Biology I Curriculum Maps

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Grade: 10 **Subject:** Biology I	**Unit 1: What is Science?**
Big Idea/Rationale	Students will become scientists. They will begin to think, observe and work like scientists. They will begin to see and understand what science is and how scientists go about answering the questions that surround us using and learning about the tools, techniques and procedures they use.
Enduring Understanding (Mastery Objective)	• SWBAT identify the characteristics of life. • SWBAT describe the process of the scientific method • SWBAT distinguish between an observation and inference.
Essential Questions (Instructional Objective)	• What is Science? • What precautions do we need to take in the lab to stay safe? • What do we do in case of an emergency? • How do Scientist's Work? • What Tools and techniques would you use as a scientist?
Content (Subject Matter)	• What is Science • The scientific method and tools/techniques of science • Lab Safety and Emergecny Procedures
Skills/ Benchmarks (CCSS Standards)	• 5.1.12.A.1 Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations. • 5.1.12.A.2 Develop and use mathematical, physical, and computational tools to build evidence-based models and to pose theories. • 5.1.12.B.2 Build, refine, and represent evidence-based models using mathematical, physical, and computational tools. • 5.1.12.B.3 Revise predictions and explanations using evidence, and connect explanations/arguments to established scientific knowledge, models, and theories.
Materials and Resources	Presentation Cart (projector/document camera), Student handouts, lab materials as necessary
Notes	

Grade: 10 **Subject:** Biology I	**Unit 2: Introduction to Biology**
Big Idea/Rationale	Students need to know what Biology is as a foundation for the year's study. This unit will also introduce vocabulary that will be used throughout the year.
Enduring Understanding (Mastery Objective)	• Students will describe what characteristics are common in all life. • Students will order vocab terms from smallest to largest to reflect the organizational hierarchy in Biology
Essential Questions (Instructional Objective)	• What is biology about? • What makes an organism alive? • How are biological systems organized?
Content (Subject Matter)	• What is Biology? • Characteristics of Life • Levels of Organization in Living Things
Skills/ Benchmarks (CCSS Standards)	• **5.1.12.A.1:** Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations • **5.1.12.D.1:** Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences.
Materials and Resources	Notes Outlines/Teacher Projector & Document Camera; Flashcards/Student Computers; Bingo Boards
Notes	

Grade: 10 **Subject:** Biology I	**Unit 3: Biochemistry**
Big Idea/Rationale	• In this unit students will learn what an element is, understand that elements are made up of only one type of atom, be able to explain and draw the structure of an atom with its subatomic particles. Students will also learn how these sub atomic particles help determine the properties of the element. Students will then learn the difference between an element and a compound. • After completing this unit students will be able to describe the four main types of organic compounds in living things, both unicellular and multi-cellular. They will be able to explain their function and identify the monomer of each of the compounds and explain how they combine to form polymers. • Students will explore proteins further, learning about enzymes, what they are, how they work, and their importance in maintaining homeostasis.
Enduring Understanding (Mastery Objective)	• Define element and describe the makeup of an atom and its subatomic parts. • Distinguish between an element and a compound. • List the four main types of organic compounds found in all life. • Explain the make-up and function of the four main types of organic compounds. • Discover what enzymes are and how they work
Essential Questions (Instructional Objective)	• What is Aluminum foil made up of? • How can we draw atoms • What is salt? • How are compounds made? • What are we made up of? • How are starches made? • What happens to starch when it is digested? • Why can't lactose intolerant people drink milk? • What does pH balanced mean?
Content (Subject Matter)	• Review of Elements and the Periodic Table • Review of Molecules and Chemical Bonds • Inorganic vs. Organic Compounds • Basic Organic Compounds, including carbohydrate, monosaccharide, polysaccharide, starch, lipids, protein, amino acid, enzyme, nucleic acid, DNA, RNA

Skills/ Benchmarks (CCSS Standards)	• 5.2.12.A.1 Electrons, protons, and neutrons are parts of the atom and have measurable properties, including mass and, in the case of protons and electrons, charge. The nuclei of atoms are composed of protons and neutrons. A kind of force that is only evident at nuclear distances holds the particles of the nucleus together against the electrical repulsion between the protons. • 5.2.12.A.3 In the Periodic Table, elements are arranged according to the number of protons (the atomic number). This organization illustrates commonality and patterns of physical and chemical properties among the elements • 5.2.12.A.4 In a neutral atom, the positively charged nucleus is surrounded by the same number of negatively charged electrons. Atoms of an element whose nuclei have different numbers of neutrons are called isotopes. • 5.3.12.A.2 Cellular processes are carried out by many different types of molecules, mostly by the group of proteins known as enzymes
Materials and Resources	Presentation Cart (projector/document camera), Student handouts, lab materials as necessary
Notes	

Grade: 10 **Subject:** Biology I	**Unit 4: Cellular Biology**
Big Idea/Rationale	• In this unit students will learn about both prokaryotic and eukaryotic cells and the cell organelles associated with the latter. Students will develop the understanding of the cell theory and be able to explain how various scientists' work contributed to the cell theory over a period of 200 years. They will be able to compare and contrast animal and plant cells, and be able to identify the cell organelles found in each type of cell. Students will understand that cells function individually as well as carrying out a specific function of a multi-cellular organism. Students will be able to explain the function of the cell organelles • Students will learn the mechanics of a compound microscope. They will learn the proper techniques used to hold, transport and use the microscope properly. • Once students are knowledgeable on cells and the compound microscope they will be able to observe cells from various organisms including their own cheek cells. • In this unit students will also reinforce their knowledge of solutions. And understand how solute concentration of solution can affect the cell. • Using their previous knowledge from Unit 2, Chemistry of Life, students will be able to describe how the make-up of the cell membrane determines the movement of materials into and out of the cell. • Students will be able to compare and contrast the various methods of transport through the cell membrane, including, but not limited to, passive and active transport.
Enduring Understanding (Mastery Objective)	• Students will be able to explain the main ideas of the cell theory. • Students will be able to compare and contrast animal cells and plant cells • Students will learn to use a compound microscope • Students will be able to observe how microscopes aid in the study of cells • Students will be able to distinguish between eukaryotic and prokaryotic cells • Students will be able to describe and draw the phospholipid bi-layer of the cell membrane. • Students will be able to explain the role proteins in the cell membrane • Students will be able to identify the role of the nucleus in the cell. • Students will be able describe how the roles of the ribosomes, Golgi complex and ER are related. • Students will be able to distinguish between the roles of lysosomes and vacuoles. • Students will be able to compare and contrast the function of the chloroplast and mitochondria.

Essential Questions (Instructional Objective)	• What are living things made up of? • Who were the scientists that help to form the cell theory? • What are exceptions to the cell theory? • How are bacteria cells different from other cells?? • How can a single cell carry out all 8 life functions?? • How do plant and animal cells differ? • What do the cell organelles look like? • How does a compound microscope work? • What do our cheek cells look like?
Content (Subject Matter)	• Cells and Cell Theory • Prokaryotic vs. Eukaryotic Cells • Organelle functions • Cell support and movement • Transport through the cell membrane • Diffusion and Osmosis • Maintaining homeostasis (equilibrium) • Cellular Energy -general
Skills/ Benchmarks (CCSS Standards)	• 5.1.12.A.1 Represent and explain the relationship between the structure and function of each class of complex molecules using a variety of models • 5.1.12.A.2 Demonstrate the properties and functions of enzymes by designing and carrying out an experiment • 5.1.12.A.3 Predict a cell's response in a given set of environmental conditions
Materials and Resources	• Order in advance: Microscopic Protista, elodea, tooth picks, methylene blue, iodine, black and white thread, magazines, cover-slips and slides. • Presentation Cart (projector/document camera), Student handouts, lab materials as necessary
Notes	Reserve computer lab for virtual cell lab

Grade: 10 **Subject:** Biology I	**Unit 5: Cellular Transport**
Big Idea/Rationale	• In this unit students will also reinforce their knowledge of solutions. And understand how solute concentration of solution can affect the cell. • Using their previous knowledge from Unit 2, Chemistry of Life and Unit 3 Biochemistry, students will be able to describe how the make-up of the cell membrane determines the movement of materials into and out of the cell. • Students will be able to compare and contrast the various methods of transport through the cell membrane, including, but not limited to, passive and active transport. • Through hands-on experimentation students will observe what happens to cell size when cells placed in various solutions.
Enduring Understanding (Mastery Objective)	• Students will be able to describe and draw the phospholipid bi-layer of the cell membrane. • Students will be able to explain the role proteins in the cell membrane • Relate diffusion and equilibrium • Describe how passive transport occurs. • Relate osmosis to solute concentration • Explain how active transport differs from passive transport • Describe how large molecules move across a membrane _transport through vesicles. • Students will be able to compare and contrast hypertonic, hypotonic and isotonic solutions
Essential Questions (Instructional Objective)	• What is the cell membrane made up of • What materials can pass through the cell membrane? • How do air freshener molecules move around a room?? • How do materials get into and out of our cells? • How is active transport different from passive transport? • How can cells take in large substances that cannot fit through the cell membrane? • What will happen to an egg if it is placed in a hypertonic solution? A hypotonic solution.
Content (Subject Matter)	• Cell Membrane Structure • Methods of Cellular Transport • Maintenance of cellular equilibrium
Skills/ Benchmarks (CCSS Standards)	• 5.1.12.A.1 Represent and explain the relationship between the structure and function of each class of complex molecules using a variety of models • 5.1.12.A.3 Predict a cell's response in a given set of environmental conditions

Materials and Resources	• Eggs, syrup, vinegar, distilled water, large plastic cups, large graduated cylinders • Presentation Cart (projector/document camera), Student handouts, lab materials as necessary
Notes	Start lab on Friday. Need egg to sit in vinegar over weekend to remove shells

Grade: 10 **Subject:** Biology I	**Unit 6: Cell Energy and Photosynthesis**
Big Idea/Rationale	• In this unit students will learn about Cellular energy and Photosynthesis. • First they will discuss the various types of energy and distinguish between kinetic and potential energy and how energy is transferred from one form to another. • Students will be able to explain the structures of ATP and ADP and use that knowledge to understand how energy is released form ATP and able to provide cells with the energy they need to do work. • In this unit students will learn how ATP structure is a more suitable compound for our cell's energy source. They will learn about the ATP cycle and why our cells need ATP. • Students will be able to explain how cells use this energy to carry the different types of cellular work. • Students will use the information they learned from unit 3, that carbohydrates are used for our primary source of energy, but in order for our cells to use this energy it must first be transferred into another molecule, ATP. • Using their knowledge from unit 4, Cell Structures, students will see how chloroplasts are able to transfer energy from the sun into glucose during photosynthesis. • Students will understand why photosynthesis and plants are essential to us. • Students will learn the steps in which photosynthesis takes place. They will learn the reactants and products of each reaction, where within the cell each reaction takes place and the importance of pigments
Enduring Understanding (Mastery Objective)	• Students will be able to explain the difference between autotrophs and heterotrophs. • Students will be able to compare and contrast kinetic energy and potential energy • Students will be able to observe the breakdown of ATP to release energy and produce ADP, through a hands-on lab with paper models • Students will be able to summarize the ATP cycle • Students will be able to give examples of work that cells perform which require ATP. • Students will be able to describe the structure of a chloroplast • Students will be able to identify the overall reactants and products of photosynthesis. • Students will be able to explain how light interacts with pigments • Students will be able to identify the reactants and chemical products of the light reactions. • Students will be able to explain how the Calvin cycle makes sugar. • Students will be able to summarize the overall equation of

	photosynthesis • Students will be able to describe the path of carbon in the carbon cycle. • Students will be able to explain how photosynthesis is related to climate.
Essential Questions (Instructional Objective)	• How do we get energy from our food? • What types of energy do we need to survive? • What is ATP and where does it store its energy? • Where do plants get their energy from? • What do plants need for photosynthesis? • What do plants produce through photosynthesis? • How can step 2 of photosynthesis take place without light energy? • How plants adapted to carry out photosynthesis? • How is cellular respiration related to photosynthesis?
Content (Subject Matter)	• Types of Energy • Chemical Energy & ATP • Photosynthesis and Light and Dark reactions • Carbohydrates • The Carbon Cycle and Respiration vs. Photosynthesis • Autotrophs and Heterotrophs
Skills/ Benchmarks (CCSS Standards)	• 5.3.12.B.1 Cite evidence that the transfer and transformation of matter and energy links organisms to one another and to their physical setting • 5.3.12.B.2 Use mathematical formulas to justify the concept of an efficient diet. • 5.3.12.B.3 Predict what would happen to an ecosystem if an energy source was removed. • 5.3.12.B.4 Explain how environmental factors (such as temperature, light intensity, and the amount of water available) can affect photosynthesis as an energy storing process • 5.3.12.B.5 Investigate and describe the complementary relationship (cycling of matter and flow of energy) between photosynthesis and cellular respiration. • 5.3.12.B.6 Explain how the process of cellular respiration is similar to the burning of fossil fuels
Materials and Resources	• Chromatography lab, spinach, black permanent markers, Microscope, leaves, clear nail polish • Presentation Cart (projector/document camera), Student handouts, lab materials as necessary
Notes	

Grade: 10 **Subject:** Biology I	**Unit 7: Cell Energy/Cellular Respiration**
Big Idea/Rationale	• In this unit students will learn about Cellular respiration and Fermentation. • Students will use the information they learned from unit 3, Biochemistry, that carbohydrates are used for our primary source of energy, and build on that concept to understand that in order for our cells to use this energy it must first be transferred into another molecule, ATP. • Using their knowledge from unit 3, Cell Structures, will see how mitochondria are able to transfer energy from food molecules into ATP during cellular Respiration. • Students will learn the steps in which the Cellular Respiration takes place. They will learn the reactants and products of each reaction. • In this unit students will be able to explain why oxygen is important to cellular respiration and how some organisms are able to produce ATP in the absence of Oxygen. – Fermentation. • Students will compare and contrast lactic acid fermentation and alcoholic fermentation. • In this unit Students will reflect back on the last unit, Photosynthesis and discuss the relationship between photosynthesis and Respiration.
Enduring Understanding (Mastery Objective)	• Students will be able to explain the difference between aerobic and anaerobic organisms. • Students will be able to Relate breathing and cellular respiration • Students will be able to summarize the equation for cellular respiration. • Students will be able to describe the structure of the mitochondria. • Students will be able to summarize the three stages of cellular respiration and identify where and how much ATP is made in each step. • Students will be able to explain the role of the Electron Transport Chain and explain how “falling” electrons are a source of energy for the cell. • Students will be able to compare and contrast alcoholic and lactic acid fermentation • Students will be able to explain how fermentation in muscle cells is different from cellular respiration. • Students will be able to give examples of products that depend on fermentation.
Essential Questions (Instructional Objective)	• How do we get energy from our food? • What types of energy do we need to survive? • Why can’t our cells use glucose to carry out cellular activities? • Why is breathing necessary? • Where is energy in a molecule of glucose? • Why is the mitochondria called the “Powerhouse” of the cell? • What happens to glucose during cellular respiration?

	• What part of cellular respiration produces the most energy? • Why do athletes have a lower pulse rate? • What happens to our cells when we exercise strenuously? • Why are yeast cells used to make bread and alcohol? • How is cellular respiration related to photosynthesis?
Content (Subject Matter)	• The role of glucose in cellular function • Function of mitochondria as cellular energy sources • Energy consumption under aerobic and anaerobic conditions
Skills/ Benchmarks (CCSS Standards)	• 5.3.12.B.1 Cite evidence that the transfer and transformation of matter and energy links organisms to one another and to their physical setting • 5.3.12.B.2 Use mathematical formulas to justify the concept of an efficient diet. • 5.3.12.B.3 Predict what would happen to an ecosystem if an energy source was removed. • 5.3.12.B.4 Explain how environmental factors (such as temperature, light intensity, and the amount of water available) can affect photosynthesis as an energy storing process • 5.3.12.B.5 Investigate and describe the complementary relationship (cycling of matter and flow of energy) between photosynthesis and cellular respiration. • 5.3.12.B.6 Explain how the process of cellular respiration is similar to the burning of fossil fuels
Materials and Resources	• Timers, warm water, yeast, artificial sweeteners, various fruit juices, zip-loc bags, 1000ml beakers, rulers, string, If possible heating lamp or electric blanker to keep yeast warm, If Possible balloons. • Presentation Cart (projector/document camera), Student handouts, lab materials as necessary
Notes	Address common misconception: Plants carry out both photosynthesis and respiration.

Grade: 10 **Subject:** Biology I	**Unit 8: Cell Division and Mitosis**
Big Idea/Rationale	• In this unit students will learn about the difficulties cells face as they continue to grow and explain what factors can limit their growth • In this unit students will learn about the cell cycle and how it relates to cell growth, development and division. • In this unit students will learn what happens to cells in each stage of the cell cycle • Students will understand the relationship between cell division, growth, repair and reproduction. • Students will understand how all cells come from pre-existing cells. • Students will compare and contrast sexual and asexual reproduction • In this unit students will learn what happens to cells in each stage of the cell cycle • In this unit students will be able to explain what factors stop a cell from growing, and how the cell cycle is regulated, in addition to what happens to a cell if it loses its ability to control growth and division, and ultimately its ability to regulate the cell cycle- cancer. • Students will compare and contrast cancer cells and malignant tumors to normal cells and benign tumors.
Enduring Understanding (Mastery Objective)	• Students will be able to explain the problems that growth causes for cells and explain how cell division solves these problems for the cell. • Students will be able to name the main events of the cell cycle including the four stages of mitosis. • Students will be able to observe and explain what happens to the cell in each of the four stages of mitosis and the cell cycle. • Students will be able to compare and contrast animal cell and plant cell mitosis. • Students will be able identify factors that can stop a cell from growing. • Students will be able to describe how the cell cycle is regulated. • Students will be able to explain how cancer cells are different from other cells and explain how cancer treatments work at a cellular level. • Students will be able to compare and contrast benign and malignant tumors.
Essential Questions (Instructional Objective)	• What difficulties will a cell face as it increases in size? • Where do cells come from? • How is asexual reproduction different from sexual reproduction?? • What is the role of chromosomes in cell division? • What are the main events of a cells life? • What happens to a cell as it divides?? • How is the cell able to maintain its chromosome number when the cell divides in half?

	• How do daughter cells split apart following mitosis? • How is the cell cycle regulated? • How are cancer cells different from normal cells? • What does cancer treatment do to stop cancer cells from growing? • How do cells become specialized for different function?
Content (Subject Matter)	• Why do cells need to divide as opposed to just getting bigger? • What are the stages of cell division? • What happens in each stage of cell division? • Students will be able to recognize diagrams of each stage of cell division, and put them in the correct order.
Skills/ Benchmarks (CCSS Standards)	• 5.3.12.D.1 Genes are segments of DNA molecules located in the chromosome of each cell. DNA molecules contain information that determines a sequence of amino acids, which result in specific proteins. Explain the value and potential applications of genome projects. • 5.3.12.D.2 Predict the potential impact on an organism (no impact, significant impact) given a change in a specific DNA code, and provide specific real world examples of conditions caused by mutations
Materials and Resources	• Non flavored gelatin or potatoes iodine for cubes in surface area/volume lab • Sign up for computer lab for on-line Mitosis lab • Presentation Cart (projector/document camera), Student handouts, lab materials as necessary
Notes	• Potatoes easier to use than gelatin. Use iodine to test absorption • Strawberries, ethyl alcohol, cheese cloth, Palmolive dish detergent, salt • Have lab assistants pre-make flip book pages

Grade: 10 **Subject:** Biology I	**Unit 9: DNA and DNA Replication**
Big Idea/Rationale	• In this unit students will learn about the work of Griffith, Avery, Hershey & Chase, Chargaff, Wilkens & Franklin and Watson & Crick and how their work contributed to the discovery and explanation of the molecular structure of DNA. • Students will learn about DNA's building blocks and the rules for base pairing and how that structure relates to its mean of replication within the nucleus of the cell. • Students will learn about how DNA directs the cell's synthesis of proteins.
Enduring Understanding (Mastery Objective)	• Students will be able to describe the overall structure of a DNA molecule and explain the scientists and their work that help Watson and Crick to develop the double helix model of DNA. Including base pairing rules. • Students will be able to summarize the events of DNA replication including the enzymes that are required. • Students will be able to relate the DNA molecule to chromosome structure – nucleosome. • Students will be able to explain the relationship between genes and DNA and explain the value of the genome project. • Students will be able to explain how DNA is replicated, why the template mechanism is important and what enzymes are necessary for DNA replication to occur • Students will be able to explain the difference between transcription and translation • Students will be able to explain how a protein is made in the ribosome.
Essential Questions (Instructional Objective)	• What scientists worked to discover the structure of DNA? • What clues did bacterial transformation yield about our genes?? • What role did bactiophages play in identifying our genetic material? • What is the role of DNA in heredity? • What is the chemical make-up of DNA? • What does the double helix model tell us about DNA? • How can DNA make a copy of itself? • How can you use one strand of DNA to determine the second strand? • How is a protein manufactured by the cell?
Content (Subject Matter)	• Structure of DNA and RNA molecules • Function of DNA and RNA molecules • When/Why does DNA replicate? • How DNA replication occurs • Construct a model of DNA and DNA replication • Transcription & Translation

Skills/ Benchmarks (CCSS Standards)	• 5.3.12.D.1 Genes are segments of DNA molecules located in the chromosome of each cell. DNA molecules contain information that determines a sequence of amino acids, which result in specific proteins. Explain the value and potential applications of genome projects. • 5.3.12.D.2 Predict the potential impact on an organism (no impact, significant impact) given a change in a specific DNA code, and provide specific real world examples of conditions caused by mutations
Materials and Resources	• DNA models- Colored paper • DNA replication. Licorice black and red & colored marshmallows toothpicks • DNA Extraction Lab • Presentation Cart (projector/document camera), Student handouts, lab materials as necessary
Notes	Strawberries, ethyl alcohol, cheese cloth, Palmolive dish detergent, salt

Grade: 10 **Subject:** Biology I	**Unit 10: Introduction to Genetics**
Big Idea/Rationale	• In this unit students will learn about Gregor Mendel, the methods he used to study inheritance and the contributions he made to the field of Genetics. • Students will compare the blending hypothesis with Mendel's particulate hypothesis of inheritance and observe why the blending hypothesis is incorrect.. • Students will explore Mendel's three principles of inheritance, Dominance, Segregation and Independent Assortment. • In this unit students will learn what happens to cells in each stage of the cell cycle • In this unit students will be able to explain how the laws of probability applies to genetics and apply those laws to predict the possible outcome of future offspring using standard and 4 X 4 sized Punnett squares. • Students will be able to compare and contrast genotype and phenotype of an individual. • In this unit students will learn how to use a Test Cross to determine unknown genotypes. • Students will learn about the interaction of alleles in intermediate inheritance and describe inheritance patterns involving multiple alleles and understand how the environment can affect the phenotype expression. • Students will learn about TH Morgan and sex-linked disorders, such as hemophilia and color-blindness. They will be able to explain why most sex-linked disorders are more commonly found in males than in females and use a Punnett square to predict the likeliness of having daughters and sons with a sex-linked disorder
Enduring Understanding (Mastery Objective)	• Students will be able to explain cross pollination helped Mendel in his experimentations with heredity. • Students will be able to define trait and explain how they are controlled by our genes • Students will be able to observe the reproductive parts of a flower to compare and contrast self pollination and cross pollination • Students will be able to Summarize Mendel's conclusions about inheritance and genetics and his three principles. • Describe the inheritance patterns of dominance and recessiveness. • Students will be able to summarize the laws of probability and how they apply to using Punnett squares to predict genetic ratios. • Students will be able to apply Mendel's rules of inheritance in a virtual lab activity. • Students will be able to describe how alleles are separated and recombined during sexual reproduction

	• Students will be able to explain how polygenic inheritance can result in a wide range of phenotypes • Students will be able to explain how sex-linked genes produce different inheritance patterns in males and females • Students will be able to use standard Punnett squares to predict the outcome of future offspring with a sex-linked disorder.
Essential Questions (Instructional Objective)	• Why do we look the way we do? (G. Mendel) • How is it possible to have blue eyes when both your parents have brown? (Principle of Dominance) • Why do some traits "skip a generation"? (Principle of Segregation) • What will your children look like? (standard Punnett squares) • How did Mendel create green wrinkled peas? (Principle of Independent Assortment) • What happened to the Sphinx cat's tail? (Regulatory genes) • What does it mean if you have type AB blood?(multiple alleles/ intermediate inheritance) • What is the likelihood of having red hair and freckles? (4 x 4 Punnett square) • Why is color-blindness more commonly found in males than females? (sex-linked traits) • What is the likelihood of a color blind man having a colorblind son or daughter? (sex linked Punnett Squares)
Content (Subject Matter)	• Genetics Crosses – 1 Trait, Incomplete Dominance, Codominance, Multiple Alleles, Sex-Linked Traits, 2-Traits • Mendel's Laws of Segregation & Independent Assortment
Skills/ Benchmarks (CCSS Standards)	• 5.3.12.D.2 -Predict the potential impact on an organism (no impact, significant impact) given a change in a specific DNA code, and provide specific real world examples of conditions caused by mutations. • 5.3.12.D.3 -Demonstrate through modeling how the sorting and recombination of genes during sexual reproduction has an effect on variation in offspring (meiosis, fertilization).
Materials and Resources	• Dragon Genetics: coins, paper and markers • Plastic egg Genetics: plastic eggs, jelly beans • Presentation Cart (projector/document camera), Student handouts, lab materials as necessary
Notes	Sort through eggs to confirm correct ratios for phenotypes and genotypes

Grade: 10 **Subject:** Biology I	**Unit 11: Modern Genetics**
Big Idea/Rationale	• In this unit students will learn about chromosomal disorders and relate them to non-disjunction of chromosomes during meiosis; Furthermore Students will learn about different chromosomal mutations, describe how chromosomes can be damaged and discover the consequences that result. • Students will learn about test such as an amniocentesis and karyotyping and how they are used to determine if an individual has a chromosome mutation or disorder in addition to determining the sex of an individual. • In this unit students will learn to make, use and interpret the information provided in pedigree charts. • In this unit students will mimic the work of a genetic counselor, using karyotypes, pedigrees and Punnett squares to predict certain genetic disorders and calculate the likeliness of them being passed on to offspring. They will be learning how recessive, dominant, and sex-linked disorders are inherited in humans. • Students will also learn about the use of bacteria in DNA technology and recent research trends in this area. They will learn how transgenic organisms and clones are produced and discuss the controversy with GMOs. They will simulate the production of transgenic bacteria by cutting and pasting human genes into bacterial plasmids and virtually clone a mouse. On-line • Furthermore in Frontiers of Genetics students will learn about the polymerase chain reaction (PCR), gel electrophoresis genetic markers and DNA fingerprinting to mass produce, separate and compare DNA samples. They will use the computer to virtually apply PCR technique, run and compare a gel plates to produce and compare DNA fingerprints to solve a crime in a virtual gel electrophoresis lab. • Students will learn about modern advances in finding cures to genetic disorders through gene therapy and stem cell research and discuss the controversy and ethical issues associated with it.
Enduring Understanding (Mastery Objective)	• Students will be able to describe the symptoms of Down syndrome, Klinefelter syndrome and Turner syndrome and relate them to the non-disjunction of specific chromosomes and identify these disorders from a human karyotype. • Students will be able to describe how chromosomes can be damaged? • Students will be able to explain how a jumping gene can affect other genes. • Students will be able to identify and explain the four types of chromosome mutations. (Duplication, Deletion< Translocation and Inversion) • Students will be able to explain how recessive, dominant, and sex-linked disorders are inherited in humans.

	• Students will be able to predict the likeliness of certain genetic disorders expressed in future generations, through the use of Punnett squares and Pedigrees. • Students will be able to explain what a carrier is and how it relates to the inheritance of certain genetic disorders. • Students will be able to construct and interpret a human pedigree. • Students will be able to explain the use of bacteria in DNA technology • Students will be able to describe the production, use and controversy of GMOs such as transgenic organisms, and clones. • Students will be able explain how gene therapy and stem cell research can be used to cure genetic disorders and the controversy behind them. • Students will be able to describe and observe the techniques used by scientists to mass produce, separate and compare DNA samples.
Essential Questions (Instructional Objective)	• What causes Down syndrome? (Chromosome disorders and non-disjunction). • How are chromosomes damaged? • Why this dog (From PowerPoint) is considered a pedigree? (Pedigree charts) • Who's the thief? (Gel electrophoresis and DNA Fingerprinting) • What does CSI do if they have an extremely small sample of DNA? (PCR) • How can bacteria save your life? (Bacteria and recombinant DNA) • What makes these (actual GMO fruits and vegetables on display) so special? –(-Transgenic organisms) • How was Dolly, the cloned sheep, produced? • Can chronic genetic disorders be cured? (PowerPoint what would you do with the broken window?) –Gene Therapy
Content (Subject Matter)	• Chromosome Theory • Karyotype Analysis • Pedigree Analysis • DNA Technology
Skills/ Benchmarks (CCSS Standards)	• 5.3.12.D.1 -Explain the value and potential applications of genome projects. • 5.3.12.D.2 -Predict the potential impact on an organism (no impact, significant impact) given a change in a specific DNA code, and provide specific real world examples of conditions caused by mutations. • 5.3.12.E.1 -Account for the appearance of a novel trait that arose in a given population.
Materials and Resources	Presentation Cart (projector/document camera), Student handouts, lab materials as necessary

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Grade: 10 **Subject:** Biology I	**Unit 12: Evolution**
Big Idea/Rationale	• In this unit students will learn about the ideas of Charles Darwin and of his experiences in the southern hemisphere that helped shape the Theory of Evolution, in addition to the ideas and work of scientist that help contribute to Darwin's work such as, but not limited to, Lamarck, Lyell , Hutton and Wallace. They will learn about the two key points that form Darwin's theory of Evolution. • Students will learn that sometimes, differences between organisms of the same kind provide advantages for surviving and reproducing in different environments. These selective differences may lead to dramatic changes in characteristics of organisms in a population over extremely long periods of time • Students will learn to relate geographic distribution of organisms to evolution and understand how the fossil record provides information for past lives on Earth, which collectively, along with similarities in development, provides evidence of evolution. • Furthermore in this unit on evolution, students will learn about and observe through a simulated lab activity, Darwin's ideas of fitness and his theory of Natural selection, what factors must be present for it to occur, compare and contrast it to artificial selection and relate it to pesticide and antibiotic resistance in insects and bacteria. • Students will compare and contrast convergent and divergent evolution. • Students will learn about reproductive barriers and their significance to speciation and learn to draw and interpret phylogenic trees.
Enduring Understanding (Mastery Objective)	• Students will be able to summarize ideas and events that influenced Darwin's Theory of Evolution. • Students will be able to explain that the diversity and changing of life forms over many generations is the result of natural selection, in which organisms with advantageous traits survive, reproduce, and pass those traits to offspring. • Students will be able to summarize the two main points, Descent with Modification and Natural selection, of Darwin's Theory of Evolution. • Students will be able to explain how the geographic distribution of organisms relates to evolution. • Students will be able to provide evidence for evolution, including, but not limited to, similarities in structure and development, fossil records and molecular make-up. • Students will be able to summarize Darwin's theory of Evolution, compare and contrast it to artificial and natural selection and relate it to pesticide and antibiotic resistance. • Students will be able to explain what is meant by the term ***fitness.*** • Students will be able to describe recent evidence for microevolution on

	the Galapagos Islands. • The diversity and changing of life forms over many generations is the result of natural selection, in which organisms with advantageous traits survive, reproduce, and pass those traits to offspring. • Students will be able to list 4 examples of reproductive barriers, geographic, behavioral, and temporal and habitat, between species, and explain why they are key to speciation. • Students will be able to draw and interpret phylogenic trees to observe evolutionary relationships, adaptive radiation and common ancestors..
Essential Questions (Instructional Objective)	• What traits help this interesting animal to survive? (PowerPoint of duckbill platypus) –adaptations • Who is responsible for framing the ideas of evolution? • What did Darwin see during his journey to the Sothern hemisphere? • How do new species form? • Why were species on the Galapagos islands different from those on the mainland? • Where do variations in a species come from? • What **non-living** things did Darwin see on his journey that helped shaped his idea of *Evolution?* • How were Darwin's views on the Earth and life different from those of the general public in the 1800's? • What scientists helped support Darwin's Theory of Evolution? • How does natural selection encourage inter and intra-specific diversity over time? • What proof do we have that evolution is real? • What causes a population to change? • What causes a Gene Pool to Change? • What type of barriers can divide a species? • What does this diagram (phylogenic tree) tell you about evolution?
Content (Subject Matter)	• Darwin's voyage and observations • Natural Selection • Artificial Selection • Darwin/Wallace vs. Lamarck
Skills/ Benchmarks (CCSS Standards)	• 5.1.12.C.3 – Consider alternative theories to interpret and evaluate evidence-based arguments • 5.3.12.E.1 -Account for the appearance of a novel trait that arose in a given population. • 5.3.12.E.2 -Estimate how closely related species are, based on scientific evidence (e.g., anatomical similarities, similarities of DNA base and/or amino acid sequence). • 5.3.12.E.3 -Provide a scientific explanation for the history of life on Earth using scientific evidence (e.g., fossil record, DNA, protein structures,

	etc.). • 5.3.12.E.4 -Account for the evolution of a species by citing specific evidence of biological mechanisms. • 5.4.12.B.3 Account for the evolution of species by citing specific absolute dating examples of fossil samples

Materials and Resources	• **Natural selection Lab**:
	  ○ Beans (black, red and white)
	  ○ Tweezers
	  ○ Spoons
	  ○ Forks
	• Presentation Cart (projector/document camera), Student handouts, lab materials as necessary

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Grade: 10 **Subject:** Biology I	**Unit 13: Exploring Life – Classification and Taxonomy**
Big Idea/Rationale	• In this unit students will learn about the hierarchical system of classification developed by Carolus Linneaus and used for the past 300 years to group and name all of the organisms found on Earth, past and present. • Students will compare Linneaus' system to today's system and learn about the different characteristics used to group individuals into specific taxa. • Students will compare and contrast the 6 kingdoms of classification used today and learn why the Kingdom Moneera was divided into two kingdoms and further divided into two domains. • Students will learn how to develop and use a dichotomous key to name specific group of organisms • Furthermore in this unit on evolution, students will learn about and observe through a simulated lab activity, Darwin's ideas of fitness and his theory of Natural selection, what factors must be present for it to occur, compare and contrast it to artificial selection and relate it to pesticide and antibiotic resistance in insects and bacteria.
Enduring Understanding (Mastery Objective)	• Describe the binomial nomenclature system and Linnaeus' system of classification. • Name the six kingdoms of life and the three-domain system if classification. • State the goals of taxonomy; • Construct and interpret a dichotomous key • Describe how evolutionary biology and molecular biology influence classification; • Summarize the meaning of a cladogram; • Compare the use of domains and kingdoms in various classification schemes • Identify two domains of prokaryotes; • Describe three physical features that are used to classify prokaryotes; • Describe the four modes of nutrition and identify which one cyanobacteria use. • Identify and describe the two types of bacteria and the factors used to identify each group. Describe two ways in which bacteria cause illness; • Identify ways that humans defend against bacterial diseases. • Describe the structure of a virus and how it causes infection. • Describe characteristics that all protists have in common; • Describe the basic structure of fungi. • Identify the four major groups of plants; describe characteristics for each. • List four general characteristics of animals. • Compare and contrast vertebrates and invertebrates.

Essential Questions (Instructional Objective)	• What is the name of this organism? (PowerPoint – silverfish, crayfish, catfish • How can we group and organize all life on the planet?? • How are living things assigned a scientific name? • What factors determine which taxon an organism is placed in? • How can we identify a particular plant or animal? –dichotomous keys • What can we learn from a cladogram? • How is the domain Eukarya different from the other domains? • Where did life begin? • How are bacteria helpful? How are they harmful?*?* • *What happens to your waste water?* • How can you defend against harmful bacteria? • What characteristics are common to all fungi?? • What characteristics are common to all plants? • Where sis land plants evolve from? • What characteristics are common to all animals? • Why is the kingdom Protista considered a dumping ground?? • How are vertebrates different from invertebrates?
Content (Subject Matter)	• Classification system devised by Linnaeus • New changes to the Classification System – 6 Kingdoms, Domains • Characteristics of each Kingdom & Domain • Using and making a Dichotomous Key
Skills/ Benchmarks (CCSS Standards)	• 5.3.12.E.2 -Estimate how closely related species are, based on scientific evidence (e.g., anatomical similarities, similarities of DNA base and/or amino acid sequence). • 5.3.12.E.3 -Provide a scientific explanation for the history of life on Earth using scientific evidence (e.g., fossil record, DNA, protein structures, etc.). • 5.1.12.D.1 --Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. • 5.1.12.C.1 -Reflect on and revise understandings as new evidence emerges.
Materials and Resources	• Classification lab : various specimen of plants and animals • Presentation Cart (projector/document camera), Student handouts, lab materials as necessary
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