Biology Curriculum Map

Six Weeks	Unit	Unit Focus	Biology Essential Standards	Vocabulary	Literacy in Science & Technical Subjects/ 8 Mathematical Practices
First Six Wks	Unit 1 **Sci. Method and Biochemistry**	Review Steps and processes of the Scientific Method. Discuss importance of structure and function of biological molecules and enzymes. Conduct experiment testing biological molecules. **Constructed Response 7** ***(Refer to the end of document for complete list):*** The diagram below shows the molecular structure of glucose:	4.1.1, 4. 1.1, 4.1.3 (2.1.2 3.1.1, 3.1.2, 4.1.2, 4.2.1, 4.2.2) 1. I can identify the major elements necessary to build molecules in living things. 2. I can determine if a substance is an acid or base by reading a pH indicator strip. 3. I can predict the effects of an acid or base on a living thing. 4. I can relate the causes of acid rain and its effects on organisms. 5. I can describe how a buffer can maintain homeostasis. 6. I can determine the elements present in a carbohydrate and their ratio and structure. 7. I can explain the role of carbohydrates. 8. I can predict the source of a carbohydrate and its function based on its name. 9. I can compare and contrast the shape an energy content of a carbohydrate with other biomolecules. 10. I can identify the shape of a lipid.	Carbohydrates Glucose Cellulose Starch Glycogen Proteins Enzymes Insulin Hemoglobin	Literacy • RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics*. • RST.9-10.5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms • RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. • RST.9-10.9. Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. Writing • WHST.9-10.1 Write arguments focused on discipline-specific content. • WHST.9-10.2 Write informative/explanatory texts, including the narration of historical

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		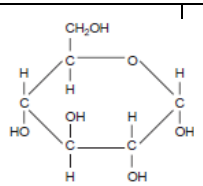
		Glucose is a simple carbohydrate that is important to living organisms.
		a. Describe the primary function of glucose in cells.
		b. Simple sugars like glucose can be used to make larger organic molecules. Identify **two** larger molecules made from simple sugars.
		c. Identify a specific cellular process that would be affected by a glucose shortage, and
			11. I can compare and contrast the shape and energy content of a lipid with other biomolecules.
			12. I can discuss secondary functions of the lipid including insulation, hormones, cell membrane, and waxes.
			13. I can explain why organisms that hibernate and estivate should store energy in lipid form instead of carbohydrate form.
			14. I can discuss the role of a hormone and give specific examples.
			15. I can compare and contrast lipids with other biomolecules.
			16. I can identify the building blocks of a protein.
			17. I can compare the energy available in a protein to other biomolecules.
			18. I can explain the primary function of a protein is structure.
			19. I can discuss the role of a special group of proteins called enzymes.
			20. I can relate the specificity and role of the enzyme to their structure.
			21. I can evaluate the effect of pH and temperature on structure of an enzyme and protein.
				Lipids
				
				Phospholipids
				
				Steroid
				
				Nucleic Acids
				Enzyme-Substrate Complex
				
				Specificity
				
				Active Site
				
				Catalyst
				
				Activation Energy
				
				Denaturation
					events, scientific procedures/ experiments, or technical processes.
					• WHST.9-10.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
					Mathematics
					• Reason abstractly and quantitatively
					  ● Uses appropriate tools strategically
					  ● Look for and make use of structure
					  ● Attend to precision

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		discuss the effects of the shortage on the process you identified.	22. I can compare and contrast proteins with other biomolecules. 23. I can identify the shape of a nucleotide and the three components. 24. I can discuss three nucleic acids and their functions. 25. I can compare and contrast the sugars in DNA and RNA, as well their different functions. 26. I can compare and contrast nucleic acids with other biomolecules.		
First Six Wks	Unit 2 **Eukaryotic/Prokaryotic Cells**	Understand the relationship between the structure and functions of cells and their organelles as a living system. Cell differentiation and adaptations.	1.1.1, 1.1.2, 1.2.3, 1.1.3, (1.2.1, 1.2.2, 4.2.1) 1. I can compare and contrast the structures, complexity, evolutionary history, and reproduction in a prokaryotic and eukaryotic cells.in reference to presence of: a. Mitochondria b. Nucleus c. Vacuole d. Chloroplasts	Chloroplast Ribosome Nucleus Plasma Membrane Vacuoles	Literacy • RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. • RST.9-10.5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*). • RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually

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			e. Ribosomes f. DNA and RNA 2. I can identify the four basic components of every cell and their function. To include plasma membrane, ribosomes, DNA, and cytoplasm. 3. I can explain why viruses are not classified as living things. I can explain the need for a host cell and the components of a virus. 4. I can differentiate between unicellular and multicellular organisms. 5. I can identify and analyze unique structures and organelles that enable the unicellular organism to survive. I can identify how the following cellular structures enhance survival: a. Contractile Vacuoles b. Cilia c. Flagella d. Pseudopods e. Eyespots 6. I can discuss the purpose of a stem cell and explain the process and end goal	Mitochondria Cell Wall Cytoplasm Surface Area Eukaryote Prokaryote Magnification Plasmids Nuclear Membrane Unicellular Multicellular Contractile Vacuoles Cilia Flagella	or mathematically (e.g., in an equation) into words. • RST.9-10.9. Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. Writing • WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. • WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research. Mathematical ● Use appropriate tools strategically ● Look for and make use of structure

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			of differentiation. 7. I can identify the major organelles and their functions. 8. I can explain the relationship between each organelle and their function. 9. I can identify the following (including the nucleus, plasma membrane, cell wall, mitochondria, vacuoles, chloroplasts, and ribosomes) 10. I can discuss in detail how oxygen and carbon dioxide are cycle and energy is transformed by mitochondria and the chloroplast. 11.I can explain how the folded inner membrane of mitochondria aids in its function. 12. I can select several cell organelles and summarize how they interact with each other to help the cell function. 13.I can operate a compound light microscope and calculate total power of magnification. 14. I can explain how the structure relates to their function in the following cells: a. Nerve Cells b. Muscle Cells c. Blood Cells d. Sperm Cells 15 I can outline the development of multicellular organisms, from zygote to	Pseudopodia Eyespots Cell Specialization Differentiation Embryonic Stem Cells Adult Stem Cells Nerve Cells Muscle Cells Red Blood Cell White Blood Cell Sperm Cells	

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			embryo. 16. I can recognize how gene expression controls cell specialization.		
First Six Wks	Unit 3 **Homeostasis / Diffusion/ Osmosis**	Explain how homeostasis is maintained in the cell and within an organism in various environments (including pH and temperature). Explain how active transport is used to maintain homeostasis.	1.1.1, 1.2.1, 4.2.2 (4.1.1, 4.1.3 1.2.3) 1. I can determine if a substance is an acid or base by reading a pH indicator strip. 2. I can predict the effects of an acid or base on a living thing. 3. I can relate the causes of acid rain and its effects on organisms 4. I can describe how a buffer can maintain homeostasis. 5. I can identify the parts of the cell membrane and their individual functions. 6. I can identify how osmosis and diffusion are maintain homeostasis. 7. I can analyze situations and determine how water will move from a high concentration to a low concentration to maintain homeostasis. 8. I can apply my knowledge of concentrations to diagrams and determine if the flow of the material would be active or	Homeostasis Buffers Active Transport Passive Transport Diffusion Osmosis PH Concentration Selectively permeable Phospholipid I	Literacy • RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. • RST.9-10.5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*). • RST.9-10.9. Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. Writing • WHST.9-10.1 Write arguments focused on discipline-specific content. • WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. • WHST.9-10.7 Conduct short as well as more sustained research projects to answer a

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			passive. 9. I can explain how active transport is used to maintain homeostasis and how unicellular organisms are adapted to pumping out water. 10. I can compare and contrast passive and active transport and discuss the amount of energy they use. 11. I can identify the parts of the plasma membrane and explain the role each part plays in the movement of materials in and out of the cell..		question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. Mathematical ● Use appropriate tools strategically ● Look for and make use of structure ● Construct viable arguments and critique the reasoning of others
First Six Wks	Unit 4 **Energy/ Photosynthesis/ Respiration**	Analyze the flow of energy and cycling of matter through ecosystems. Analyze photosynthesis and cellular respiration in terms of how energy is stored, released, and transferred within and	2.1.1, 4.2.1 (1.1.1, 1.2.3, 2.1.3, 4.2.2) 1. I can explain the role of mitochondria and chloroplast in photosynthesis and respiration. 2. I can analyze how oxygen and carbon dioxide is cycled through the ecosystem in the processes of photosynthesis and respiration. 3.I can name reactants and products in: a. Photosynthesis b. Cellular Respiration 4.I can identify several factors that affect the rates of:	Reactants Products Photosynthesis Cellular Respiration	Literacy ● RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10* ***texts and topics*****.** ● RST.9-10.5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms ● RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually

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		between these systems.	a. Photosynthesis b. Cellular Respiration 5. I can distinguish between aerobic and anaerobic respiration as related to ATP production. 6. I can name the types of organisms that carry out: a. Photosynthesis b. Cellular Respiration 7. I can name cell organelles involved in: a. Photosynthesis b. Cellular Respiration 8. I can explain when lactic acid fermentation and alcoholic fermentation take place and the products of each. 9. I can explain how energy is used to maintain homeostasis.	ATP Aerobic Respiration Anaerobic Respiration Lactic Acid Fermentation Alcoholic Fermentation Mitochondria Chloroplasts	or mathematically (e.g., in an equation) into words. Writing ● WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. ● WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research. Mathematical ● Makes sense of problems and persevere in solving them ● Construct viable arguments and critique the reasoning of others ● Look for and make use of structure ● Model with mathematics ● Reason abstractly and quantitatively
Second Six Wks	Unit Five **Cell Cycle and Mitosis/ Meiosis**	Analyze how cells grow and reproduce in terms of interphase, mitosis, meiosis, and cytokinesis.	1.2.2, 3.2.1 (1.1.1, 2.1.2, 3.1.1) 1. I can explain the function and structure of chromosomes. 2. I can explain the cell cycle and its components. 3. I can explain the importance of Interphase in preparing the cells to divide. 4. I can sequence the phases of mitosis	Cell Cycle Growth 1 Synthesis Growth 2 Mitosis	Literacy ● RST.9-10.5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms ● RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

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			and discuss the importance of mitosis to cell division. 5. I can explain the role of cytokinesis and its importance I 6. I can compare the daughter cells produced by mitosis to the original parent cell. 7. I can analyze the environmental effects on the cell cycle and how it causes malfunctions such as cancer. 8. I can explain the function of meiosis. 9. I can analyze the effects of meiosis on chromosome number. 10. I can compare the chromosome number of cells produced by meiosis to the original parent cell. 11. I can explain how the process of crossing over and independent assortment increase variation. 12. I can explain how various mutagens create specific mutations. 13. I can identify specific mutations and analyze them by reading a karyotype. (Nondisjunction) 14. I can compare and contrast the processes of cell division in plants and animals. 15. I can identify processes occurring in each phase of meiosis analyzing	Cytokinesis Asexual Reproduction Budding Binary Fission Regeneration Meiosis Genes Chromosomes Crossing Over Nondisjunction Homologous Chromosomes Gametes Somatic Cells Variation	Writing • WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. • WHST.9-10.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. • WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research. Mathematical ● Construct viable arguments and critique the reasoning of others ● Look for and make use of structure ● Reason abstractly and quantitatively ● Model with mathematics ● Use appropriate tools strategically ● Attend to precision

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			diagrams of the phases. 16. I can explain how meiosis can lead to greater genetic diversity. 17.I can explain how the following processes can lead to genetic variation: a. Crossing Over b. Independent Assortment c. Gene Mutation d. Nondisjunction e. Fertilization 18. I can compare and contrast mitosis and meiosis in terms of: a. chromosome number b. number of cell divisions c. number of cells produced d. type of reproduction e. replication of DNA	Cancer Karyotype Monosomy Trisomy Autosomes	
Second Six Weeks	Unit Six **Genetics**	Understand how the environment, and/or the interaction of alleles, influences the expression of genetic traits.	1.2.2, 3.2.1 (1.1.1, 2.1.2, 3.1.1) 1. I understand Mendel's law and how they impact inheritance. 2. I can identify the structures of a flower and the function of each. 3. I understand what dominant and recessive means. 4. I can write homozygous dominant,	Punnett Square Genotypic Ratio Phenotypic Ratio Alleles	Literacy • RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. • RST.9-10.5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*).

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			heterozygous, and homozygous recessive. 5. I can distinguish between genotypes and phenotypes? I understand how genotype affects phenotypes. 6. I can analyze a problem and set up a Punnett square to solve it. 7. I can explain the difference between complete, incomplete and codominance. 8. I can identify the blood types and explain who can receive which transfusion. 9. I can write out blood types and do blood crosses. 10. I can identify the characteristics and inheritance pattern for cystic fibrosis, Huntington's, PKU, and Tay-Sach's. 11. I know what multiple alleles are and an example of this type of inheritance. 12. I can analyze a word problem and determine how to write a sex-linked genotype. 13. I know examples of sex-linked traits and can explain how they are	Dominant Recessive Heterozygous Homozygous Independent Assortment Pedigrees Codominance Incomplete Dominance Intermediate	● RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. Writing ● WHST.9-10.1 Write arguments focused on discipline-specific content. ● WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. ● WHST.9-10.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. Mathematical ● Reason abstractly and quantitatively ● Construct viable arguments and critique the reasoning of others ● Model with mathematics ● Use appropriate tools strategically ● Attend to precision ● Look for and make use of structure

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			transmitted. 14. I can explain the symptoms of colorblindness and hemophilia. 15. I can explain why males are likely to obtain sex-linked recessive traits. 16. I can read a pedigree. 17. I can explain what the symbols mean on a pedigree. 18. I can determine what type of inheritance is exhibited in a pedigree. 19. I can explain the effect of inbreeding on a pedigree and predict if an individual is a carrier of the gene. 20. I can explain the purpose of a testcross and the genotypes use. 21. I can explain polygenic inheritance and give examples of traits that are inherited via polygenic inheritance. 22. What traits are inherited by polygenic inheritance? 23. I can explain how environment may affect phenotype and give specific examples such as PKU, twins separated	Polygenic Traits Sex-Linked Traits Hemophilia Cystic Fibrosis Huntington's disease Carrier Test cross Inbreeding PKU Sickle Cell Anemia	• Look for and express regularity in repeated reasoning

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			at birth, lack of sunlight on chlorophyll, and Himalayan rabbits		
Second Six Wks	Unit 7		3.1.1, 3.1.2, 3.1.3, 3.2.3, 4.1.2 (1.1.1, 1.1.2, 1.1.3,2.1.2, 3.4.3, 3.5.2, 4.1.1, 4.1.3) 1. I can identify the monomer of DNA and RNA. 2. I can diagram the structure of DNA and identify the sugar of DNA. 3. I can apply the base pairing rules. 4. I can identify the bonds that hold DNA together and analyze their significance in replication. 5. I understand the process and location of replication. 6. I can summarize the process of replication. 7. I can explain the impact of an incorrect base pair during replication. 8. I can identify the monomer of DNA and RNA. 9 I can diagram the structure of DNA and identify the sugar of DNA. 10. I can apply the base pairing rules. 11. I can identify the bonds that hold DNA together and analyze their significance in replication. 12. I understand the process and location of replication.	Replication Semi-conservative Hydrogen bond Transcription Translation mRNA tRNA rRNA Ribosome Amino Acids Polypeptides Peptide Bonds Codon Anti-Codon Proteins Mutation Deletion	Literacy • RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. • RST.9-10.5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*). • RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. Writing • WHST.9-10.1 Write arguments focused on discipline-specific content. • WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. • WHST.9-10.6 Use technology, including the Internet, to produce, publish, and update

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			13. I can summarize the process of replication. 14. I can explain the impact of an incorrect base pair during replication. 15.I can assess a sequence of nucleic acids and complete the following a. determine if it is DNA or RNA b. replicate DNA to DNA c. transcribe DNA to RNA d. Convert RNA to RNA e. identify a mutation f. Infer the affect of the mutation on the protein sequence. 16. I can identify possible mutagens in the environment.	Addition Substitution	individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. Mathematical ● Reason abstractly and quantitatively ● Construct viable arguments and critique the reasoning of others ● Model with mathematics ● Use appropriate tools strategically ● Attend to precision ● Look for and make use of structure ● Look for and express regularity in repeated reasoning
Second Six Wks.	Unit 8 **Genetic and Biotechnology**	Understanding the application of DNA technology including transgenic organisms, ethical issues, and the Human Genome Project.	3.3.1, 3.3.2, 3.3.3 (3.2.2) 1. I can explain how the process of gel electrophoresis separates molecules based on size. 2. I can interpret or "read" a gel. 3. I can explain how DNA is used to compare, catalog and identify organisms. 4. I can explain several uses of transgenic organisms in agriculture and pharmaceuticals.	Gel Electrophoresis Restriction Enzymes DNA Fingerprinting Transgenic Organism Insulin Plasmid	Literacy ● RST.9-10.2. Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. ● RST.9-10.5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms ● RST.9-10.6. Analyze the author's purpose in providing an explanation, describing a

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			5. I can summarize the steps of bacterial transformation. 6. I can summarize the steps in transforming a bacteria to produce a specific product (insulin/human growth hormone). 7. I can identify reasons for establishing the Human Genome Project. 8. I can explain how the Human Genome Project can lead to new types of gene therapy. 9. I can discuss several ethical issues surrounding stem cell research, gene therapy and the use of genetically modified organisms. 10. I can discuss stem cells and how gene expression allows for differentiation.	Human Genome Project Gene Therapy Genomics Stem Cell Research Genetically Modified Organism Biotechnology Gene Therapy	procedure, or discussing an experiment in a text, defining the question the author seeks to address. • RST.9-10.8. Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. Writing • WHST.9-10.1 Write arguments focused on discipline-specific content. • WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. • WHST.9-10.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. • WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research Mathematical • Constructs viable arguments and critique the reasoning of others • Look for and express regularity in repeated reasoning

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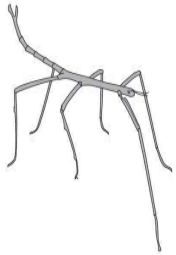
Third Six Wks	Unit 9 **Evolution**	Explain the theory of evolution by natural selection as a mechanism for how species change over time, survive and reproduce. **Constructed Response 1: Use picture to answer the question**  **Walking Stick (unstriped)** Scientists observe insects called walking sticks living in the California Mountains.	2.1.2, 3.4.1, 3.4.2, 3.4.3 (3.1.1, 3.1.2, 3.1.3, 3.3.1, 4.1.1, 4.1.2) 1. I can use Miller/Urey's experiment to discuss the hypothesized early Earth atmosphere. 2. I can apply my prior knowledge of prokaryotes and anaerobic fermentation to explain the first cells. 3. I can create a time line showing the order in which various types of cells appeared on Earth. 4. I can discuss how fossil evidence can be used to gain an understanding of the evolution of species. Law of Superposition. 5. I can discuss biochemical similarities and anatomical structures as related to our understanding of evolution. 6. I can distinguish between homologous, analogous, and vestigial structure and how infer from this common ancestor and similarity of environment. 7. I can explain these aspects of natural selection: a. population numbers b. genetic variability c. limited resources d. adaptations e. survival and reproduction f. speciation	Aerobic Organisms Anaerobic Organisms Miller/Urey Experiment Oparin's Theory Prokaryote Eukaryote Photosynthetic Endosymbiosis Fossil Evidence Law of Superposition **Biochemical Evidence** Homologous Structures Vestigial Structures Analogous structures	Literacy • RST.9-10.2. Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. • RST.9-10.5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms • RST.9-10.6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address. • RST.9-10.8. Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. • RST.9-10.9. Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. Writing • WHST.9-10.2 Write informative/explanatory

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		The insects look like the plants on which they live. The walking stick population has two patterns: • Some have striped patterns on their bodies and are usually found on striped chamise plants. • Some have no stripes and are usually found on unstriped lilac plants. Describe how the theory of evolution is supported by the walking stick population, **and** predict how the walking stick population	8. I can explain the increase in the allele frequency of an advantageous adaptation in terms of fitness. 9. I can illustrate the role of geographic isolation and reproductive isolation in speciation. 10. I can discuss the process of natural selection that leads to: a. antibiotic resistance in bacteria b. pesticide resistance in insects 11. I can discuss the types of evolution and the mechanisms that drive them. 12.I can discuss the role of coevolution in terms of symbioses to include: a. mutualism b. predation c. parasitism d. competition 13. I can discuss the role of selection in speciation and fitness. 14.I can discuss the rates of evolution to include: a. gradualism punctuated equilibrium 15. I can discuss passive/active immunity, antivirals and vaccines as related to natural selection.	Allele frequency Adaptation Geographic isolation Reproductive isolation Antibiotic resistance Pesticide resistance Mutualism Predation Parasitism Convergent evolution Divergent evolution Coevolution Passive immunity Active immunity	texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. • WHST.9-10.9 Draw evidence from informational texts to support analysis, reflection, and research. Mathematical • Construct viable arguments and critique the reasoning of others • Look for and make use of structure • Look for and express regularity in repeated reasoning

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		would change over time if the lilac population was rapidly reduced by a virus.		Directional selection Stabilizing selection Disruptive selection Sexual selection Genetic Drift	
Third Six Wks	Unit 10 **Populations/ Classifications/Viruses/ Bacteria**	Analyze the classification of organisms according to their evolutionary relationships and how they adapt to survive and reproduce.	1.2.3, 2.1.2, 3.5.1, 3.5.2 (1.1.1, 1.1.2, 1.1.3, 2.1.3, 3.4.3, 4.2.2) 1. I can explain why classification systems have changed over time. 2. I can describe some early classification systems and how they differ from some more modern ones. 3. I can use a dichotomous key to identify an unknown organism. 4. I can analyze a phylogenetic tree to compare relatedness of organisms. 5. I can infer an organism's time of appearance in history based on a phylogenetic tree. 6. I can analyze how various adaptations allow organisms to survive and reproduce in various environments. 7. I can analyze how the following	Dichotomous Key Phylogenic Tree Common Ancestor Transport Excretion Vascular Plant Xylem Phloem Stomata **Nonvascular Plant** Respiration	Literacy ● RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics*. ● RST.9-10.5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms ● RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. ● RST.9-10.9. Compare and contrast findings

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			structural adaptations help organisms accomplish basic life functions: a. Nutrition b. Respiration c. Transport & Excretion Mechanisms d. Camouflage e. Movement 8. I can analyze how the following reproductive adaptations help organisms accomplish basic life functions: a. Sexual vs. Asexual Reproduction b. Eggs c. Spores d. Seeds e. Placenta f. Types of Fertilization 9. I can analyze how the following behavioral adaptations help organisms accomplish basic life functions: a. Suckling b. Taxes/Taxis c. Migration d. Estivation e. Hibernation f. Habituation g. Imprinting h. Classical Conditioning i.Trial and Error Learning	Nutrition Autotrophic Heterotrophic Asexual Reproduction Sexual Reproduction Eggs Seeds Internal Fertilization External Fertilization Spore Stimulus . Trial and Error Learning Symbiotic Relationships Mutualism Parasitism Predator Prey	presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. Writing ● WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. ● WHST.9-10.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. Mathematical ● Reason abstractly and quantitatively ● Construct viable arguments and critique the reasoning of others ● Look for and make use of structure ● Look for and express regularity in repeated reasoning

Biology Curriculum Map

				Competition Pheromones Courtship Behavior Territoriality Imprinting Innate Instinct Classical Conditioning	
Third Six Wks	Unit 11 **Ecology**	Explain how organisms interact with each other and their environment. Infer how human activities may impact the environment.	2.1.1, 2.1.3, 2.1.4, 2.2.1, 2.2.2 (4.2.1) 1. I can describe the effects of removal of an organism from a food web. 2.I can interpret the following population graphs: S-curve and carrying capacity, J curve and exponential growth, human population graphs 3.I can explain how viruses and other diseases can affect populations 4. I can explain the following human impacts on natural resources: a. Resource Depletion b. Deforestation	Acid Rain Deforestation Carrying capacity Exponential growth Logistic growth Habitat Destruction Invasive Plants	Literacy • RST.9-10.2. determine the central ideas or conclusions of a text; trace the text's explanation or DEPICTION of a complex process, phenomenon, or concept; provide an accurate summary of the text. • RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics*. • RST.9-10.5. Analyze the structure of the relationships among concepts in a text,

Biology Curriculum Map

			c. Pesticide Use d. Bioaccumulation 5. I can describe several conservation methods. 6. I can explain the meaning of stewardship as related to the environment. 7... I can identify resources as sustainable or non-sustainable. 8. I can explain the affect that non-native species have on biodiversity and how they can outcompete native species. 9. I can explain the importance of keystone species. 10 I can label a diagram of a carbon cycle with: a. Photosynthesis b. Cellular Respiration c. Decomposition 11. I can explain the role of nitrogen-fixing bacteria in the nitrogen cycle. 12 I can identify ways that humans impact the carbon cycle as related to the greenhouse effect. 13 I can identify natural processes (as opposed to human impact) that can lead to climate change. Examples volcano and seasonal change. 14 I can explain the recycling of matter and the tendency toward a more disorganized state. 15 I can explain the importance of	Photosynthesis Cellular Respiration Decomposition Nutrient Cycle Carbon Cycle Greenhouse Effect Nitrogen Cycle Nitrogen Fixation Energy Pyramid Energy Transfer Radiant Energy Chemical Energy Producers Fertilizer	including relationships among key terms • RST.9-10.6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address. • RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. • RST.9-10.8. Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. • RST.9-10.9. Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. Writing • WHST.9-10.1 Write arguments focused on discipline-specific content. • WHST.9-10.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

Biology Curriculum Map

			continuous radiant energy in an ecosystem. 16. I can analyze an energy pyramid and label the direction of energy transfer as well as the amount of energy transferred at each level. 17 I can summarize how the following human activities impact the environment: a. human population growth b. technology c. consumption of resources d. production of wastes 18. I can explain several factors that impact North Carolina ecosystems (invasive species, pollution, deforestation, disease) 19.I can interpret data related to the historical and predicted impact on ecosystems and global climate.	Resource Depletion Deforestation Pesticide Bioaccumulation Conservation Stewardship Sustainability	• WHST.9-10.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. Mathematical • Makes sense of problems and persevere in solving them • Reason abstractly and quantitatively • Construct viable arguments and critique the reasoning of others • Model with mathematics • Use appropriate tools strategically • Attend to precision • Look for and make use of structure • Look for and express regularity in repeated reasoning

Biology Curriculum Map

Unit One: Scientific Method and Biochemistry

Standard	Learning Target
Bio.4.1.1 Compare the structures and functions of the major biological molecules (carbohydrates, proteins, lipids, and nucleic acids) as related to the survival of living organisms.	• Compare the structure and function of each of the listed organic molecules and organisms (carbohydrates, proteins, lipids, and nucleic acids).
Bio.4.1.3 Explain how enzymes act as catalysts for biological reactions.	• Develop a cause and effect model for specificity of enzymes.

Biology Curriculum Map

Unit Two: Eukaryotic and Prokaryotic Cells

Standard	Learning Target
Bio.1.1.1 Summarize the structure and function of organelles in eukaryotic cells (including the nucleus, plasma membrane, cell wall, mitochondria, vacuoles, chloroplasts, and ribosomes) and ways that these organelles interact with each other to perform the function of the cell.	● Identify the cell organelles and diagrams of plant and animal cells. ● Explain how the structure of the organelle determines its function. ● Summarize how organelles interact to carry out functions.
Bio.1.1.2 Compare prokaryotic and eukaryotic cells in terms of their general structures (plasma membrane and genetic material) and degree of complexity.	● Proficiently use proper light microscopic technique as well as determine total power magnification. ● Infer that prokaryotic cells are less complex than eukaryotic cells. ● Compare and contrast prokaryotic and eukaryotic cells.
Bio.1.1.3 Explain how instructions in DNA lead to cell differentiation and result in cells specialized to perform specific functions in multicellular organisms.	● Compare a variety of specialized cells and understand how the function of these cells vary. ● Variation in DNA expression causes undifferentiated cells to specialize. ● Recall that chemical signals may be released by one cell to influence the development and activity of another cell. ● Identify stem cells as unspecialized cells that continually reproduce themselves and have the ability to differentiate into specialized cells

Biology Curriculum Map

Bio.1.2.3 Explain how specific cell adaptations help cells survive in particular environments (focus on unicellular organisms).	• Explain how various structures of unicellular organisms help that organisms survive. • Summarize adaptive behavior.

Biology Curriculum Map

Unit Three: Homeostasis, Diffusion, and Osmosis

Standard	Learning Target
Bio.1.1.1 Summarize the structure and function of organelles in eukaryotic cells (including the nucleus, plasma membrane, cell wall, mitochondria, vacuoles, chloroplasts, and ribosomes) and ways that these organelles interact with each other to perform the function of the cell.	● Identify the cell organelles and diagrams of plant and animal cells. ● Explain how the structure of the organelle determines its function. ● Summarize how organelles interact to carry out functions.
Bio.1.2.1 Explain how homeostasis is maintained in a cell and within an organism in various environments (including temperature and pH).	● Explain how cells use buffers to regulate cell pH and how cells can respond to maintain temperature, glucose levels, and water balance in organisms. ● Compare the mechanisms of active versus passive transport. Conclude how the plasma membrane structure functions. ● Explain changes in osmotic pressure that occurs when cells are placed in solution of differing concentrations.
Bio 4.2.2 Explain ways that organisms use released energy for maintaining homeostasis (active transport).	● Conclude that energy productions by organisms is vital for maintaining homeostasis and that the maintenance of homeostasis is necessary for life.

Biology Curriculum Map

Unit Four: Energy, Photosynthesis, and Respiration

Standard	Learning Target
Bio.2.1.1 Analyze the flow of energy and cycling of matter (such as water, carbon, nitrogen and oxygen) through ecosystems relating the significance of each to maintaining the health and sustainability of an ecosystem.	● Deconstruct the carbon cycle as it relates to photosynthesis, cellular respiration, decomposition, and climate change. ● Summarize the nitrogen cycle and its importance to synthesis of proteins and DNA. ● Identify factors that influence climate. (Greenhouse Effect) ● Explain the recycling of matter within ecosystems in a tendency toward a more disorganized state. ● Analyze energy pyramids for direction and efficiency of energy transfer.
Bio 4.2.2 Explain ways that organisms use released energy for maintaining homeostasis (active transport).	● Conclude that energy productions by organisms is vital for maintaining homeostasis and that the maintenance of homeostasis is necessary for life.

Biology Curriculum Map

Unit Five: Cell Cycle, Mitosis, and Meiosis

Standard	Learning Target
Bio.1.2.2 Analyze how cells grow and reproduce in terms of interphase, mitosis and cytokinesis.	● Outline the cell cycle. ● Recognize mitosis as part of asexual reproduction. ● Organize diagrams of mitotic phases and describe what is occurring throughout the process
Bio.3.2.1 Explain the role of meiosis in sexual reproduction and genetic variation.	● Recall the process of meiosis and identify process occurring in diagrams of stages. ● Infer the importance of the genes being on separate chromosomes as it relates to meiosis. ● Explain how the process of meiosis leads to independent assortment and greater diversity. ● Exemplify sources of genetic variation in sexually reproducing organisms. ● Compare and contrast meiosis and mitosis.

Biology Curriculum Map

Unit Six: DNA, RNA, Protein Synthesis

Standard	Learning Target
Bio.3.1.1 Explain the double-stranded, complementary nature of DNA as related to its function in the cell.	● Develop a cause and effect model relating the structure of DNA to the functions of replication and protein synthesis. ● Infer the advantages and disadvantages of the overproduction, underproduction, or production of proteins at the incorrect times.
Bio.3.1.2 Explain how DNA and RNA code for proteins and determine traits.	● Explain the process of protein synthesis. ● Interpret a codon chart to determine the amino acid sequence produced by a particular sequence of bases. ● Explain how an amino acid sequence forms a protein that leads to a particular function and phenotype in an organism.
Bio.3.1.3 Explain how mutations in DNA that result from interactions with the environment (i.e. radiation and chemicals) or new combinations in existing genes lead to changes in function and phenotype.	● Understand that mutations are changes in DNA coding and can be deletions, additions, or substitutions. ● Develop a cause and effect model in order to describe how mutations can result in heritable changes.
Bio.3.2.3 Explain how the environment can influence the expression of genetic traits.	● Develop a cause and effect relationship between environmental factors and expression of a particular genetic trait.

Biology Curriculum Map

Bio.4.1.2 Summarize the relationship among DNA, proteins and amino acids in carrying out the work of cells and how this is similar in all organisms.	• Recall that the sequence of nucleotides in DNA codes for specific amino acids which link to form proteins. • Identify the five nitrogenous bases found in nucleic acids. • Summarize the process of protein synthesis.

Biology Curriculum Map

Unit Seven: Genetics

Standard	Learning Target
Bio.3.2.2 Predict offspring ratios based on a variety of inheritance patterns (including dominance, co-dominance, incomplete dominance, multiple alleles, and sex-linked traits).	● Interpret Punnett squares to determine genotypic and phenotypic ratios. ● Determine parental genotypes based on offspring ratios. ● Interpret karyotypes. ● Recognize a variety of intermediate patterns of inheritance. ● Recognize that some traits are controlled by more than one pair of genes and that this pattern of inheritance is identified by the presence of a wide range of phenotypes. ● Interpret autosomal inheritance patterns. ● Solve and interpret co-dominant crosses involving multiple alleles including blood typing problems. ● Understand human sex chromosomes and interpret crosses involving sex-linked traits. ● Interpret phenotype pedigrees to identify the genotypes of individuals and the type of inheritance.
Bio.3.2.3 Explain how the environment can influence the expression of genetic traits.	● Develop a cause and effect relationship between environmental factors and expression of a particular genetic trait.

Biology Curriculum Map

Unit Eight: Genetic Technology

Standard	Learning Target
Bio.3.3.1 Interpret how DNA is used for comparison and identification of organisms.	● Summarize the process of gel electrophoresis as a technique to separate molecules based on size. ● Interpret or read a gel. ● Exemplify applications of DNA fingerprinting.
Bio.3.3.2 Summarize how transgenic organisms are engineered to benefit society.	● Generalize the application of transgenic organisms in agriculture and industry including pharmaceutical application such as the production of human insulin. ● Summarize the steps in bacterial transformation.
Bio.3.3.3 Evaluate some of the ethical issues surrounding the use of DNA technology (including cloning, genetically modified organisms, stem cell research, and Human Genome Project).	● Identify the reason for establishing the Human Genome Project. ● Recognize that the project is useful in determining whether individuals may carry genes for genetic conditions and in developing gene therapy. ● Evaluate some of the science of gene therapy. ● Critic the ethical issues and implications of Genomics and Biotechnology.

Biology Curriculum Map

Unit Nine: Evolution

Standard	Learning Target
Bio.2.1.2 Analyze the survival and reproductive success of organisms in terms of behavioral, structural, and reproductive adaptations.	● Analyze how various organisms accomplish life functions through adaptations within particular environments and that these adaptations have evolved to ensure survival and reproductive success. ● Analyze behavioral adaptations that help accomplish basic life functions.
Bio.3.4.1 Explain how fossil, biochemical, and anatomical evidence support the theory of evolution.	● Summarize the hypothesized early atmosphere and experiments that suggest how the first cells may have evolved and how early conditions affected the type of organism that developed. ● Summarize how fossil evidence informs our understanding of the evolution of species and what can be inferred from this evidence. ● Generalize what biochemical similarities tell us about evolution. ● Generalize what shared anatomical structures tell us about evolution.
Bio.3.4.2 Explain how natural selection influences the changes in species over time.	● Develop a cause and effect model for the process of natural selection. ● Illustrate the role of geographic isolation in speciation.

Biology Curriculum Map

Bio.3.4.3 Explain how various disease agents (bacteria, viruses, chemicals) can influence natural selection.	• Develop a cause and effect model for the role of disease agents in natural selection.

Biology Curriculum Map

Unit Ten: Populations, Classifications, Viruses, and Bacteria

Standard	Learning Target
Bio.1.2.3 Explain how specific cell adaptations help cells survive in particular environments (focus on unicellular organisms).	● Explain how various structures of unicellular organisms help that organisms survive. ● Summarize adaptive behavior
Bio.2.1.2 Analyze the survival and reproductive success of organisms in terms of behavioral, structural, and reproductive adaptations.	● Analyze how various organisms accomplish life functions through adaptations within particular environments and that these adaptations have evolved to ensure survival and reproductive success. ● Analyze behavioral adaptations that help accomplish basic life functions.
Bio.3.5.1 Explain the historical development and changing nature of classification systems.	● Generalize the changing nature of classification based on new knowledge generated by research on evolutionary relationships and the history of classification systems.
Bio.3.5.2 Analyze the classification of organisms according to their evolutionary relationships (including dichotomous keys and phylogenetic trees).	● Classify organisms using a dichotomous key. ● Compare organisms on a phylogenetic tree in terms of relatedness and time of appear

Biology Curriculum Map

Unit Eleven: Ecology

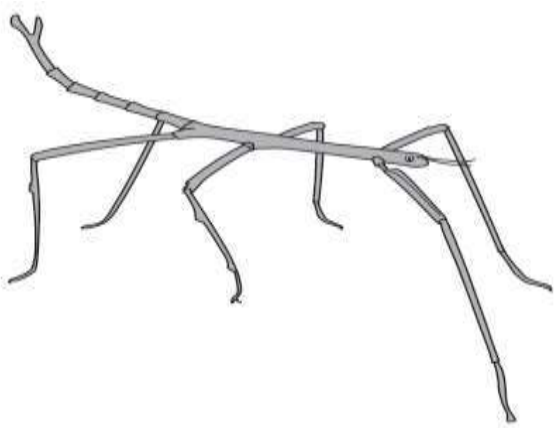
Standard	Learning Target
Bio.2.1.1 Analyze the flow of energy and cycling of matter (such as water, carbon, nitrogen and oxygen) through ecosystems relating the significance of each to maintaining the health and sustainability of an ecosystem.	● Deconstruct the carbon cycle as it relates to photosynthesis, cellular respiration, decomposition, and climate change. ● Summarize the nitrogen cycle and its importance to synthesis of proteins and DNA. ● Identify factors that influence climate. (Greenhouse Effect) ● Explain the recycling of matter within ecosystems in a tendency toward a more disorganized state. ● Analyze energy pyramids for direction and efficiency of energy transfer.
Bio 2.1.3 Explain various ways organisms interact with each other (including predation, competition, parasitism, mutualism) and with their environments resulting in stability within ecosystems.	● Identify and describe symbiotic relationships such as mutualism and parasitism. ● Exemplify various forms of communication and territorial defense. ● Explain patterns in predator prey and competition relationships and how the patterns help maintain stability within an ecosystem
Bio.2.1.4 Explain why ecosystems can be relatively stable over hundreds or thousands of years, even though populations may fluctuate (emphasizing	● Generalize that although some populations have the capacity for exponential growth there are limited resources that create specific carrying

availability of food, availability of shelter, number of predators and disease).	capacity and population sizes are in a dynamic equilibrium with these factors. ● Interpret various types of population graphs. ● Explain how disease can disrupt ecosystem balance.
Bio.2.2.1 Infer how human activities (including population growth, pollution, global warming, burning of fossil fuels, habitat destruction and introduction of nonnative species) may impact the environment.	● Summarize how humans modify ecosystems. ● Interpret data regarding the historical and predicted impact on ecosystems in global climate. ● Explain factors that impact North Carolina Ecosystems.
Bio.2.2.2 Explain how the use, protection and conservation of natural resources by humans impact the environment from one generation to the next.	● Explain the impact of humans on natural resources. ● Exemplify conservation methods and stewardship.

Biology Curriculum Map

Biology I Constructed Responses:

1. Use the picture to answer the question.



Walking Stick (unstriped)

Scientists observe insects called walking sticks living in the California Mountains. The insects look like the plants on which they live.

The walking stick population has two patterns:

- Some have striped patterns on their bodies and are usually found on striped chamise plants.
- Some have no stripes and are usually found on unstriped lilac plants.

Describe how the theory of evolution is supported by the walking stick population, **and** predict how the walking stick population would change over time if the lilac population was rapidly reduced by a virus.

Biology Curriculum Map

2. Cross-pollination of plants is used to develop hybrids with desirable traits. One desirable trait is frost resistance. If the genotypes of hybrids are all heterozygous for frost resistance, they will all be frost-resistant.

A) Determine the phenotypes of two parent plants that would have only heterozygous offspring (Ff).

B) Determine the genotypes of two parent plants that have only heterozygous offspring (Ff).

3. Starting with mRNA leaving the nucleus, list and describe four major steps involved in protein synthesis.

4. Discuss the impacts on society and on the environment of each of the following:

A) Combustion of fossil fuels

B) Use of chemical pesticides

Biology Curriculum Map

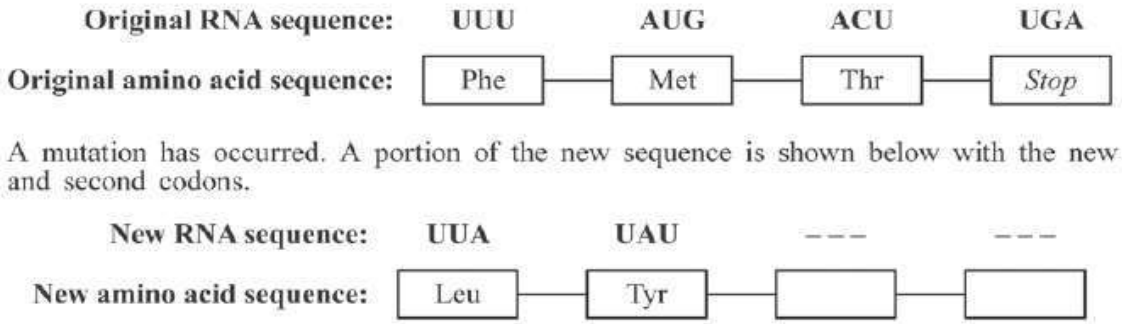
Use the chart to answer the question.

Amino Acids and Their Codons

	U	C	A	G
U	UUU, UUC – Phe UUA, UUG – Leu	UCU, UCC, UCA, UCG – Ser	UAU, UAC – Tyr UAA, UAG – *Stop*	UGU, UGC – Cys UGA – *Stop* UGG – Trp
C	CUU, CUC, CUA, CUG – Leu	CCU, CCC, CCA, CCG – Pro	CAU, CAC – His CAA, CAG – Gln	CGU, CGC, CGA, CGG – Arg
A	AUU, AUC, AUA – Ile AUG – Met	ACU, ACC, ACA, ACG – Thr	AAU, AAC – Asn AAA, AAG – Lys	AGU, AGC – Ser AGA, AGG – Arg
G	GUU, GUC, GUA, GUG – Val	GCU, GCC, GCA, GCG – Ala	GAU, GAC – Asp GAA, GAG – Glu	GGU, GGC, GGA, GGG – Gly

Biology Curriculum Map

Below is an RNA sequence consisting of three amino acids and a stop codon. Above each amino acid and the stop codon is the list of bases that code for that amino acid.



A mutation has occurred. A portion of the new sequence is shown below with the new first and second codons.

A) What will be the fourth codon in the new sequence?

B) What amino acid will be coded for by the fourth codon in the new sequence?

C) What name is given to this type of mutation?

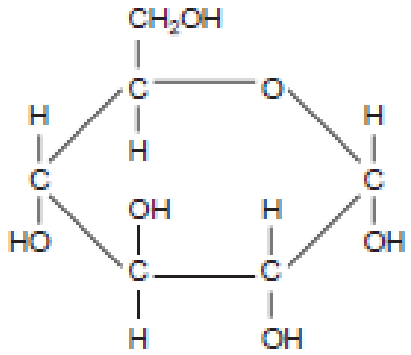
Biology Curriculum Map

6. In a bone marrow transplant, bone marrow from a healthy individual is transplanted into an individual with a blood disorder.

a. Explain why a successful bone marrow transplant could treat sickle cell anemia in an individual.

b. Suppose individual Z were treated for sickle cell anemia by receiving a bone marrow transplant. Could any children that individual Z has after the transplant inherit the gene for the sickle cell trait? Explain your answer.

7. The diagram below shows the molecular structure of glucose:



Glucose is a simple carbohydrate that is important to living organisms.

a. Describe the primary function of glucose in cells.

b. Simple sugars like glucose can be used to make larger organic molecules. Identify **two** larger molecules made from simple sugars.

c. Identify a specific cellular process that would be affected by a glucose shortage, and discuss the effects of the shortage on the process you identified.

Biology Curriculum Map

8. The table below shows the classifications of three different sea lions:

	California Sea Lion	Galápagos Sea Lion	New Zealand Sea Lion
Kingdom	Animalia	Animalia	Animalia
Phylum	Chordata	Chordata	Chordata
Class	Mammalia	Mammalia	Mammalia
Order	Carnivora	Carnivora	Carnivora
Family	Otariidae	Otariidae	Otariidae
Genus	*Zalophus*	*Zalophus*	*Phocarctos*
Species	*californianus*	*wollebaeki*	*hookeri*

a. Identify which two of the sea lions are most closely related.

b. Justify your answer to part (a).

c. Describe and explain **two** types of evidence scientists would have used to determine the proper classifications of these three sea lions.