Middle/Senior High School Curriculum Map

Curriculum Map

Course Title: AP Biology	**Quarter:** 1	**Academic Year:** 2022-2023

Essential Questions for this Quarter:

1. What is the role of energy in the making and breaking of polymers?
2. How do living systems transmit information in order to ensure their survival?
3. How would living systems function without the polarity of the water molecule?
4. How do you defend the origin of eukaryotic cells?
5. How do the mechanisms for transport across membranes support energy conservation?
6. How are living systems affected by the presence or absence of subcellular components?

Unit/Time Frame	Standards	Content	Skills	Assessment	Resources
UNIT 1 – (4 weeks) **-Chemistry of Life** **UNIT 2 – (5 weeks)** **-Cell Structure and Function**	**1.1** **1.2** **1.3** **1.4** **1.5** **1.6** **2.1** **2.2** **2.3** **2.4** **2.5** **2.6** **2.7** **2.8** **2.9** **2.10** **2.11**	UNIT 1 CHEMISTRY OF LIFE -Structure of water and hydrogen bonding -Elements of life -Introduction to biological macromolecule -Properties of biological macromolecules -Structure and function of biological macromolecules -Nucleic acids UNIT 2 CELL STRUCTURE AND FUNCTION -Cell structure subcellular components -Cell structure and function -Cell size -Plasma membranes -Membrane permeability -Membrane transport -Facilitated diffusion -Tonicity and osmoregulation -Mechanisms of transport -Cell compartmentalization	**CHEMISTRY OF LIFE** **1. Explain how the properties of water that result from its polarity and hydrogen bonding affect its biological function** -The subcomponents of biological molecules and their sequence determine the properties of that molecule -Living systems depend on properties of water that result from its polarity and hydrogen bonding -The hydrogen bonds between water molecules result in cohesion, adhesion, and surface tension **2. Describe the composition of macromolecules required by living organisms** -Organisms must exchange matter with the environment to grow, reproduce, and maintain organization -Atoms and molecules from the environment are necessary to build new molecules **3. Describe the properties of the monomers and the type of bonds that connect the monomers in biological macromolecules** -Hydrolysis and dehydration synthesis are used to cleave and form covalent bonds between monomers. -Structure and function of polymers are derived from the way their monomers are assembled	Test / Quizzes 40% Labs 40% Homework 20%	AP 11th Edition Campbell Biology MasteringBiology.com AP Central AP Test Prep Series

		-Origins of cell compartmentalization	**4. Explain how a change in subunits of a polymer may lead to changes in structure or function of the macromolecule.** -Directionality of the subcomponents influences structure and function of the polymer **5. Describe the structural similarities and differences between DNA and RNA** **CELL STRUCTURE AND FUNCTION** **6. Describe the structure and/or function of subcellular components and organelles** -Ribosomes comprise of rRNA and protein according to mRNA sequence -Ribosomes are found in all forms of life reflecting the common ancestry of all known life -Endoplasmic reticulum occurs in two forms- smooth and rough. -The Golgi complex is a membrane-bound structure that consists of a series of flattened membrane sacs **7. Explain how subcellular components and organelles contribute to the function of the cell** -Organelles and subcellular structures, and the interactions among them, support cellular function **8. Describe the structural features of a cell that allow organisms to capture, store, use energy** - The folding of the inner membrane increases the surface area, which allows for more ATP to be synthesized -Within the chloroplast are thylakoids and the stroma -The thylakoids are organized in stacks called grana -Membranes contain chlorophyll pigments and electron transport proteins that comprise the photosynthesis -The light-dependent reactions of photosynthesis occur in the grana -The stroma is the fluid within the inner chloroplast membrane and outside of the thylakoid -The Calvin-Benson cycle reactions of photosynthesis occur in the stroma -The Krebs cycle reactions occur in the matric of the mitochondria -Electron transport and ATP synthesis occur on the inner mitochondrial membrane **CELL SIZE** **9. Explain the effect of surface area-to-volume ratios on the exchange of materials between cells or organism and the environment**		

			- Surface area-to-volume ratios affect the ability of a biological system to obtain necessary resources, eliminate wastes, acquire or dissipate thermal energy, and otherwise exchange chemicals and energy with the environment. - The surface area of the plasma membrane must be large enough to adequately exchange materials **10. Explain how specialized structures and strategies area used for the efficient exchange of molecules to the environment.** - Organisms have evolved highly efficient strategies to obtain nutrients and eliminate wastes. **11. Describe the roles of each of the components of the cell membrane in maintaining the internal environment of the cell.** -Phospholipids have both hydrophilic and hydrophobic regions. -Embedded proteins can be hydrophilic, with charged and polar side groups, or hydrophobic, with nonpolar side groups **12. Describe the Fluid Mosaic Model of cell membranes** -Cell membranes consist of a structural framework of phospholipid molecules that is embedded with proteins, steroids, glycoproteins, and glycolipids that can flow around the surface of the cell within the membrane. **13. Explain how the structure of biological membranes influences selective permeability** - The structure of cell membranes results in selective permeability. -Cell membranes separate the internal environment of the cell from the external environment -Selective permeability is a direct consequence of membrane structure, as described by fluid mosaic model -Small nonpolar molecules N_2 O_2 CO_2, freely pass across the membrane -Polar uncharged molecules, including water pass through the membrane in small amounts **14. Describe the role of the cell wall in maintaining cell structure and function** - Cell walls provide a structural boundary, as well as a permeability barrier for some substances to the internal environments - Cell walls of plants, prokaryotes, and fungi are composed of complex carbohydrates		

			15. Describe the mechanisms that organisms use to maintain solute and water balance - Passive transport is the net movement of molecules from high concentration to low concentration without the direct input of metabolic energy - Passive transport plays a primary role in the import of materials and the export of wastes - Active transport required the direct input of energy to move molecules from regions of low concentration to regions of high concentration **16. Describe the mechanisms that organisms use to transport large molecules across the plasma membrane** - The selective permeability of membranes allows for the formation of concentration gradients of solutes across the membrane -The processes of endocytosis and exocytosis require energy to move large molecules into and out the cells **17. Explain how the structure of a molecule affects its ability to pass through the plasma membrane** - Membrane proteins are required for facilitated diffusion of charged and large polar molecules through a membrane - Membrane proteins are necessary for active transport - Metabolic energy is required for active transport of molecules and/or ions across the membrane and to establish and maintain concentration gradients - The Na^+/K^+ ATPase contributes to the maintenance of the membrane potential **18. Explain how concentration gradients affect the movement of molecules across membranes** - The selective permeability of membranes allows for the formation of concentration gradients of solutes across the membrane -The processes of endocytosis and exocytosis require energy to move large molecules into and out the cells **19. Describe the mechanisms that organisms use to transport large molecules across the plasma membrane** - The selective permeability of membranes allows for the formation of concentration gradients of solutes across the membrane - The processes of endocytosis and exocytosis require energy to move large molecules into and out of cells		

			20. Explain how the structure of a molecule affects its ability to pass through the plasma membrane - Membrane proteins are required for facilitated diffusion of charged and large polar molecules through a membrane -Membrane proteins are necessary for active transport -Metabolic energy is required for active transport of molecules and/or ions across the membrane and to establish and maintain concentration gradients -The Na^+/K^+ ATPase contributes to the maintenance of the membrane potential **21. Explain how concentration gradients affect the movement of molecules across membranes** - External environments can be hypotonic, hypertonic or isotonic to internal environments of cells **22. Explain how osmoregulatory mechanisms contribute to the health and survival of organisms** -Growth and homeostasis are maintained by the constant movement of molecules across membranes -Osmoregulation maintains water balance and allows organisms to control their internal solute composition/water potential **23. Describe the processes that allow ions and other molecules to move across membranes** - A variety of processes allow for the movement of ions and other molecules across membranes, including passive and active transport, endocytosis and exocytosis **24. Describe the membrane bound structures of the eukaryotic cell** -Membranes and membrane-bound organelles in eukaryotic cells compartmentalize intracellular metabolic processes and specific enzymatic reactions **25. Explain how internal membranes and membrane bound organelles contribute to compartmentalization of eukaryotic cell functions** -Internal membranes facilitate cellular processes by minimizing competing interactions and by increasing surface areas where reactions can occur **26. Describe similarities and/or differences in compartmentalization between prokaryotic and eukaryotic cells** -Membrane-bound organelles evolved from once free-living prokaryotic cells via endosymbiosis		

			-Prokaryotes generally lack internal membrane bound organelles but have internal regions with specialized structures and functions **27. Describe the relationship between the functions of endosymbiotic organelles and their free-living ancestral counterparts** - Membrane bound organelles evolved form previously free-living prokaryotic cells via endosymbiosis		

Curriculum Map

Course Title: AP Biology	**Quarter:** 2	**Academic Year:** 2022-2023

Essential Questions for this Quarter:

1. How is energy captured and then used by a living system?
2. How do organisms use energy or conserve energy to respond to environmental stimuli?
3. In what ways do cells use energy to communicate with one another?
4. How does the cell cycle aid in the conservation of genetic information?
5. Why and in what ways do cells communicate with one another?

Unit/Time Frame	Standards	Content	Skills	Assessment	Resources
UNIT 3 – (4.5 weeks) **-Cellular Energetics** **UNIT 4 – (4.5 weeks)** **-Cell Communication and Cell Cycle**	**3.1** **3.2** **3.3** **3.4** **3.5** **3.6** **3.7** **4.1** **4.2** **4.3** **4.4** **4.5** **4.6** **4.7**	UNIT 3 CELLULAR ENEERGETICS -Enzyme structure -Enzyme catalysis -Environmental impacts on enzyme function -Cellular energy -Photosynthesis -Cellular respiration -Fitness UNIT 4 CELL COMMUNICATION AND CELL CYCLE -Cell communication -Introduction to signal transduction -Signal transduction -Changes in signal transduction pathways	**CELLULAR ENEGETICS** **1. Describe the properties enzymes** - The structure of enzymes includes the active site that specifically interacts with substrate molecules - For an enzyme-mediated chemical reaction to occur, the shape and charge of the substrate must be compatible with the active site of the enzyme **2. Explain how enzymes affect the rate of biological reactions** - The structure and function of enzymes contribute to the regulation of biological processes **3. Explain how changes to the structure of an enzyme may affect its function** -Change to the molecular structure of a component in an enzymatic system may result in a change of the function or efficiency of the system	Test / Quizzes 40% Labs 40% Homework 20%	AP 11th Edition Campbell Biology MasteringBiology.com AP Central AP Test Prep Series

		-Feedback -Cell cycle -Regulation of cell cycle	-In some cases, enzyme denaturation is reversible, allowing the enzyme to regain activity **4. Explain how the cellular environment affects enzyme activity** -Environmental pH can alter the efficiency of enzyme activity, including through disruption of hydrogen bonds that provide enzyme structure -The relative concentrations of substrates and product determine how efficiently an enzymatic reaction proceeds -Higher environmental temperatures increase the speed of movement of molecules in a solution, increasing the frequency of collisions between enzymes and substrates and therefore increasing the rate of reaction -Competitive inhibitor molecules can bind reversibly or irreversibly to the active site of the enzyme. Noncompetitive inhibitors can bind allosteric sites, changing the activity of the enzyme. **5. Describe the role of energy in living organism** -All living systems require constant input of energy -Energy-related pathways in biological systems are sequential to allow for more controlled and efficient transfer of energy. **6. Describe the photosynthetic processes that allow organisms to capture and store energy** - Organisms capture and store energy for use in biological processes - The light-dependent reactions of photosynthesis in eukaryotes involve a series of coordinated reaction pathways that capture energy present in light to yield APT and NADPH, which power the production of organic molecules **7. Explain how cells capture energy from light and transfer it to biological molecules for storage and use** -During photosynthesis, chlorophylls absorb energy from light, boosting electrons to a higher energy level in photosystems I and II **8. Describe the processes that allow organisms to use energy stored in biological macromolecules** -Fermentation and cellular respiration use energy from biological macromolecules to produce ATP, Respiration and fermentation are characteristic of all forms of life -Cellular respiration in eukaryotes involves a series of coordinated enzyme-catalyzed		

			reactions that capture energy from biological macromolecules -The electron transport chain transfers energy from electrons in a series of coupled reactions that establish an electrochemical gradient across membranes **9. Explain how cells obtain energy from biological macromolecules in order to power cellular functions** -Glycolysis is a biochemical pathway that releases energy in glucose to form ATP from ADP and inorganic phosphate, NADH from HAD+, and pyruvate -Pyruvate is transported from the cytosol to the mitochondrion, where further oxidation occurs -In the Krebs cycle, carbon dioxide is released from organic intermediates, APT is synthesized form ADP and inorganic phosphate, and electrons are transferred to the coenzymes NADH and $FADH_2$ -Electrons extracted in glycolysis and Krebs cycle reactions are transferred by HADH and $FADH_2$ to the electron transport chain in the inner mitochondrial membrane -When electrons are transferred between molecules in a sequence of reactions as they pass through the ETC, an electrochemical gradient of protons across inner mitochondrial membrane is established -Fermentation allows glycolysis to proceed in the absence of oxygen and produces organic molecules, including alcohol and lactic acid, as waste products -The conversion of ATP to ADP releases energy, which is used to power many metabolic processes **10. Explain the connection between variation in the number and types of molecules within cells to the ability of the organism to survive and/or reproduce in different environments** -Variation at the molecular level provides organisms with the ability to respond to a variety of environmental stimuli -Variation in the number and types of molecules within cells provides organisms a greater ability to survive and/or reproduce in different environments **CELL COMMUNICATION AND CELL CYCLE** **11. Describe the ways that cells can communicate with one another** - Cells communicate with one another through direct contact with other cells or from a distance via chemical signaling		

			12. Explain how cells communicate with one another over short and long distances - Cells communicate over short distances by using local regulators that target cells in the vicinity of the signal-emitting cell **13. Describe the components of a signal transduction pathway** -Signal transduction pathways link signal reception with cellular responses -Many signal transduction pathways include protein modification and phosphorylation cascades **14. Describe the role of components of a signal transduction pathway in producing a cellular response** -Signaling begins with recognition of a chemical messenger-a ligand-by a receptor protein in a target cell -Signaling cascades relay signals form receptors to cell targets, often amplifying the incoming signals, resulting in the appropriate responses by the cell, which could include cell growth, secretion of molecules, or gene expression **15. Describe the role of the environment in eliciting a cellular response** -Signal transduction pathways influence how the cell responds to its environment **16. Describe the different types of cellular responses elicited by a signal transduction pathway** - Signal transduction may result in changes in gene expression and cell function, which may alter phenotype or result in programmed cell death **17. Explain how a change in the structure of any signaling molecule affects the activity of the signaling pathway** -Changes in signal transduction pathways can alter cellular response -Chemicals that interfere with any component of the signaling pathway may activate or inhibit the pathway **18. Describe positive and/or negative feedback mechanisms** -Organisms use feedback mechanisms to maintain their internal environments and respond to internal and external environment changes **19. Explain how negative feedback helps to maintain homeostasis** -Negative feedback mechanisms maintain homeostasis for a particular condition by regulating physiological processes.		

			20. Explain how positive feedback affects homeostasis -Positive feedback mechanisms amplify responses and processes in biological organisms **21. Describe the events that occur in the cell cycle** -In eukaryotes, cells divide and transmit genetic information via two highly regulated processes -The cell cycle is a highly regulated series of events for the growth and reproduction of cells **22. Explain how mitosis results in the transmission of chromosomes from one generation to the next** - Mitosis is a process that ensures that transfer of a complete genome from a parent cell to two genetically identical daughter cells **23. Describe the role of checkpoints in regulating the cell cycle** -A number of internal controls or checkpoints regulate progression through the cycle -Interactions between cyclins and cyclin-dependent kinases control the cell cycle **24. Describe the effects of disruptions to the cell cycle on the cell or organism** -Disruptions to the cell cycle may result in cancer and/or programmed cell death **25. Explain how negative feedback helps to maintain homeostasis** -Negative feedback mechanisms maintain homeostasis for a particular condition by regulating physiological processes. **26. Explain how positive feedback affects homeostasis** -Positive feedback mechanisms amplify responses and processes in biological organisms		

Curriculum Map

Course Title: AP Biology	**Quarter:** 3	**Academic Year:** 2022-2023

Essential Questions for this Quarter:

1. How is our understanding of evolution influenced by our knowledge of genetics?
2. Why is it important that not all inherited characteristics get expressed in the next generation?

3. How would Mendel's laws have been affected if he had studied a different type of plant?
4. How does the diversity of a species affect inheritance?
5. How does gene regulation relate to the continuity of life?
6. How is a species' genetic information diversified from generation to generation?

Unit/Time Frame	Standards	Content	Skills	Assessment	Resources
UNIT 5 – (4.5 weeks) **-Heredity** **UNIT 6 – (4.5 weeks)** **-Gene Expression and Regulation**	**5.1** **5.2** **5.3** **5.4** **5.5** **5.6** **6.1** **6.2** **6.3** **6.4** **6.5** **6.6** **6.7** **6.8**	UNIT 5 HEREDITY -Meiosis -Meiosis and genetic diversity -Mendelian genetics -Non-Mendelian genetics -Environmental effects on phenotypes -Chromosomal inheritance UNIT 6 GENE EXPRESSION AND REGULATION -DNA and RNA structure -Replication -Transcription and RNA processing -Translation -Regulation of gene expression -Gene expression and cell specialization -Mutations -Biotechnology	**HEREDITY** **1. Explain how meiosis results in the transmission of chromosomes from one generation to the next** - Meiosis is a process that ensures the formation of haploid gamete cells in sexually reproducing diploid organisms **2. Describe similarities and/or differences between the phases and outcomes of mitosis and meiosis** - Mitosis and meiosis are similar in the way chromosomes segregate but differ in the number of cells produced and the genetic content of the daughter cells **3. Explain how the process of meiosis generates genetic diversity** -Separation of the homologous chromosomes in meiosis I ensures that each gamete receives a haploid set of chromosomes that comprises both material and paternal chromosomes -During meiosis I, homologous chromatids exchange genetic material via a process called "crossing over" which increases genetic diversity among the resultant gametes -Sexual reproduction in eukaryotes involving gamete formation – including crossing over, the random assortment of chromosomes during meiosis, and subsequent fertilization of gametes – serves to increase variation **4. Explain how shared conserved, fundamental processes and features support the concept of common ancestry for all organisms** -DNA and RNA are carriers of genetic information -Ribosomes are found in all forms of life -Major features of the genetic code are shared by all modern living systems -Core metabolic pathways are conserved across all currently recognized domains **5. Explain the inheritance of genes and traits as described by Mendel's laws**	Test / Quizzes 40% Labs 40% Homework 20%	AP 11th Edition Campbell Biology MasteringBiology.com AP Central AP Test Prep Series

			-Mendel's laws of segregation and independent assortment can be applied to genes that are on different chromosomes -Fertilization involves the fusion of two haploid gametes, restoring the diploid number of chromosomes and increasing genetic variation in population by creating new combinations of alleles in the zygote **6. Explain deviations from Mendel's model of the inheritance of traits** - Patterns of inheritance of many traits do not follow ratios predicted by Mendel's laws and can be identified by quantitative analysis, where observed phenotypic ratios statistically different from the predicted ratio - Some traits are determined by genes on sex chromosomes and are known as sex-linked traits can often be predicted from data, including pedigree, indicating the parent genotype/phenotype and the offspring genotypes/phenotypes - Many traits are the product of multiple genes and/or physiological processes acting in combination; these traits therefore do not segregate in Mendelian patterns - Some traits result from non-nuclear inheritance **7. Explain how the same genotype can result in multiple phenotypes under different environmental conditions** -Environmental factors influence gene expression and can lead to phenotypic plasticity. **8. Explain how chromosomal inheritance generates genetic variation in sexual reproduction** -Segregation, independent assortment of chromosomes, and fertilization result in genetic variation in populations -The chromosomal basis of inheritance provides an understanding of the pattern of transmission of genes from parent to offspring -Certain human genetic disorders can be attributed to the inheritance of a single affected or mutated allele or specific chromosomal changes, such as nondisjunction **GENE EXPRESSION AND REGULATION** **9. Describe the structures involved in passing hereditary information from on generation to the next** -DNA, and in some cases RNA, is the primary source of heritable information		

			-Genetic information is transmitted from one generation to the next through DNA or RNA -Prokaryotes and eukaryotes can contain plasmids, which are small extra-chromosomal, double-stranded, circular DNA molecules **10. Describe the characteristics of DNA that allow I tot be used as hereditary material** -DNA, and sometimes RNA, exhibits specific nucleotide base pairing that is conserved through evolution: A-T or A-U and G-C **11. Describe the mechanisms by which genetic information is copied for transmission between generations** - DNA replication ensures continuity of hereditary information **12. Describe the mechanisms by which genetic information flows from DNA to RNA to protein** - The sequence of the RNA bases, together with the structure of the RNA molecule, determines RNA function - Genetic information flows from a sequence of nucleotides in DNA to a sequence of bases in an mRNA molecule to a sequence of amino acids in a protein - RNA polymerases use a single template strand of DNA to direct the inclusion of bases in the newly formed RNA molecule known as transcription - The DNA strand acting as the template strand is also referred to as the noncoding strand, minus strand or antisense strand. Selection of which DNA strand serves as the template strand depends on the gene being transcribed - The enzyme RNA polymerase synthesizes mRNA molecules in the 5' to 3'direction by reading the template DNA strand in the 3' to 5' direction - In eukaryotic cells the mRNA transcript undergoes a series of enzyme-regulated modifications **13. Describe how the phenotype of an organism is determined by its genotype** -Translation of the mRNA to generate a polypeptide occurs on ribosomes that are present in the cytoplasm of both prokaryotic and eukaryotic cells and on the rough endoplasmic reticulum of eukaryotic cells -In prokaryotic organisms, translation of the mRNA molecule occurs while it is being transcribed		

			-Translation involves energy and many sequential steps, including initiation, elongation, and termination -The salient features of translation -Genetic information is retroviruses is a special case and has an alternate flow of information **14. Describe the types of interaction that regulat gene expression** -regulatory sequences are stretches of DNA that interact with regulatory proteins to control transcription -Epigenetic changes can affect gene expression through reversible modifications of DNA or histones -The phenotype of a cell or organism is determined by the combination of genes that are expressed and the levels at which they are expressed **15. Explain how the location of regulatory sequences relates to their function** -Both prokaryotes and eukaryotes have groups of genes that are coordinately regulated **16. Explain how the binding of transcription factors to promoter regions affects gene expression and/or the phenotype of the organism** - Promoters are DNA sequences upstream of the transcription start site where RNA polymerase and transcription factors bind to initiate transcription - Negative regulatory molecules inhibit gene expression by binding to DNA and blocking transcription **17. Explain the connection between the regulation of gene expression and phenotypic differences in cells and organisms** -Gene regulation results in differential gene expression and influences cell products and function -Certain small RNA molecules have roles in regulating gene expression **18. Describe the various types of mutation** -Changes in genotype can result in changes in phenotype -Alterations in a DNA sequence can lead to changes in the type or amount of the protein produced and the consequent phenotype. DNA mutations can be positive, negative or neutral. **19. Explain how changes in genotype may result in changes in phenotype** -Errors in DNA replication or SNA repair mechanisms, and external factors, including		

			radiation and reactive chemicals, can cause random mutation in the DNA -Errors in mitosis or meiosis can result in changes in phenotype **20. Explain how alterations in DNA sequences contribute to variation that can be subject to natural selection** -Changes in genotype may affect phenotypes that are subject to natural selection. Genetic changes that enhance survival and reproduction can be selected for by environmental conditions **21. Explain the use of genetic engineering techniques in analyzing or manipulating DNA** -Genetic engineering techniques can be used to analyze and manipulate DNA and RNA		

Curriculum Map

Course Title: AP Biology	**Quarter:** 4	**Academic Year:** 2022-2023

Essential Questions for this Quarter:

1. What conditions in a population make it more or less likely to evolve?
2. Scientifically defend the theory of evolution?
3. How does species interaction encourage or slow changes in species?
4. How does diversity among and between species in a biological system affect the evolution of species within the system?
5. How does the acquisition of energy relate to the health of a biological system?
6. How do communities and ecosystems change, for better or worse, due to biological disruption?
7. How does a disruption of a biological system affect genetic information storage and transmission?
8. How do species interactions affect the survival of an ecosystem?

Unit/Time Frame	Standards	Content	Skills	Assessment	Resources
UNIT 7 – (4 weeks) **-Natural Selection** **UNIT 8 – (3 weeks)** **-Ecology** **AP Test Review – (2 weeks)**	**7.1** **7.2** **7.3** **7.4** **7.5** **7.6**	UNIT 7 NATURAL SELECTION -Introduction to natural selection -Natural selection -Artificial selection -Population genetics -Hardy-Weinberg Equilibrium	**NATURAL SELECTION** **1. Describe the causes of natural selection** - Natural selection is a major mechanism of evolution - According to Darwin's theory of natural selection, competition for limited resources results in differential survival.	Test / Quizzes 40% Labs 40% Homework 20%	AP 11th Edition Campbell Biology MasteringBiology.com AP Central AP Test Prep Series

	7.7 **7.8** **7.9** **7.10** **7.11** **7.12** **7.13** **8.1** **8.2** **8.3** **8.4** **8.5** **8.6** **8.7**	-Evidence of Evolution -Common Ancestry -Continuing Evolution -Phylogeny -Speciation -Extinction -Variations in Populations -Origins of Life on Earth UNIT 8 ECOLOGY -Responses to the environment -Energy flow through ecosystems -Population ecology -Effect of density of populations -Community ecology -Biodiversity -Disruptions to ecosystems	**2. Explain how natural selection affects populations** - Evolutionary fitness is measured by reproductive success - Biotic and abiotic environments can be more or less stable/fluctuating, and this affects the rate and direction of evolution; different genetic variations can be selected in each generation **3. Describe the importance of phenotypic variation in a population** -Natural selection acts on phenotypic variations in populations -Environments change and apply selective pressures to populations -Some phenotypic variations significantly increase and decrease fitness of the organism in particular environments **4. Explain how humans can affect diversity within a population** -Through artificial selection, humans affect variation in other species **5. Explain the relationship between changes in the environment and evolutionary changes in the population** -Convergent evolution occurs when similar selective pressures result in similar phenotypic adaptations in different populations or species **6. Explain how random occurrences affect the genetic makeup of a population** - Evolution is also driven by random occurrences **7. Describe the role of random processes in the evolution of specific populations** -Reduction of genetic variation within a given population can increase the differences between populations of the same species **8. Describe the change in the genetic makeup of a population over time** -Mutation results in genetic variation, which provides phenotypes on which natural selection acts **9. Describe the conditions under which allele and genotype frequencies will change in populations** -Hardy-Weinberg is a model for describing and predicting allele frequencies in a non evolving population **10. Explain the impacts on the population if any of the conditions of Hardy-Weinberg are not met** -Changes in allele frequencies provide evidence for the occurrence of evolution in a population		

			-Small populations are more susceptible to random environmental impact than large populations **11. Describe the types of data that provide evidence for evolution** - Evolution is supported by scientific evidence from many disciplines **12. Explain how morphological, biochemical, and geological data provide evidence that organisms have changed over time** - Molecular, morphological, and genetic evidence from extant and extinct organisms adds to our understanding of evolution - A comparison of DNA nucleotide sequences and/or protein amino acid sequences evidence for evolution and common ancestry **13. Describe the fundamental molecular and cellular features shared across all domains of life, which provide evidence of common ancestry** -Many fundamental molecular and cellular features and processes are conserved across organisms -Structural and functional evidence supports the relatedness of organisms in all domains **14. Describe structural and functional evidence on cellular and molecular levels that provides evidence for the common ancestry of all eukaryotes** -Structural evidence indicates common ancestry of all eukaryotes: membrane bound, linear chromosomes, genes that contain introns **15. Explain how evolution is an ongoing process in all living organisms** -Populations of organisms continue to evolve -All species have evolved and continue to evolve **16. Describe the types of evidence that can be used to infer an evolutionary relationship** - Phylogenetic trees and cladograms show evolutionary relationships among lineages **17. Explain how a phylogenetic tree and/or cladogram can be used to infer evolutionary relatedness** -Phylogenetic trees and cladograms can be used to illustrate speciation that has occurred. The nodes on a tree represent the most recent common ancestor of any two groups or lineages - Phylogenetic trees and cladograms can be constructed from morphological similarities of living or fossil species and from DNA and protein sequence similarities		

			- Phylogenetic trees and cladograms represent hypotheses and are constantly being revised, based on evidence **18. Describe the conditions under which new species may arise** -Speciation may occur when two populations become reproductively isolated from each other -The biological species concept provides a commonly used definition of species for sexually reproducing organisms **19. Describe the rate of evolution and speciation under different ecological conditions** -Punctuated equilibrium is when evolution occurs rapidly after a long period of stasis. Gradualism is when evolution occurs slowly over hundreds of thousands or millions of years. -Divergent evolution occurs when adaptation to new habitats results in phenotypic diversification **20. Explain the processes and mechanisms that drive speciation** -Speciation results in diversity of life forms -Speciation may be sympatric or allopatric -Various prezygotic and postzygotic mechanisms can maintain reproductive isolation and prevent gene flow between populations **21. Describe the factors that lead to the extinction of a populations** -Extinctions have occurred throughout Earth's history -Extinction rates can be rapid during times of ecological stress **22. Explain how the risk of extinction is affected by changes in the environment** -Human activity can drive changes in ecosystems that cause extinctions **23. Explain species diversity in an ecosystem as a function of speciation and extinction rates** -The amount of diversity in an ecosystem can be determined by the rate of speciation and the rate of extinction **24. Explain how extinction can make new environments available for adaptive radiation** -Extinction provides newly available niches that can then be exploited by different species **25. Explain how the genetic diversity of a species or population affects its ability to withstand environmental pressures**		

			-The level of variation in a populations affects population dynamics **26. Describe the scientific evidence that provides support for models of the origin of life on Earth** -Several hypotheses about the origin of life on Earth are supported with scientific evidence -The RNA World Hypothesis proposes that RNA could have been the earliest genetic material **ECOLOGY** **27. Explain how the behavioral and/or physiological responses of an organism is related to changes in internal or external environment** -Organisms respond to changes in their environment through behavioral and physiological mechanism -Organisms exchange information with one another in response to internal changes and external cues, which can change behavior **28. Explain how the behavioral responses of organisms affect their overall fitness and may contribute to the success of the population** -Individuals can act on information and communicate it to others -Communication occurs through various mechanisms -Responses to information and communication of information are vital to natural selection and evolution **29. Describe the strategies organisms use to acquire and use energy** -Organisms use energy to maintain organization, grow and reproduce **30. Explain how changes in energy availability affect populations and ecosystems** -Changes in energy availability can result in changes in population size -Changes in energy availability can result in disruptions to an ecosystem **31. Explain how the activities of autotrophs and heterotrophs enable the flow of energy within an ecosystem** -Autotrophs capture energy from physical or chemical sources in the environment -Heterotrophs capture energy present in carbon compounds produced by other organisms **32. Describe factors that influence growth dynamics of populations**		

			-Populations comprise individual organisms that interact with one another and with the environment in complex ways -Many adaptations in organisms are related to obtaining and using energy and matter in a particular environment **33. Explain how the density of a population affects and is determined by resources availability in the environment** -A population can produce a density of individuals that exceeds the system's resource availability -As limits to growth due to density-dependent and density-independent factors are imposed, a logistic growth model generally ensues **34. Describe the structure of a community according to its species composition and diversity** -The structure of a community is measured and described in terms of species composition and species diversity **35. Explain how interactions within and among populations influence community structure** -Communities change over time depending on interactions between populations -Interactions among populations determine how they access energy and matter within a community -Relationships among interacting populations can be characterized by positive and negative effects and can be modeled -Competition, predation, and symbioses, including parasitism, mutualism, and commensalism, can drive population dynamics **36. Explain how community structure is related to energy availability in the environment** -Cooperation or coordination between organisms, populations, and species can result in enhanced movement of, or access to, matter and energy **37. Describe the relationship between ecosystem diversity and its resilience to changes in the environment** -Natural and artificial ecosystems with fewer component parts and with little diversity among the parts are often less resilient to changes in the environment		

			-Keystone species, produces, and essential abiotic and biotic factors contribute to maintaining the diversity of an ecosystem **38. Explain how the addition or removal of any component of an ecosystem will affect its overall short-term and long-term structure** -The diversity of species within an ecosystem may influence the organization of the ecosystem -The effects of keystone species on the ecosystem are disproportionate relative to their abundance I the ecosystem, when when they are removed from the ecosystem, the ecosystem often collapses **39. Explain the interaction between the environment and random or preexisting variations in populations** -An adaptation is a genetic variation that is favored by selection and is manifested as a trait that provides an advantage to an organism in a particular environment -Mutations are random and are not directed by specific environmental pressures **40. Explain how invasive species affect ecosystem dynamics** -The intentional or unintentional introduction of an invasive species can allow the species to exploit a new niche free of predators or competitors or to outcompete other organisms for resources. -The availability of resources can result in uncontrolled population growth and ecological changes **41. Describe human activities that lead to changes in ecosystem structure and/or dynamics** -The distribution of local and global ecosystems changes over time -Human impact accelerates change at local and global levels **42. Explain how geological and meteorological activity leads to changes in ecosystem structure and/or dynamics** -Geological and meteorological events affect habitat change and ecosystem distribution. Biogeographical studies illustrate these changes.		