
<th>Needs more work</th>
<th>Needs more information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Review what I learned last time</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Study the first standard in Content Domain I</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Study the second standard in Content Domain I</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

What I learned today:
1. How scientists conduct investigations.
2. The definitions of some important terms.
3. Why lab reports are important and how they are organized.

Today’s reward for meeting my study goals: Eating some popcorn
Appendix D

Blank Daily Study Plan Sheet

Materials I May Need Today:

1. _______________________________
2. _______________________________
3. _______________________________
4. _______________________________
5. _______________________________

Today’s Study Location: _______________________________

Study Time Today: _______________________________
(Be sure to consider how long you can actively study in one sitting. Can you sit for 20 minutes? 30 minutes? An hour? If you say you will study for three hours, but get restless after 40 minutes, anything beyond 40 minutes may not be productive—you will most likely fidget and daydream your time away. “Doing time” at your desk doesn’t count for real studying.)

If I start to get tired or lose focus today, I will _______________________________

Today’s Study Goals and Accomplishments: (Be specific. Include things like number of pages, sections, or standards. The more specific you are, the better able you will be to tell if you reached your goals. Keep it REALISTIC. You will retain more if you study small “chunks” or blocks of material at a time.)

<table>
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<th>Completed</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
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<td>4.</td>
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<tr>
<td>5.</td>
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</tbody>
</table>

What I learned today:

1. _______________________________
2. _______________________________
3. _______________________________

Today’s reward for meeting my study goals: _______________________________

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