This course supports the assessments for QXT2. The course covers 6 competencies and represents 5 competency units.

**Introduction**

**Overview**
Welcome to the exciting topic of biology, which involves the study of all living things! Biology covers a broad range of topics, from the chemical processes that occur inside a cell’s organelles to the climates of various biomes. As a science teacher, you will want to convey to your students how exciting the careers related to biology are.

The six main topics in biology include

- cellular biology,
- heredity,
- evolution,
- diversity of life,
- interdependence of life, and
- ecology.

The topics are chunked into manageable sections of activities to complete. Be sure to check your understanding for each section. This practice will help you build on your knowledge. Model the behaviors you would want your students to practice when learning new material.

Watch the following video for an introduction to this course:

*Note: View the video in full screen at 720p for best results.*

**Competencies**

This course provides guidance to help you demonstrate the following [#] competencies:

- **Competency 205.1.1: Cells**
  The graduate has a deep understanding of cells as the structural and functional units of life, including an understanding of prokaryotic cells, eukaryotic cells, viruses, homeostasis, cell differentiation analysis, and tissue and organ development.

- **Competency 205.1.2: Heredity**
  The graduate has a deep understanding of heredity as the continuity and variations of traits from one generation to the next, including the structure and regulation of RNA, the model of protein synthesis, mitosis, meiosis, human karyotype, DNA sequences, and embryology.

- **Competency 205.1.3: Diversity of Life**
  The graduate understands the historical changes in life forms (evolution of life) and the diversity of life (similarities and differences among organisms), including natural
selection, global catastrophes, human influence, environmental change, and the development of hierarchical classification systems.

- **Competency 205.1.4: Interdependence of Life**
  The graduate understands the interdependence of life and the flow of energy and matter.

- **Competency 205.1.5: Evolutionary Patterns and History of Life**
  The graduate understands evolutionary patterns and the history of life.

- **Competency 205.1.6: Ecological Issues**
  The graduate understands important ecological issues, ideas, and structures, including population dynamics, community energetics, and biogeochemical cycles.

### Teaching Dispositions Statement

Please review the [Statement of Teaching Dispositions](#).

### Course Mentor Assistance

As you prepare to successfully demonstrate competency in this subject, remember that course mentors stand ready to help you reach your educational goals. As subject matter experts, mentors enjoy and take pride in helping students become reflective learners, problem solvers, and critical thinkers. Course mentors are excited to hear from you and eager to work with you.

Successful students report that working with a course mentor is the key to their success. Course mentors are able to share tips on approaches, tools, and skills that can help you apply the content you’re studying. They also provide guidance in assessment preparation strategies and troubleshoot areas of deficiency. Even if things don’t work out on your first try, course mentors act as a support system to guide you through the revision process. You should expect to work with course mentors for the duration of your coursework, so you are welcome to contact them as soon as you begin. Course mentors are fully committed to your success!

### Preparing for Success

The information in this section is provided to detail the resources available for you to use as you complete this course.

#### Learning Resources

The learning resources listed in this section are required to complete the activities in this course. For many resources, WGU has provided automatic access through the course. However, you may need to manually enroll in or independently acquire other resources. Read the full instructions provided to ensure that you have access to all of your resources in a timely manner.

##### Manually Enrolled Resources

Take a moment to enroll in the learning resources listed in this section. To enroll, navigate to the “Learning Resources” tab, click the “Sections” button, and then click the “Enroll Now” button for each resource. Once your mentor approves your enrollment in the resource, you will receive an e-mail with further access instructions. Contact your mentor if you have questions.

*Note: For instructions on how to enroll in or subscribe to learning resources through the*
"Learning Resources" tab, please see the "Acquiring Your Learning Resources" page.

AMNH Seminars (Optional)

Online seminars offered by the American Museum of Natural History (AMNH) use multimedia and discussions to connect teachers and future teachers from around the world to cutting-edge research, classroom resources, and each other. Participating in the seminars develops your understanding of the content, models an appropriate teaching technique, and exposes you to an array of resources that can be used in your classroom. While this is an optional learning resource, you are strongly encouraged to take advantage of this opportunity.

The following seminars are related to this course:

- "Genetics, Genomics, Genethics"
- "Evolution"
- "Diversity of Fishes."

Each six-week seminar requires about eight hours per week of your time. Review the AMNH Calendar http://www.amnh.org/learn/calendar to determine when the course is offered and consult your mentor to coordinate this seminar with your schedule. Discuss the AMNH-WGU FAQ https://web5.wgu.edu/aap/content/amnh%20wgu%20faq.pdf document with your mentor to better understand how to successfully use the AMNH seminar as a WGU learning resource.

Automatically Enrolled Resources

You can access the learning resources listed in this section by clicking on the links provided throughout the course. You may be prompted to log in to the WGU student portal to access the resources.

VitalSource E-Texts

The following textbook is available to you as an e-text within this course. You will be directly linked to the specific readings required within the activities that follow.


*Note: This e-text is available to you as part of your program tuition and fees, but you may purchase hard copies at your own expense through a retailer of your choice. If you choose to do so, please use the ISBN listed to ensure that you receive the correct edition.*

Thinkwell's Biology Online

You will access Thinkwell materials at the activity level within this course. This web-based resource includes

- multimedia video lectures,
- review notes,
- interactive animations,
sample exercises.

Other Learning Resources

LabPaq is a laboratory kit that contains a lab manual, science equipment, specimens, supplies, and chemicals necessary to complete laboratory experiments at home.

To order this resource, you will need to fill out and submit a lab work form. For additional information and to download the form, please see the "LabPaq Instructions" page.

*Note: This resource is only available to students in a program with a version of 200810 or newer.*

Additional Preparations

Graphing Calculator

Acquire a graphing calculator and familiarize yourself with how to use it. Refer to the WGU Calculator and Scratch Paper Guidelines document for calculators permitted on WGU exams. If you are in a secondary mathematics program, refer to the WGU Calculator Recommendations for Secondary Math and Science Programs document for calculator suggestions for your degree program.

Biochemistry

Biochemistry is the study of the molecules and chemical reactions that sustain life. It uses chemistry to explain the biological processes that happen at the molecular level. The basic principles of biochemistry are common for all living organisms. The further you go into your studies of biology, the more you will need to understand and rely on chemistry.

Unique Properties of Water

Water molecules have the unusual characteristic of hydrogen bonding. Hydrogen bonding is the attraction of the partially positively charged hydrogen atoms of one water molecule with the partially negatively charged oxygen atoms of another water molecule. This unusual behavior creates properties of water that are essential for life.

Water and the Fitness of the Environment

Read the following chapter in Biology:

- chapter 3 ("Water and Life")

This will provide you with a review of bonds related to water. In your notebook, draw water molecules showing two different types of bonds related to water. Explain how these bonds affect water’s properties.

In your notebook, describe the characteristics of water and how these are helpful to living organisms. Write a brief explanation of why water is called the "miracle liquid." Provide examples of both hydrophilic and hydrophobic substances.

Properties of Water Lab
Complete the following exercises in laboratory 6 ("The Properties of Water") of the General Biology LabPaq.

- exercise 1
- exercise 3
- exercise 4

After you complete the lab, send your lab report to the course mentor to receive feedback. These exercises are related to surface tension, density, and specific heat capacity.

**Biochemical Functional Groups**

Molecules, such as proteins, have functional groups that interact with the molecules' surroundings. This is an important feature as molecules interact with each other in the body. Enzymes bind to their substrate. Hormones bind to markers.

**Carbon and the Molecular Diversity of Life**

Read the following in *Biology*:

- chapter 4 ("Carbon and the Molecular Diversity of Life")

In your notebook, write down the structure and properties of some important biochemical functional groups. As your guide, use figure 4.9 "Exploring Some Biologically Important Chemical Groups." You should be able to describe each of these chemical groups on your own.

**Macromolecules**

In the previous section, you studied the properties of relatively simple molecules (such as water) and some basic organic functional groups. Properties of a molecule come from its physical structure.

In this section, you will expand your knowledge of macromolecules.

**Structure and Function of Macromolecules**

During Life Science you studied macromolecules, but now you need to understand more details regarding these types of molecules.

This topic addresses the following competency:

- **Competency 205.1.1: Cells**
  The graduate has a deep understanding of cells as the structural and functional units of life, including an understanding of prokaryotic cells, eukaryotic cells, viruses, homeostasis, cell differentiation analysis, and tissue and organ development.

**Chemical Subunits**

The bonding characteristics of carbon atoms result in many biological molecules. Each of the four main classes of biological molecules is built out of particular chemical subunits. Using the following in *Biology* as a resource, make a chart of biological molecules (carbohydrates, nucleic acids, proteins, and lipids) with two columns:
chapter 5 ("The Structure and Function of Large Biological Molecules")

Molecular Structure Review

Make a chart of biological molecules (e.g., simple and complex hydrocarbons) and macromolecules (e.g., polysaccharides, nucleic acids [DNA, RNA], proteins, starch, and lipids) with four columns.

Put "Name of Molecule" in the first column, "Structure" in the second column, and "Biological Function" in the third column. In the fourth column, write any interesting information that will help you remember the properties of the molecule. Notice that the physical shape of the molecule is related to its function.

Specifics on Lipids and Carbohydrates

In the "Molecular Structure Review" activity you completed previously, you described the four main classes of macromolecules in general. Now you need to know more specifics.

Lipids include fatty acids, waxes, triglycerides, phospholipids, and steroids. Carbohydrates include monosaccharides, disaccharides, and polysaccharides.

In your notebook, describe the general structure and function of these specific molecules.

Testing for the Presence of Macromolecules

Complete the following in the General Biology LabPaq:

- laboratory 1 ("Basic Chemistry for Investigating Living Systems")

Be sure to read through the entire lab, including the introduction. After completing this lab, send your lab report to the course mentor to receive feedback.

Cellular Activities

Living organisms are made up of cells. Cells are made up of molecules. There are different types of cells that make up the various living organisms. In more complex organisms, cells work together and form tissues.

Types of Cells

Work through the activities in this section to understand the various types of cells and the processes that occur in cells.

This topic addresses the following competency:

- Competency 205.1.1: Cells
  The graduate has a deep understanding of cells as the structural and functional units of life, including an understanding of prokaryotic cells, eukaryotic cells, viruses, homeostasis, cell differentiation analysis, and tissue and organ development.

Eukaryotic Versus Prokaryotic Cells
Review your notes from the following in *Biology* regarding eukaryotic and prokaryotic cells:

- **chapter 6** ("A Tour of the Cell")

Review the following Thinkwell Biology section:

- "An Introduction to Cell Biology"

Be sure to take the quiz after each step in the section to check your understanding.

Check your notes for accuracy.

Complete the following in the General Biology LabPaq:

- exercise 1 in laboratory 2 ("Cell Structure and Function").

After completing this exercise in the lab, send your lab report to the course mentor to receive feedback.

**Plant and Animal Cell Structure and Function**

Complete the following in the General Biology LabPaq:

- exercise 2 in laboratory 2 ("Cell Structure and Function")

After completing this exercise in the lab, send your lab report to the course mentor to receive feedback.

Review the following in *Biology*:

- **chapter 6** ("A Tour of the Cell")

Make a Venn diagram depicting the similarities and differences between plant and animal cells.

**Membrane Structure and Function**

Read the following in *Biology*:

- **chapter 7** ("Membrane Structure and Function")

For each component of the cell membrane, you should be able to describe its structure and function.

**Passive Transport of Materials Through the Cell Membrane**

Review the following section in *Biology*:

- **section 7.3** "Passive transport is diffusion of a substance across a membrane with no energy investment"
In your notebook, write down an explanation of passive transport, osmosis, and diffusion as it relates to cellular membranes.

Complete the following in the General Biology LabPaq:

- exercise 3 in laboratory 2 ("Cell Structure and Function")

After completing this exercise in the lab, send your lab report to the course mentor to receive feedback.

**Active Transport of Materials Through the Cell Membrane**

Review the following section in *Biology*:

- section 7.4 "Active transport uses energy to move solutes against their gradients"

In your notebook, write down an explanation of active transport as it relates to cellular membranes.

Complete the following in the General Biology LabPaq:

- exercise 4 in laboratory 2 ("Cell Structure and Function")

Review the structure of the cell membrane and the terms hydrophilic and hydrophobic.

After completing this exercise in the lab, send your lab report to the course mentor to receive feedback.

**Organelles**

Complete the following Thinkwell Biology sections:

- "The Cytoskeleton"
- "Membrane-Bound Organelles"

Be sure to take the quiz after each step in these sections to check your understanding.

Write notes in your lab notebook describing the functions of the important organelles (e.g., cell wall, endoplasmic reticulum, nucleus, Golgi complex, lysosome, vacuoles, mitochondria, plastids, chloroplasts, cytoplasm, flagella, centriole, and ribosomes). The various organelles work together to meet the needs of the cell. Plant cells are the only cells with chloroplasts. Bacteria cells are prokaryotic and do not have the membrane-bound organelles. All cells have ribosomes and can therefore make proteins.

**Biochemical Reactions**

Numerous chemical reactions occur inside cells. All of these reactions require energy in the form of ATP and are regulated by enzymes.
In this section, you will better understand the role of ATP and the role of enzymes in regulating cellular reactions.

**How ATP Powers Cellular Work**

ATP is the source of energy for activities in your body. The exothermic reaction of ATP to ADP + P is paired with an endothermic reaction.

This topic addresses the following competency:

- **Competency 205.1.1: Cells**
  The graduate has a deep understanding of cells as the structural and functional units of life, including an understanding of prokaryotic cells, eukaryotic cells, viruses, homeostasis, cell differentiation analysis, and tissue and organ development.

**ATP Powers Cellular Work**

Read the following in *Biology*:

- **section 8.3 "ATP powers cellular work by coupling exergonic reactions to endergonic reactions"**

In your notebook, describe how ATP powers cellular work. Energy is stored within the bonds of molecules. In this case, the bond holding the last phosphate group is broken to release energy. Enzymes play a role in pairing the exothermic reaction of breaking down ATP with an endothermic reaction needing energy.

**Enzyme Function**

Complete the following Thinkwell Biology section:

- **"Enzymes"**

Be sure to take the quiz after each step in this section to check your understanding. Write notes in your lab notebook as needed. In your notebook, make a series of drawings that show the basic action of enzymes as you work through this information.

**Role of Enzymes**

Read the following sections in *Biology*:

- **section 8.4 "Enzymes speed up metabolic reactions by lowering energy barriers"**
- **section 8.5 "Regulation of enzyme activity helps control metabolism"**

Your goal is to understand how enzymes, coenzymes, and inhibitors are used to regulate metabolic pathways. In organisms, the exergonic reaction of ATP to ADP + P is paired with an endergonic reaction.

**Drawing to Check Your Understanding**
In your notebook, draw your own illustration of endergonic and exergonic reactions. Draw a simple diagram illustrating the induced fit model of enzyme binding to substrate.

**Enzyme-Facilitated Reactions**

Enzymes function best under certain conditions. In this lab, you will investigate how enzyme activity is affected by temperature, substrate concentration, and pH level.

Complete the following lab in the General Biology LabPaq:

- laboratory 3 ("Enzymes")

Be sure to read through the entire lab, including the introduction. After completing this lab, send your lab report to the course mentor to receive feedback.

**Redox**

Oxidation refers to the loss of electrons, while reduction refers to the increase of electrons. Your goal here is to understand how redox is related to the reactions of respiration and photosynthesis.

This topic addresses the following competency:

- **Competency 205.1.1: Cells**
  The graduate has a deep understanding of cells as the structural and functional units of life, including an understanding of prokaryotic cells, eukaryotic cells, viruses, homeostasis, cell differentiation analysis, and tissue and organ development.

**Oxidation and Reduction**

Read the following in *Biology* to better understand the principle of redox as it applies to respiration:

- section 9.1 "Catabolic pathways yield energy by oxidizing organic fuels"

Reduction is related to the increase of electrons. Oxidation is related to the loss of electrons. During cellular respiration, NAD+ functions as an oxidizing agent, and glucose is oxidized.

Read the following in Biology to better understand the principle of redox as it applies to photosynthesis:

- section 10.1 "Photosynthesis converts light energy to the chemical energy of food"

In this reaction, NADP+ functions as an electron acceptor as carbon-dioxide is reduced. Be sure that you can apply oxidation and reduction to the biological processes of photosynthesis and respiration and that you can give net chemical reactions.

**Making ATP**

In this section, you will better understand how cells convert the energy stored within the bonds
of organic molecules to energy stored within the ATP molecule. Prokaryotes do not have mitochondria and are therefore limited in their capacity to make ATP, which is one factor which limits their size. Eukaryotes, on the other hand, are bigger cells than prokaryotes and have mitochondria that can mass produce ATP. Because of the ability to make larger quantities of ATP, eukaryotes are much more diverse than prokaryotes.

**Anaerobic and Aerobic Metabolism**

Work through the activities in this section to understand the breakdown of glucose and to gain an understanding of the term metabolism.

This topic addresses the following competency:

- **Competency 205.1.1: Cells**
  The graduate has a deep understanding of cells as the structural and functional units of life, including an understanding of prokaryotic cells, eukaryotic cells, viruses, homeostasis, cell differentiation analysis, and tissue and organ development.

**Introduction to Respiration**

Complete the following Thinkwell Biology section:

- "An Introduction to Respiration"

Be sure to take the quiz after each step in this section to check your understanding. Write notes in your lab notebook as needed.

**Cellular Respiration**

Read of the following in Biology:

- chapter 9 ("Cellular Respiration: Harvesting Chemical Energy")

Your goal is to understand the main steps to harvesting usable energy from glucose and where these steps occur in the cell.

In your notebook, describe the reactants and products of glycolysis, the citric acid cycle, and oxidative phosphorylation.

Answer the following:

- Which of these processes require oxygen?
- Where do these reactions occur in the cell?

**Fermentation**

Review the following in Biology:

- chapter 9 ("Cellular Respiration: Harvesting Chemical Energy")
Your goal is to describe fermentation, which is an anaerobic process of producing ATP. During anaerobic glycolysis, sugar is broken down into pyruvate molecules within the cytoplasm. Yeast cells can anaerobically convert pyruvate into ethanol and carbon dioxide to produce more ATP. When your muscle cells need ATP when no oxygen is present, they can convert pyruvate into lactic acid to make more ATP.

Explain to a peer the flow of energy through anaerobic respiration.

**Primary Producers**

As part of the food chain, primary producers store energy in the form of organic molecules. Photosynthesis and chemosynthesis are processes that only primary producers can perform. An ecosystem is dependent on its primary producers to provide the initial source of energy for other organisms. From here, the entire food web can be formed and biodiversity increased.

**Photoautotrophs**

During photosynthesis, light energy is stored within organic molecules using carbon dioxide as the carbon source.

This topic addresses the following competency:

- **Competency 205.1.1: Cells**
  The graduate has a deep understanding of cells as the structural and functional units of life, including an understanding of prokaryotic cells, eukaryotic cells, viruses, homeostasis, cell differentiation analysis, and tissue and organ development.

**Introduction to Photosynthesis**

Complete the following Thinkwell Biology sections:

- "Discovering Photosynthesis"
- "Adaptations for Photosynthesis"

Be sure to take the quiz after each step to check your understanding. Write notes in your lab notebook as needed.

**Photosynthesis**

Read the following in *Biology*:

- *chapter 10 ("Photosynthesis")*

In your notebook, write down an overview of the stages of photosynthesis:

- electron transport reactions
- ATP synthesis
- the Calvin cycle

This chapter also describes the unique abilities of C3 and C4 plants. Take notes on these
sections. Appreciate that plant cells are involved in the process of cellular respiration as well as in photosynthesis.

In your notebook, draw a large plant cell with mitochondria and chloroplasts. Illustrate the stages of cellular respiration and photosynthesis as they would occur in this plant cell.

**Chlorophyll Pigments**

Complete the following in the General Biology LabPaq:

- exercise 1 in laboratory 4 ("Photosynthesis and Respiration")

After completing this exercise in the lab, send your lab report to the course mentor to receive feedback.

**Drawing to Check Your Understanding**

In your notebook, draw and label a diagram of chloroplasts in leaves. Next to your drawing, describe the structure of chloroplasts. You can then check your understanding by trying to recreate this diagram without looking at any resources.

**Exploring Photosynthesis and Respiration**

Complete the following experiment in the General Biology LabPaq:

- Photosynthesis and Respiration

The objectives of the lab are to observe the effect of photosynthesis in capturing and storing energy from the Sun, to observe the effect of respiration in the production of energy, and to understand how photosynthesis and respiration are complementary processes.

To receive feedback, send your lab report to the course mentor.

**Chemoautotrophs**
During chemosynthesis, inorganic substances are oxidized and energy is stored within organic molecules using carbon dioxide as the carbon source.

This topic addresses the following competency:

- **Competency 205.1.1: Cells**
  The graduate has a deep understanding of cells as the structural and functional units of life, including an understanding of prokaryotic cells, eukaryotic cells, viruses, homeostasis, cell differentiation analysis, and tissue and organ development.

**Chemosynthesis**

Primary producers process energy from inorganic sources and create organic substances used by other organisms. For example, plants use photosynthesis to convert inorganic water and carbon dioxide into sugars with the help of sunlight’s energy. Another example of a primary producer is found at hydrothermal vents on the ocean floor.

Read the following in *Biology* to learn more about how these chemoautotrophs perform chemosynthesis and prokaryotes that live in the harsh conditions found at hydrothermal vents:

- **section 27.3 "Diverse nutritional and metabolic adaptations have evolved in prokaryotes"**

Page 1162 in *Biology* has a picture of hydrothermal vents.

**Cell Division**

In this section you will investigate mitosis and meiosis in more detail.

**Meiosis Versus Mitosis**

In this topic, you will learn about the similarities and differences between meiosis and mitosis.

This topic addresses the following competency:

- **Competency 205.1.2: Heredity**
  The graduate has a deep understanding of heredity as the continuity and variations of traits from one generation to the next, including the structure and regulation of RNA, the model of protein synthesis, mitosis, meiosis, human karyotype, DNA sequences, and embryology.

**Introduction to the Cell Cycle**

Complete the following Thinkwell Biology section:

- "An Introduction to the Cell Cycle and Mitosis"

Be sure to take the quiz after each step in the section to check your understanding. Write notes in your lab notebook as needed.

**Cell Cycle**
Read the following in *Biology*:

- **chapter 12 (“The Cell Cycle”)**

In your notebook, describe the main phases of the cell cycle, including a description of the main phases of mitosis. Draw a labeled picture for each phase of mitosis.

**Mitosis Lab**

Complete the following in the General Biology LabPaq:

- exercise 1 in laboratory 5 (“Mitosis and Meiosis”)

After completing this exercise in the lab, send your lab report to the course mentor to receive feedback.

**Introduction to Meiosis**

Complete the following Thinkwell Biology section:

- "Meiosis"

Be sure to take the quiz after each step in this section to check your understanding. Be sure you understand the genetic significance of haploid and diploid cells.

**Meiosis and Sexual Life Cycles**

Complete the following Thinkwell Biology section:

- "Understanding Meiosis"

Be sure to take the quiz after each step in this section to check your understanding.

Read the following in *Biology*:

- **chapter 13 (“Meiosis and Sexual Life Cycles”)**

In your notebook, explain how genetic diversity of offspring is possible.

**Meiosis Lab**

Complete the following in the General Biology LabPaq:

- exercises 2 and 3 in laboratory 5 (“Mitosis and Meiosis”)

After completing these exercises in the lab, send your lab report to the course mentor to receive feedback.

**Genes**
In this section, you will study various inheritance patterns that enable scientists to predict the outcomes of crosses and analyze how traits are passed on.

**Inheritance Patterns**

With the current knowledge of genetics, it is possible to analyze the inheritance of characteristics.

This topic addresses the following competency:

- **Competency 205.1.2: Heredity**
  
  The graduate has a deep understanding of heredity as the continuity and variations of traits from one generation to the next, including the structure and regulation of RNA, the model of protein synthesis, mitosis, meiosis, human karyotype, DNA sequences, and embryology.

**Mendelian Inheritance**

Complete the following Thinkwell Biology sections:

- "Laws and Probability"
- "The Laws of Mendelian Inheritance"
- "Segregation and Independent Assortment"

Be sure to take the quiz after each step in these sections to check your understanding.

Read the following sections in *Biology*:

- section 14.1 "Mendel used the scientific approach to identify two laws of inheritance"
- section 14.2 "The laws of probability govern Mendelian inheritance"

In your notebook, describe how Mendel derived his laws of inheritance.

**Punnett Squares**

The following section in *Biology* describes how to use Punnett squares to make predictions:

- section 14.3 "Inheritance patterns are often more complex than predicted by simple Mendelian genetics"

Complete the genetics problems at the end of the following in Biology to practice making predictions:

- chapter 14 ("Mendel and the Gene Idea")

**Dominance Types**

When first working with Punnett squares, you should usually start with the traits that show complete dominance, causing the heterozygotes to display the dominant trait.
Review the following in *Biology* to understand the effects of codominance, incomplete dominance, and multiple alleles:

- **section 14.3** "Inheritance patterns are often more complex than predicted by simple Mendelian genetics"

Section 14.3 also describes the circumstance of multiple genes affecting a trait.

Read the following in *Biology* to better understand the effects of sex-linked genes:

- **section 15.2** "Sex-linked genes exhibit unique patterns of inheritance"

Complete the genetics problems at the end of the following in *Biology* to practice making predictions:

- **chapter 15** ("The Chromosomal Basis of Inheritance")

**Pedigree Analysis**

The following section in *Biology* describes how to analyze pedigrees. There is a genetics problem on page 285 to help you practice this analysis:

- **section 14.4** "Many human traits follow Mendelian patterns of inheritance"

Complete the following Thinkwell Biology section:

- "Sex Linkage and Pedigree Charts"

**Human Karyotype**

A karyotype illustrates that sexually-reproducing organisms have two complete sets of chromosomes. One set was given by the father, and one set was given by the mother.

Page 250 of Biology has a picture of a normal human karyotype. Notice that the chromosomes are numbered, number one being the biggest chromosome.

Genetic testing can examine a person’s karyotype. The following section in *Biology* describes chromosomal alterations that can be detected by examining a karyotype:

- **section 15.4** "Alterations of chromosome number or structure cause some genetic disorders"

**Learned Characteristics**

Traits found in DNA are considered inherited traits and can be passed on to the next generation genetically. Learned characteristics are determined after birth through environmental experiences. These two, inherited traits and learned characteristics, are often discussed as "nature versus nurture."
The following section in *Biology* describes learned characteristics:

- *section 51.2 "Learning establishes specific links between experience and behavior"

In your notebook, compare and contrast inherited traits with learned characteristics.

**Pedigree Performance Task**

You now have all the tools you need to complete the Pedigree task.

This topic addresses the following competency:

- **Competency 205.1.2: Heredity**
  The graduate has a deep understanding of heredity as the continuity and variations of traits from one generation to the next, including the structure and regulation of RNA, the model of protein synthesis, mitosis, meiosis, human karyotype, DNA sequences, and embryology.

**Pedigree Performance Task**

Complete the following task in [TaskStream](#):

- Interdisciplinary Biological Science: Pedigree

The Message Board for this topic has posts related to Pedigree Analysis. Watch these videos to better understand how to perform pedigree analysis.

For details about this performance assessment, see the "Assessment Preparation" box in this course.

**DNA and RNA**

DNA holds the code for making the various proteins needed for cellular function. This coding is passed on to the next generation. Scientists have discovered that different organisms have the same genetic coding, which uses the A,C,G,T bases. If a human gene is inserted into a bacteria’s DNA, the bacteria can read the code and make the corresponding protein.

In this section, you will first investigate the rules associated with the genetic code, and then the technological advances possible based on this understanding.

**Structure and Role of DNA and RNA**

DNA is an example of a macromolecule. The "NA" stands for nucleic acid. Hydrogen bonds keep the two halves of DNA "zipped" together.

This topic addresses the following competency:

- **Competency 205.1.2: Heredity**
  The graduate has a deep understanding of heredity as the continuity and variations of traits from one generation to the next, including the structure and regulation of RNA, the model of protein synthesis, mitosis, meiosis, human karyotype, DNA sequences, and
Replication of DNA

Complete the following Thinkwell Biology sections:

- "Introduction to DNA Replication"
- "Events of DNA Replication"

Be sure to take the quiz after each step to check your understanding. Write notes in your lab notebook as needed.

View the animation of DNA replication within Thinkwell by clicking on "Animations" from the left-hand column and then choosing "DNA Replication."

Section 16.2 "Many proteins work together in DNA replication and repair" of Biology also reviews this information. In your notebook, draw a storyboard showing the steps in DNA replication.

RNA Versus DNA

In your notebook, draw a Venn diagram comparing RNA and DNA.

Base Pairing Rules

During transcription and translation, base pairing rules are significant. In your notebook, draw pictures to show the base paring rules in effect during transcription as the mRNA is formed. Also, draw pictures to show the base paring rules in effect during translation, as the tRNA pairs with mRNA to make the protein.

Process of Protein Synthesis

Protein synthesis occurs during translation at the ribosome.

This topic addresses the following competency:

- Competency 205.1.2: Heredity
  The graduate has a deep understanding of heredity as the continuity and variations of traits from one generation to the next, including the structure and regulation of RNA, the model of protein synthesis, mitosis, meiosis, human karyotype, DNA sequences, and embryology.

Protein Synthesis

Complete the following Thinkwell Biology sections:

- "Translation"
- "Protein Synthesis Review"

Be sure to take the quiz after each step in these sections to check your understanding.
Read the following in *Biology*:

- **chapter 17 ("From Gene to Protein")**

In your notebook, describe the process of protein synthesis, starting with RNA.

**Codons**

Describe the genetic code with reference to the structure, number, and function of various codons.

**Mutagens**

Some environmental factors can cause mutations. Some mutations can have no effect on the organism, while others create more recognizable changes.

Review mutagens in the following section of *Biology*:

- **section 17.5 "Mutations of one or a few nucleotides can affect protein structure and function"**

In your notebook, describe some causes of mutations.

**How Viruses Can Affect DNA**

Work through the activities in this section to understand how viruses depend on cells for the energy and raw materials they need to reproduce.

This topic addresses the following competency:

- **Competency 205.1.2: Heredity**
  The graduate has a deep understanding of heredity as the continuity and variations of traits from one generation to the next, including the structure and regulation of RNA, the model of protein synthesis, mitosis, meiosis, human karyotype, DNA sequences, and embryology.

**Bacteria Cells Versus Viruses**

Complete the following Thinkwell Biology section:

- **"Viruses and Prions"**

Be sure to take the quiz after each step in this section to check your understanding. Write down the differences between bacteria cells (prokaryotes) and viruses.

**How Viruses Reproduce**

Read the following in *Biology*:

- **chapter 19 ("Viruses")**
Describe how viruses use their host. Compare and contrast the lytic and lysogenic cycles of viral reproduction.

**Biotechnology**

DNA can be manipulated to make useful products. Biotechnology has benefitted agriculture, health, and the environment.

This topic addresses the following competency:

- **Competency 205.1.2: Heredity**
  
The graduate has a deep understanding of heredity as the continuity and variations of traits from one generation to the next, including the structure and regulation of RNA, the model of protein synthesis, mitosis, meiosis, human karyotype, DNA sequences, and embryology.

**Recombinant DNA Techniques**

The term recombinant DNA refers to the recombining of DNA segments in a new way. Restriction enzymes cut DNA at certain points, creating "sticky" ends. DNA ligase connects DNA segments.

To gain a better understanding of these techniques, read the following in *Biology*:

- **section 20.1 "DNA Cloning yields multiple copies of a gene or other DNA segment"**

**DNA Cloning Using Bacteria**

Often, mass quantities of a gene are wanted. Bacteria have a plasmid, which is a circular form of DNA. Fortunately, the same genetic coding used in human cells is also used in other organisms. When a human gene is placed within a bacterial plasmid, the bacteria will reproduce as normal, including the new section of DNA.

To better understand this process, examine the following in *Biology*:

- **figure 20.4**

**Gene Therapy**

Read the following in *Biology* to better understand the biotechnology techniques used in gene therapy:

- **section 20.4 "The practical applications of DNA technology affect our lives in many ways"**

**PCR**

Another way of multiplying DNA is with the technique called polymerase chain reaction (PCR).

To better understand this process, examine the following in *Biology*:
The Evolution of Populations

Variety within a population is beneficial to the survival of the population. Environments change, and if there is variety in a population, then it is more likely that some will be suited to survive in the new environment.

Mechanisms of Evolution

Complete the activities in this section to understand how life has changed over time.

This topic addresses the following competency:

- **Competency 205.1.5: Evolutionary Patterns and History of Life**
  The graduate understands evolutionary patterns and the history of life.

Adaptations

Read the following in *Biology*:

- **chapter 22 (“Descent with Modification: A Darwinian View of Life”)**

As the beginning of chapter 22 in *Biology* describes, evolutionary adaptation is an accumulation of inherited characteristics that enhance organisms’ ability to survive and reproduce in specific environments.

In this section, focus on the specific illustrations of how organisms are adapted to their environment, both on land and in water.

As you read, take notes on how organisms have adapted to their environments, including aquatic environments.

Evidence

Complete the following Thinkwell Biology section:

- "Evidence for Evolution"

Be sure to take the quiz after each step to check your understanding.

In your notebook, describe the evidence showing that life has changed over time. For example, the homologous structures of different mammals.

Genetic Material

The following section in *Biology* discusses the genetic code:

- **section 17.1 "Genes specify proteins via transcription and translation"**

At the end of this section, there is a discussion on the evolution of the genetic code. Plants and
animals contain the same genetic code, which is evidence for a common ancestor.

**Importance of the Hardy-Weinberg Law**

A gene pool consists of all the alleles in a population. Individuals possess two alleles for a trait. Given certain conditions, the Hardy-Weinberg law states that the frequencies of alleles in a population will remain constant.

This topic addresses the following competency:

- **Competency 205.1.5: Evolutionary Patterns and History of Life**
  The graduate understands evolutionary patterns and the history of life.

**Variation**

Complete the following Thinkwell Biology section:

- "Variations in Populations"

Be sure to take the quiz after each step in this section to check your understanding. In your notebook, write down the role of natural selection on species variation.

Then read the following in *Biology* to better understand this concept:

- section 23.1 "Genetic variation makes evolution possible"

**Hardy-Weinberg Theory**

Complete the following Thinkwell Biology section

- "The Hardy-Weinberg Theory"

There are 6 sub-sections to work through. Professor Wolfe walks through examples showing how to use the Hardy-Weinberg equation. Be sure to take the quizzes to check your understanding.

Read the following in *Biology* to better understand this concept:

- section 23.2 "The Hardy-Weinberg equation can be used to test whether a population is evolving"

The importance of the Hardy-Weinberg equation is discussed at the end of this section. For example, the percentage of carriers in a population can be determined using the Hardy-Weinberg equation. In your notebook, describe the Hardy-Weinberg theory and its importance.

As an additional resource to understand this concept, you can watch this 15 minute video from the Khan Academy:
Adaptive Genetic Change

Complete the following lab in the General Biology LabPaq:

- laboratory 13 ("The Hardy-Weinberg Principle")

After completing this lab, send your lab report to the course mentor to receive feedback.

Evolution

In this section, you will focus on specific cases that cause populations to change over time.

This topic addresses the following competency:

- **Competency 205.1.5: Evolutionary Patterns and History of Life**
  The graduate understands evolutionary patterns and the history of life.

Genetic Drift

Read the following in *Biology* to learn more about genetic drift:

- section 23.3 "Natural selection, genetic drift, and gene flow can alter allele frequencies in a population"

Sudden changes in the environment can drastically change populations. In your notebook, explain how this happens.

Different Magnitudes of Evolution

Read the following in *Biology*:

- chapter 24 ("The Origin of Species")

In your notebook, compare and contrast microevolution, macroevolution, and speciation.

Value of Sexual Reproduction

Reflecting on your reading of the following section in *Biology*:

- section 23.1 "Genetic variation makes evolution possible"

Write down how sexual reproduction can increase variation within a species.

Natural Selection Task

You now have all the tools you need to complete the Natural Selection task.

Complete the following task in TaskStream:

- Interdisciplinary Biological Science: Natural Selection
For details about this performance assessment, see the "Assessment Preparation" box in this course.

**Phylogeny**

As populations change, a new species might emerge. There has been much evidence collected over time regarding all the different species that have existed on earth. Scientists then try to create a time line of events regarding life on earth; DNA analysis has provided more information regarding the relationship between species.

In this section you will investigate the different methods used to organize the vast amount of information that now exists regarding the history of life on earth.

**Classification**

There are many organisms living on Earth. Scientists have studied these organisms’ characteristics in order to classify living organisms into groups.

This topic addresses the following competency:

- **Competency 205.1.5: Evolutionary Patterns and History of Life**
  
  The graduate understands evolutionary patterns and the history of life.

**Classification**

Complete the following Thinkwell Biology sections:

- "Classifying Life"
- "Classifying Earth's Organisms"

These are part of the "Biology of Organisms" chapter. Be sure to take the quiz after each step in these sections to check your understanding. Write notes in your lab notebook as needed.

In your notebook, describe the basis for the three-domain system.

**Linnaean Taxonomic System**

Read the following in *Biology*:

- **section 26.1 "Phylogenies show evolutionary relationships"**

Carolus Linnaeus based his classification on the resemblances of organisms. Now that DNA can be compared between organisms, the limitations of this system can be figured out. Organisms may have similar features and yet have had very different evolutionary paths. Binomial nomenclature is used for naming organisms.

As you can see from the following figure in Biology, domain is the largest group, to which kingdoms belong:

- **figure 26.3**
In your notebook, explain how phylogeny is used in classification.

**Homologous and Analogous**

Read the following in *Biology*:

- [section 26.2 "Phylogenies are inferred from morphological and molecular data"](#)

In your notebook, distinguish between homologous and analogous structures. As a reminder, homologous structures were described in more detail in the following chapter:

- [chapter 22 (“Descent with Modification: A Darwinian View of Life”)](#)

**Phylogenetic System**

Read the following in *Biology* to understand how to classify organisms using the phylogenetic system:

- [section 26.3 "Shared characters are used to construct phylogenetic trees"](#)

While working in this section, be sure you can interpret cladograms.

After working through this course, you will be able to describe the organization of living organisms from ecosystems to the inside of cells.

**Eukaryotic Organisms**

Complete the following Thinkwell Biology sections:

- "Protists"
- "Fungi"
- "Plants"

In your lab notebook, describe the characteristics of protists, which are one-celled eukaryotic organisms.

Also describe the characteristics of these multicellular groups of organisms: plants, fungi, and animals. Plants and animals are covered in more detail in later sections in this course of study.

**Geologic Time**

Fossils have been found around the world, providing evidence of organisms that no longer inhabit Earth. Footprints are considered a type of fossil.

Due to plate tectonics, the strata that fossils are in can shift. Scientists studying fossils also have to understand some geology to properly interpret the significance of the fossil.

**The Geologic Time Scale**

Complete the activities in this section to better understand when the different forms of life first appeared on Earth.
This topic addresses the following competency:

- **Competency 205.1.5: Evolutionary Patterns and History of Life**
  The graduate understands evolutionary patterns and the history of life.

### Origin of Life

Complete the following Thinkwell Biology section:

- "The Origin of Life"

Be sure to take the quiz after each step in this section to check your understanding.

Read the following section in *Biology*:

- section 25.1 "Conditions on early Earth made the origin of life possible"

Write notes in your lab notebook related to how life might have begun in the water during the early stages of Earth’s atmosphere.

### Major Divisions

The following table in *Biology* depicts the approximate dates of the major divisions of the modern geologic time scale:

- table 25.1 within section 25.3

Precambrian refers to the time period before the start of the Cambrian time period, which would be any time before 542 million years ago. In your notebook, state the time periods for the following divisions:

- Precambrian
- Paleozoic era and periods
- Cenozoic era, periods, and epochs

Place important events within a geologic time frame (e.g., first land plants, first vertebrates, first gymnosperms, extinction of the dinosaurs).

### Extinction

The following section in *Biology* outlines evidence for mass extinctions that have occurred:

- section 25.4 "The rise and fall of groups of organisms reflect differences in speciation and extinction rates"

Complete the following Thinkwell Biology subsection within the section "Fossils and Evolution":

- "Mass Extinctions: An Asteroid Can Ruin Your Day"
Extinction provides an open niche for new species to fill. Consequently, biodiversity has the opportunity to increase after a niche is opened for new species. In your notebook, write down causes for extinction.

**Major Fauna and Flora**

In your notebook, describe the Paleozoic, Mesozoic, and Cenozoic fauna and flora (especially dominant species), and identify samples from important taxa. For example, dinosaurs are an important fauna of the Mesozoic Era.

**The Fossil Record**

Complete the activities in this section to better understand how to interpret various fossils.

This topic addresses the following competency:

- **Competency 205.1.5: Evolutionary Patterns and History of Life**
  The graduate understands evolutionary patterns and the history of life.

**Types of Fossils**

Complete the following Thinkwell Biology subsections within the section "Fossils and Evolution":

- "Fossil Formation, Dating, and Indexing"
- "The Fossil Record"

The following figure in Biology illustrates different fossils:

- figure 25.4

Complete the following lab in the General Biology LabPaq:

- laboratory 10 ("The Fossilization Process")

After completing this lab, send your lab report to the course mentor to receive feedback.

In your notebook, describe:

- different ways preservation can take place, as described within the lab
- the use of indexing to age fossils

**Prokaryotes to Eukaryotes**

Read the following in Biology to learn more about the oldest known fossils:

- section 25.3 "Key events in life's history include the origins of single-celled and multicelled organisms and the colonization of land"

In your notebook, describe the following:
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- stromatolites
- the endosymbiont theory
- the complexity of organisms and the biodiversity during the cambrian explosion
- significance of the Ediacaran fauna

Examining Fossil Evidence

Complete the following lab in the General Biology LabPaq:

- laboratory 12 ("Life through Time")

After completing this lab, send your lab report to the course mentor to receive feedback.

Major Steps in the Evolution of Primates and Hominids

Complete the activities in this section to better understand the major steps in the evolution of primates and hominids.

This topic addresses the following competency:

- **Competency 205.1.5: Evolutionary Patterns and History of Life**
  The graduate understands evolutionary patterns and the history of life.

Human Evolution

Complete the following Thinkwell Biology section:

- "Human Evolution"

Be sure to take the quiz after each step in this section to check your understanding.

Read the following in Biology:

- **section 34.8 "Humans are mammals that have a large brain and bipedal locomotion"**

In your notebook, describe major steps in the evolution of primates and hominids.

Common Descent

Complete the following lab in the General Biology LabPaq:

- laboratory 11 ("Evolution")

After completing this lab, send your lab report to the course mentor to receive feedback.

Animals and Plants

Animals and plants have a variety of structures to meet their needs. Animals and plants are complex organisms. Both plants and animals have specialized cells that are organized into tissues. Both plants and animals have specialized structures to help the organisms survive.

Plant and Animal Tissues
Complete the activities in this section to better understand tissues.

This topic addresses the following competency:

- **Competency 205.1.5: Evolutionary Patterns and History of Life**
  The graduate understands evolutionary patterns and the history of life.

**Plant Tissues**

The following section in *Biology* describes three plant tissues: dermal, vascular, and ground:

- **section 35.1 "Plants have a hierarchical organization consisting of organs, tissues, and cells"**

In your notebook, describe the different types of plant tissues.

Complete the following in the General Biology LabPaq:

- **exercise 2 in laboratory 6 ("The Properties of Water")**

This lab demonstrates the capillary action of vascular tissue. After completing this exercise in the lab, send your lab report to the course mentor to receive feedback.

**Animal Tissues**

The following section in *Biology* describes animal tissues:

- **section 40.1 "Animal form and function are correlated at all levels of organization"**

In your notebook, describe the different types of animal tissues.

**Major Systems in Plants and Animals**

In this section, you will investigate the structures that organisms have to perform various functions.

This topic addresses the following competency:

- **Competency 205.1.3: Diversity of Life**
  The graduate understands the historical changes in life forms (evolution of life) and the diversity of life (similarities and differences among organisms), including natural selection, global catastrophes, human influence, environmental change, and the development of hierarchical classification systems.

**Diverse Structures of Plants**

Read and review the following in *Biology*:

- **chapter 29 ("Plant Diversity I: How Plants Colonized Land")**
- **chapter 30 ("Plant Diversity II: The Evolution of Seed Plants")**
• chapter 35 ("Plant Structure, Growth, and Development")

In your notebook, describe the structures, components, and functions of the major systems in plants.

These chapters also illustrate the life cycles of some plants. Describe these life cycles in your notebook.

**Invertebrate Structures**

Some invertebrate animals have exoskeletons for support (such as lobsters) while others use the properties of water to support their bodies (such as squid).

Read the following in Biology:

• chapter 33 ("An Introduction to Invertebrates")

In your notebook, describe the structures, components, and functions of the major systems in invertebrates. This chapter also illustrates the life cycles of some invertebrates. Describe some of these varied life cycles in your notebook.

**Vertebrate Structures**

Vertebrate animals have skeletons for support. Read the following in Biology:

• chapter 40 ("Basic Principles of Animal Form and Function")

In your notebook, describe the structures, components, and functions of the major systems in vertebrate animals.

**Stages of Embryonic Development**

Animals start off as one cell, called a zygote. Cells divide and undergo specialization during development.

This topic addresses the following competency:

• **Competency 205.1.3: Diversity of Life**
  The graduate understands the historical changes in life forms (evolution of life) and the diversity of life (similarities and differences among organisms), including natural selection, global catastrophes, human influence, environmental change, and the development of hierarchical classification systems.

**Key Stages**

Read the following in Biology to learn the stages of embryonic development:

• section 47.1 "Fertilization and cleavage initiate embryonic development"

In your notebook, name and describe the principal stages in embryonic development.
(fertilization, cleavage, gastrulation, and organogenesis).

**Populations Within a Community**

When populations are interacting with each other, it is called a community. When focusing on the living organisms within an ecosystem, you can see that there are several communities within an ecosystem.

**Population Dynamics**

Population sizes often show some fluctuation.

This topic addresses the following competency:

- **Competency 205.1.4: Interdependence of Life**
  The graduate understands the interdependence of life and the flow of energy and matter.

**Variations in Population Size**

Read the following in *Biology*:

- chapter 53 "Population Ecology"

Define population dynamics in terms of changes in size, density, dispersion, and age distribution in response to environmental change.

In your notebook, define exponential population growth. Discuss the history of global human population size and projections for the future. What societal issues are related to human population growth? Describe the importance of the predator-prey relationship in the functioning of an ecosystem.

**Population Growth Performance Task**

You now have all the tools you need to complete the Population Growth task.

This topic addresses the following competency:

- **Competency 205.1.4: Interdependence of Life**
  The graduate understands the interdependence of life and the flow of energy and matter.

**Population Growth Performance Task**

Complete the following task in *TaskStream*:

- Interdisciplinary Biological Science: Population Growth

For details about this performance assessment, see the "Assessment Preparation" box in this course.

**A Community's Interactions and Their Importance**
Work through the activities in this section to understand community ecology.

This topic addresses the following competency:

- **Competency 205.1.4: Interdependence of Life**
  The graduate understands the interdependence of life and the flow of energy and matter.

**Interdependence Within a Community**

Complete the following Thinkwell Biology section:

- "Community Ecology: Interspecific Interactions"

Be sure to take the quiz after each step in these sections to check your understanding.

Write notes in your lab notebook as needed.

Read the following in *Biology*:

- section 54.1 "Community interactions are classified by whether they help, harm, or have no effect on the species involved"

In your notebook, explain types of interspecific competition, symbiosis, parasitism, commensalism, and mutualism, and how organisms may serve certain functions (ecological niches).

In your notebook, describe the defenses or survival adaptations (e.g., protective coloration and production of toxic chemicals) some organisms use against parasites and against predation.

**Coevolution**

Review page 806 in *Biology* to better understand coevolution.

Define coevolution and include an example in your notebook.

**Succession**

After a forest fire, the recolonization of species in the forest is somewhat predictable. This predictability is possible because of an understanding of ecological succession. Review the following in *Biology*:

- section 54.3 "Disturbance influences species diversity and composition"

In your notebook, define and describe the stages of ecological succession.

**Ecological Issues**

The biotic and abiotic components of the environment constantly interact. The oxygen in the
atmosphere is considered abiotic, but after it is breathed in, the oxygen is considered biotic as the atoms are reconfigured inside of organisms. There is interdependence between all components of the environment.

**Nutrient Cycles**

Nutrients are continually circulating between the biosphere, lithosphere, atmosphere, and hydrosphere.

This topic addresses the following competency:

- **Competency 205.1.6: Ecological Issues**
  The graduate understands important ecological issues, ideas, and structures, including population dynamics, community energetics, and biogeochemical cycles.

**Limitations of an Ecosystem**

A rain forest has many more organisms than a desert. Primary productivity plays a role in this difference.

Read the following in *Biology*:

- *chapter 55 "Ecosystems and Restoration Ecology"

In your notebook, define net primary production and primary productivity. Explain how it limits the number of organisms in an ecosystem.

**Biogeochemical Cycles**

Complete the following Thinkwell Biology section:

- *"Chemical Cycling in the Ecosystem"

Be sure to take the quiz after each step in this section to check your understanding.

Explain how phosphorous, sulfur, carbon, nitrogen and trace elements, such as iron, are cycled between living and nonliving parts of an ecosystem, as well as globally.

From your reading of the following in *Biology*, make note of the main reservoirs for each nutrient:

- *chapter 55 "Ecosystems and Restoration Ecology"

The hydrosphere on Earth allows life to exist. Water molecules are continually circulating; explain how water is recycled globally and in the ecosystem.

**Nutrients for Plants**

The cycling of nutrients in an ecosystem is important. Ultimately, plants use sunlight’s energy to convert inorganic nutrients into organic molecules.
Using the following section in *Biology* as a guide, differentiate between macronutrients and micronutrients:

- **section 37.2 "Plants require essential elements to complete their life cycle"**

**Biochemical Cycles Performance Task**

You now have all the tools you need to complete the Biochemical Cycles task.

This topic addresses the following competency:

- **Competency 205.1.6: Ecological Issues**
  The graduate understands important ecological issues, ideas, and structures, including population dynamics, community energetics, and biogeochemical cycles.

**Biochemical Cycles Performance Task**

Complete the following task in TaskStream:

- Interdisciplinary Biological Science: Biochemical Cycles

For details about this performance assessment, see the "Assessment Preparation" box in this course.

**Effects of Human Activity on the Environment**

Human activities have an effect on the environment. Advances in health and medicine allow for human life spans to increase.

This topic addresses the following competency:

- **Competency 205.1.6: Ecological Issues**
  The graduate understands important ecological issues, ideas, and structures, including population dynamics, community energetics, and biogeochemical cycles.

**Effects of Human Activity**

Complete the following Thinkwell Biology section:

- "Human Effect on the Ecosystem"

Be sure to take the quiz after each step in this section to check your understanding.

Read the following in *Biology*:

- chapter 56 "Conservation Biology and Global Change"

In your notebook, discuss the effects of human activity on land fertility, aquatic viability, and sources of pollution.
Ozone in the stratosphere protects Earth from ultraviolet light. When closer to Earth, however, ozone is considered a form of pollution. In your notebook, describe the location and importance of the ozone layer. Explain the probable cause for the recent depletion of the stratospheric ozone layer.

**Protecting Our Ecosystems**

Members of an ecosystem each serve a role allowing the ecosystem to thrive. Decomposers break down material supplying nutrients to the soil, thereby allowing plants to survive. Plants, in turn, are a food source for numerous animals. If the balance within an ecosystem is disturbed, the impact can be profound.

This topic addresses the following competency:

- **Competency 205.1.6: Ecological Issues**
  The graduate understands important ecological issues, ideas, and structures, including population dynamics, community energetics, and biogeochemical cycles.

**Introduced Species**

The movement of human populations around the globe has increased the likelihood of species being introduced into new habitats.

Reflecting on your reading of chapter 56 in *Biology*, discuss the problems related to humans transporting species into a new habitat.

**Land Use**

Reflecting on your reading of chapter 56 in *Biology*, identify methods of land use and management in your notebook.

**Habitats and Humans**

Complete the following lab in the General Biology LabPaq:

- laboratory 14 ("Habitats and Humans")

After completing this lab, send your lab report to the course mentor to receive feedback.

**Mass Extinctions Performance Task**

You now have all the tools you need to complete the Mass Extinctions task.

This topic addresses the following competency:

- **Competency 205.1.6: Ecological Issues**
  The graduate understands important ecological issues, ideas, and structures, including population dynamics, community energetics, and biogeochemical cycles.

**Mass Extinctions Performance Task**

Complete the following task in *TaskStream*:
Interdisciplinary Biological Science: Mass Extinctions

For details about this performance assessment, see the "Assessment Preparation" box in this course.

Biodiversity Issues Performance Task
You now have all the tools you need to complete the Biodiversity Issues task.

This topic addresses the following competency:

- **Competency 205.1.6: Ecological Issues**
  The graduate understands important ecological issues, ideas, and structures, including population dynamics, community energetics, and biogeochemical cycles.

Biodiversity Issues Performance Task

Complete the following task in TaskStream:

- Interdisciplinary Biological Science: Biodiversity Issues

For details about this performance assessment, see the "Assessment Preparation" box in this course.

Final Steps

Congratulations on completing the activities in this course! This course has prepared you to complete the assessments associated with this course. If you have not already been directed to complete the assessments, schedule and complete your assessments now.

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