Biology I Honors Curriculum Maps

Grade: 9 **Subject:** Biology I Honors	**Unit 1: Introduction to Science**
Big Idea/Rationale	• The importance of lab safety. • Learn what safety precautions should be taken to prevent an accident • What to do in case of an emergency. • Describe the nature of Discovery Science • Think like a scientist. • Learn the importance of careful observation • Processes and use of the scientific method through theory and hand-on experimentation of controlled experiments. • Organize, graph and interpret data • Use and conversions of metric measurements. • Introduction to biology. • Explain what it means to be alive, • Common characteristics in all living things • Latin and Greek root words in biology
Enduring Understanding (Mastery Objective)	**Students will be able to:** • Learn and practice safety in the science laboratory • Location and use of lab safety tools • Understand what to do in a lockdown, evacuation and/or fire drill • Learn and use the scientific method effectively • Develop and carry out controlled experiments. • Identifying variables • Compare quantitative and qualitative observations • Define and understand the differentiate between inference, hypothesis and theory and explain how they are used in science • Use observations to make inference and hypothesis • Organize data into graphs and tables • Analyze observations to make conclusion • Trace the process of hypothesis bases science through experimentation • Use scientific told to carry out experiments • Explain how additional tools are used in science laboratories around the world • Use compound and scanning microscopes • Measuring in metric • Use Latin root word, prefixes and suffixes to aid in understanding and memorizing key biological terms • Convert between larger and smaller units within the metric system • Compare and contrast Abiotic and Biotic • List and describe Common characteristics of life. • Hierarchal order of multi-cellular organisms

Essential Questions (Instructional Objective)	• How can we prevent accidents in the lab?? • How can we safely respond to emergencies in the lab? • What is the goal of science? • What steps are taken by scientists to better understand the world around us? • What is a hypothesis? • How do you set up a controlled experiment? • What units of measurements are used by scientists and why? • How can you convert between metric units? • How can we make our data easy to read and interpret? • What tools and techniques are used by scientists? • What can you see using a compound microscope? • What 8 characteristics are common in all living things?
Content (Subject Matter)	• Lab safety • The scientific method • Identifying variables • Developing controlled experiments • Tools and techniques of scientist • General Use of a compound microscope • Measuring in metric • Obtaining, collecting and analyzing data • Production of graphs • Standard and metric conversions • Latin root word, prefixes and suffixes • Common characteristics of life.
Skills/ Benchmarks (CCSS Standards)	• **5.3.8.A.1** -All organisms are composed of cell(s). In multi-cellular organisms, specialized cells perform specialized functions. Tissues, organs, and organ systems are composed of cells and function to serve the needs of cells for food, air, and waste removal. • **5.1.12.A.1** - Mathematical, physical, and computational tools are used to search for and explain core scientific concepts and principles. • **5.1.12.A.2** -Interpretation and manipulation of evidence-based models are used to build and critique arguments/explanations. • **5.1.12.A.3** -Revisions of predictions and explanations are based on systematic observations, accurate measurements, and structured data/evidence. • **5.1.12.B.1** -Design investigations collect evidence analyze data and evaluate evidence to determine measures of central tendencies causal correlation relationships and anomalous data. • **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. • **5.1.12.B.4** -Develop quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations.
Materials and Resources	Overhead camera, various lab tools including but not limited to: centrifuge, compound microscope, scanning microscope, mortar/pestle, petri dishes, cover slips and slides, glassware, safety goggles and safety apron, meter sticks, rulers and computers
Notes	

Grade: 9 **Subject:** Biology I Honors	**Unit 2: The Chemistry of Life**
Big Idea/Rationale	• In this unit students will learn about elements and their basic units,-atoms. They will be able to draw the atomic structures for elements 1-18 in the periodic table. • They will compare and contrast the three sub-atomic particles and understand how they affect the properties of the element. They will be able to differentiate between elements and compounds elements and list those commonly found on Earth. They will also be able to predict how an atom is changed if any of the particles are changed;-forming ions and isotopes. • Students will compare the different types of bond (ionic and covalent) and be able to draw structural formulas to represent various simple molecules. • Students will be able to relate the structure of a water molecule to its unique properties. • Students will be able to extend the structural of water to distinguishing between acids and bases. • Once students are knowledgeable on atoms, boning and molecular structures they will begin focusing on the four main types of organic compound found in all living things. They will learn how these compounds form, and be able to describe their structure and function in sustaining life.
Enduring Understanding (Mastery Objective)	• Students will be able to list the most common elements and compounds in living things • Students will be able to compare and contrast elements and compounds • Students will be able to calculate the number of each sub-atomic particle given the information from the Periodic table of Elements • Students will be able to describe and draw the structure of an atom • Students will be able to compare and contrast isotope and ion • Students will be able to compare and contrast ionic and covalent bonds • Students will be able to explain the role of valence electrons in determining stability of an atom. • Students will learn to write and read chemical formulas, chemical equations, and structural formulas. • Students will be able to list and describe water's properties and describe the structure of a water molecule • Students will be able to distinguish between and acid and a base. • Students will be able to identify carbon skeletons and functional groups. • Students will be able to Relate monomers and polymers • Students will be able to describe the processes of building and breaking polymers.

	• Students will be able to describe the function and structure of carbohydrates, lipids, proteins and nucleic acids • Students will be able to explain how enzymes affect activation energy • Students will be able to describe how an enzyme's shape is important to its function • Students will be able to use their knowledge of organic compounds and work as a nutritionist to plan a balanced and nutritious meal. • Students will be able to explain how the carbon cycle reuses carbon in the environment.
Essential Questions (Instructional Objective)	• What are living things made up of? • What information does the Periodic Table give us? • What do atoms look like? • How can atoms be changed? • What is a compound and how are they held together? • What are the properties of water? • What does the pH scale measure? • Why is carbon so important? • How does a formula tell you what's in a compound? • What are polymers? • How are polymers made and broken? • Why do we need carbohydrates in our diet? • Why do we need lipids in our diet? • What are nucleic acids? • Why do we need proteins in our diet? • What are enzymes and how do they s work? • What factors affect how well an enzyme works? • How is carbon recycled in the environment? • How can you plan a healthy meal?
Content (Subject Matter)	Chapter 4 –Chemical Basis of Life • 25 essential elements to life • Atomic structure • Chemical bonds • Properties of water Chapter 5 –Molecules of Life • Carbon (the back bone to organic molecules) • Carbohydrates • Lipids • Nucleic acids • Proteins • Enzymes

Skills/ Benchmarks (CCSS Standards)	• 5.2A 12 CPI 01 -Use atomic models to predict the behaviors of atoms in interactions. • 5.2A 12 CPI 02 -Account for the differences in the physical properties of solids, liquids, and gases. • 5.2A 12 CPI 04 -Explain how the properties of isotopes, including half-lives, decay modes, and nuclear resonances, lead to useful applications of isotopes. • 5.2A 12 CPI 05 -Describe the process by which solutes dissolve in solvents. • 5.2A 12 CPI 06 -Relate the pH scale to the concentrations of various acids and bases. • 5.2B 12 CPI 01 -Model how the outermost electrons determine the reactivity of elements and the nature of the chemical bonds they tend to form. • 5 .3B 12 CPI 01 -Cite evidence that the transfer and transformation of matter and energy links organisms to one another and to their physical setting. • 5.3.12.A.01 -Represent and explain the relationship between the structure and function of each class of complex molecules using a variety of models. • 5.3.12.B.02 - Use mathematical formulas to justify the concept of an efficient diet • 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 • 5.3.12.A.02 -Demonstrate the properties and functions of enzymes by designing and carrying out an experiment.
Materials and Resources	**Beanium Lab:** • Beans (three different types/colors) • Triple/quadruple beam balance • Paper or plastic bags **Properties of Water Lab:** • pennies, eyedroppers, paper towels, • water molecules kits **PH mini lab** • pH paper, blue and red litmus paper, various household items, beakers, iodine, benedicts solution, brown paper, hot plates, biurets solution **Food Testing Lab:** • various examples of carbohydrates, lipids and protein • test tubes, test tube racks, TT holders, hot plates, large beakers (for hot water baths), biurets solution, brown paper, Benedicts solution, Iodine and Sudan IV solution **Enzyme Lab:** • Raw liver, mortar and pestle, forceps, test tubes, test tube racks, TT holders, hot plates, large beakers (for hot water baths) HCl in dropper

	bottles, 3% hydrogen peroxide diluted. **Miscellaneous:,** • protein tubers • paper clip chain, pop link toys and/or paper link chain • magic sand • various examples of carbohydrates, lipids and protein • egg (x4 one for each class) + small frying pan -denaturation of a protein • paper plates and magazines
Notes	• Students should know atomic structure prior to the start of this unit • Students will be quizzed on atomic structure, chemical bonds, propertied of water & the pHscale upon completion of chapter 4.

Grade: 9 **Subject:** Biology I Honors	**Unit 3: 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 cells • 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 describe and draw the make-up of a eukaryotic cell. • Students will be able to compare and contrast plant and animal cells • Students will be able to distinguish between eukaryotic and prokaryotic cells • Students will be able to explain the main ideas of the cell theory and describe the work of the scientists that contributed to the cell theory. • Students will be able to compare and contrast the function of the chloroplast and mitochondria • 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 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 describe and draw the phospholipid bi-layer of the cell membrane • Students will be able to identify functions of various proteins in cellular membrane. • Students will be able to relate diffusion and equilibrium. • Students will be able to describe how passive transport occurs. • Students will be able to relate osmosis to solute concentration. • Students will be able to explain how active transport differs from passive transport. • Students will be able to describe how large molecules move across a membrane
Essential Questions (Instructional Objective)	• What are living things made up of? • What do the various cell organelles look like? • How can a single cell carry out all 8 life functions?? • How are bacteria cells different from other cells? • What is The Cell Theory? • Who were the scientists that help to form the cell theory? • What are exceptions to the cell theory? • How do plant and animal cells differ? • How does a cell control what enters and leaves its cytoplasm? • What roles do proteins play inside the cell membrane? • How does a compound microscope work? • What do our cheek cells look like? • How do cells get the oxygen and nutrients they need? • How do our cells maintain water balance? • How do our cells remove unwanted or harmful wastes?
Content (Subject Matter)	**Chapter 6:** • Cells and Cell Theory • Organelle functions • Cell support and movement • Transport through the cell membrane • Diffusion and Osmosis • Maintaining homeostasis (equilibrium) • Cellular Energy -general
Skills/ Benchmarks (CCSS Standards)	• 5.3.12.A.03 -Predict a cell's response in a given set of environmental conditions. • 5.3.12.A.06 - Describe how a disease is the result of a malfunctioning system organ and cell and relate this to possible treatment interventions (e.g. diabetes cystic fibrosis lactose intolerance). • 5.3.12.B.05 -Investigate and describe the complementary relationship (cycling of matter and flow of energy) between photosynthesis and cellular respiration

Materials and Resources	• **Lab: Observing Plant & Animal cells** - Order in advance: Microscopic Protista, elodea, tooth picks, methylene blue, iodine, black and white thread, magazines, cover-slips and slides, scissors, glue, compound microscopes, aprons • **Lab: SA vs. Absorption rate** – potatoes (need to be slightly dehydrated) iodine, scalpels or plastic knives, Petri dishes and rulers, aprons • **Lab: Osmosis Lab**- eggs, vinegar, distilled water, maple/karo syrup large plastic cups, triple beam balance large graduated cylinders, plastic spoons, aprons • **Lessons:** • Cell model, coloring cell diagrams, phospholipid model, magic sand, air freshener, vanilla, balloon, small box, balloon plastic goo.
Notes	• Reserve computer lab for virtual cell lab • Egg Osmosis lab- needs to be started on a Monday.

Grade: 9 **Subject:** Biology I Honors	**Unit 4: Cell Energy**
Big Idea/Rationale	• In this unit students will learn about cellular energy "production" through the process of Cellular respiration and Photosynthesis. • They will learn about the various types of energy and distinguish between kinetic and potential energy and how energy is transferred from one form to another. • Students will use the information they learned from unit 2, 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. • Students will learn about the transfer and loss of energy within an ecosystem from one organism, starting with plants/autotrophs though heterotrophs and ending with the recycling of matter and the decomposers. (food chain/web) • 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. • Using their knowledge from unit 3, Cell Structures, will see how chloroplasts are able to transfer energy from the sun into glucose during photosynthesis, and how both plants and animals can transfer the energy in glucose into ATP during cellular Respiration inside the mitochondria of our cells. • Students will understand why photosynthesis and plants are essential to us and how cells would produce ATP in the absence of oxygen. • Students will learn the steps in which the two processes above take place. They will learn the reactants and products of each reaction, and explain why the two reactions are referred to as opposite reactions.
Enduring Understanding (Mastery Objective)	Chapter 7: • Students will be able to compare and contrast kinetic energy and potential energy • Students will be able to describe the different forms of energy such as, but not limited to, thermal and light energy. • Students will be able to explain what chemical energy is and how cells release it from food. • Students will be able to define calories and kilocalories as units of energy. • Students will be able to explain the difference between autotrophs and heterotrophs and the different types of heterotrophs;- consumers and decomposers. • Students will be able to describe the structure of ATP and how it stores energy

	• 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 Relate breathing and cellular respiration • Students will be able to summarize the equation for cellular respiration. • Students will be able to explain the role of electrons and electron transport chains as a source of energy • 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 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. • 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. Chapter 8: • Students will be able to Identify the overall reactants and products of photosynthesis • Students will be able to describe the structure of a chloroplast • Students will be able to Explain how light interacts with pigments. • Students will be able to identify the 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 process 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)	Chapter 7: Energy from Food • What are the different types of energy? • How do we get energy from our food? • How does energy move through the ecosystem? • What is ATP and how does it store its energy?

	• Why is breathing necessary? • Where is energy in a molecule of glucose and how do our cells release that energy? • How does cellular respiration begin? • What role do electrons play in cellular respiration? • What part of cellular respiration produces the most energy? • How do cells produce energy in the absence of oxygen? • Where do plants get their energy from? Chapter 8: Energy from sun light • What do plants need for photosynthesis? • How is a chloroplast adapted to carry out photosynthesis? • What happens in each step of photosynthesis? • How are plants adapted to carry out photosynthesis? • What factors can affect the rate of photosynthesis? • How is cellular respiration related to photosynthesis?
Content (Subject Matter)	Chapter 7: • Sunlight powers Life • Food stores Chemical energy • ATP provides energy for cellular work • Electrons "fall" from food to oxygen during cellular respiration. • Cellular respiration converts energy from food to energy in ATP. • Some cell can harvest energy without oxygen. Chapter 8: • Photosynthesis uses light energy to make food • The light reaction converts light energy into chemical energy • Calvin cycle makes sugars from carbon dioxide • Photosynthesis has a global impact
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	• Lab: ATP modeling: colored paper, glue scissors • Lab: **:** Effect of exercise on Respiration small flasks, balloons, string, rulers, sugar, splenda, fruit juices equal, sweet and low, soda, diet soda • Lab : Yeast Fermentation- straws 250mll flasks, timers, graph paper, rulers, calculators and bromothymol blue. • Lab: Chromatography- filter paper, ethyl alcohol, sharpie markers, spinach, red coleus pl leaves, pencil • Lesson: marshmallows, Bunsen burner • Lesson skittle candy, Bunsen burner, potassium chloride – class demo in fume hood • Lesson: molecule kit • Lesson: Chloroplast model
Notes	

Grade: 9 **Subject:** Biology I Honors	**Unit 5: Cell Division and DNA**
Big Idea/Rationale	• In this unit students will learn about the difficulties cells face as they grow and explain what factors can limit their growth • They will learn about the cell cycle and how it relates to cell growth, development and division and what happens to a cell in each stage of the cell cycle. • Students will understand the relationship between cell division, growth, repair and reproduction. • They will understand how all cells come from pre-existing cells. • 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. • In this unit students will learn about the importance of DNA as our genetic material, the work of Griffith, Avery, Hershey & Chase, Chargaff, Wilkins & Franklin and Watson & Crick and how their work contributed to the development of the molecular structure of DNA and the understanding of why and how it replicates before a cell can divide. • Students will learn about DNA's building blocks, the rules for base pairing, replication and the role it plays as our genetic material in protein production and how proteins are produced from these genetic instructions.
Enduring Understanding (Mastery Objective)	Chapter 9: • 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. Chapter 11 • 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 explain where DNA is found within a cell and how so much DNA can fit into such a small area. • 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 "one gene–one polypeptide" hypothesis. • Students will be able to trace the information flow from DNA to protein. • Students will be able to describe how amino acids are coded. • Students will be to describe the types of mutations that can affect genes. • Students will be able to explain what can cause a mutation.
Essential Questions (Instructional Objective)	Chapter 9: The Cellular Basis of Inheritance: • What happens to a cell if it grows too large? • What happens to a cell as it moves through the cell cycle? • How does a single cell divide into two cells? • How is the cell cycle regulated? • What happens to a cell if its cell cycle is not regulated? Chapter 11: DNA and the Language of Life • What does DNA look like? • What scientists help find the molecular structure of DNA? • What other types of nucleic acids are found in our cells and what role do they play? • What are genes? • What is the genome project & how is it useful to us? • How can one strand of DNA allow you to determine the sequence of bases in the 2nd strand of DNA? • How does DNA replicate in the S phase of the cell cycle?? • What is the “one gene–one polypeptide” hypothesis? • How are proteins produced from the information in our DNA? (2 days) • Day 1: How does the information in our DNA get to the ribosomes? • Day 2: How are proteins produced from the genetic information in the mRNA? • How are amino acids coded? • What happens if out genetic code is wrong?
Content	Chapter 9:

(Subject Matter)	• All cells come from cells • The cell cycle multiplies cells • Cells divide during the mitotic phases • Cancer cells grow and divide out of control • Chapter11: • Genes are made of DNA • Nucleic acids store information in the sequence of chemical units • DNA replication is the molecular mechanism of inheritance • A gene provides the information for making a specific protein • Two main steps involved from making a protein from a gene • Mutations can change the meaning of genes.
Skills/ Benchmarks (CCSS Standards)	• **5.3A Grade 12 CPI 02 -**Demonstrate the properties and functions of enzymes by designing and carrying out an experiment. • **5.3A Grade 12 CPI 03-** Predict a cell's response in a given set of environmental conditions. • **5.3A Grade 12 CPI 04 -**Distinguish between the processes of cellular growth (cell division) and development (differentiation). • **5.3D Grade 12 CPI 01 -**Explain the value and potential applications of genome projects. • **5.3D Grade 12 CPI 02 -**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	• **Lab**: Surface area versus volume lab Potatoes, iodine, petri dishes, scalpels, rulers • **Lab:** Observing Mitosis –micro-viewers, booklets, packets and colored pencils, and • Lesson: Mitosis models • Lesson: Helicase shield, polymerase capes, DNA nucleotide pieces from coloring activity • **Lab:** DNA models: licorice black and red, gumdrops or marshmallows (x4 colors) tooth picks, coloring pages of nucleotides • **Lab**: DNA Extraction- frozen strawberries, mortar pestle, dawn dishwashing detergent, ice cold ethyl alcohol, ice, test tubes, plastic bags, salt
Notes	

Grade: 9 **Subject:** Biology I Honors	**Unit 6: Patterns of Inheritance**
Big Idea/Rationale	• In this unit students will learn about the Chromosome theory of Inheritance and the production of gametes with a reduced haploid number of chromosomes through the process of meiosis. They will see how the chromosome number is restored to diploid through fertilization, and how this reduction and restoring of the chromosome number helps to increase genetic variation among sexually reproductive organisms and what could happen to an individual if meiosis is not carried out correctly. • 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. They will use the laws of probability to predict the possible outcome of future offspring using standard and 4 X 4 sized and later 8 X 8 sized Punnett squares to predict genotype and phenotype of future offspring, and learn how to use a Test Cross to determine unknown genotypes • Students will compare the blending hypothesis with Mendel's particulate hypothesis of inheritance and observe why the blending hypothesis is incorrect, they will observe and learn from the inaccuracies in each of Mendel's three principles of Inheritance, as they relate to human inheritance today. • Students will learn about the interaction of alleles in intermediate inheritance and describe inheritance patterns involving multiple alleles, polygenic traits and traits that can be affected by the environment. • 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)	Chapter 9: • Students will be able to describe how homologous chromosomes are alike and how they differ. • Students will be able to contrast haploid and diploid cells. • Students will be able to summarize the process of meiosis. • Students will be able to observe and interpret information on a karyotype to determine the sex of an individual. • Students will be able to describe how chromosome assortment during meiosis contributes to genetic variation. • Students will be able to explain how crossing over contributes to genetic variation. • Students will be able to compare and contrast mitosis and meiosis. Chapter 10: • Students will be able to define trait and explain how they are controlled

	by our genes • Students will be able to compare and contrast the blending hypothesis and the particulate hypothesis of inheritance. • 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 explain how cross pollination helped Mendel in his experimentations with heredity • Students will be able to Explain Mendel's principle of segregation. • Students will be able to describe how probability applies to genetics. • Students will be able to contrast genotype and phenotype. • Describe the inheritance patterns of dominance and recessiveness. • Students will be able to describe how alleles are separated and recombined during sexual reproduction • Students will be able to Explain Mendel's principle of independent assortment • 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 Summarize Mendel's conclusions about inheritance and genetics and his three principles. • Students will be able to describe how alleles interact in intermediate inheritance. • Students will be able to describe inheritance patterns involving multiple alleles. • Students will be able to explain how polygenic inheritance can result in a wide range of phenotypes. • Students will be able to describe how environmental conditions can affect phenotype expression. • Students will be able to Use 8 x 8 Punnett squares to predict the outcome of future offspring in a di-hybrid cross. • Students will be able to explain how polygenic inheritance can result in a wide range of phenotypes • Students will be able to summarize the chromosome theory of inheritance. • Students will be able to explain how genetic linkage provides exceptions to Mendel's principle of independent assortment. • 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. • Students will be able to explain why most sex-linked disorders are more common in males. Chapter 12: • Students will be able to describe how DNA is packed within the nucleus. • Students will be able to explain the significance of the Human Genome

	Project. • Students will be able to relate chromosome disorders such as Downs, Kleinfelters and Turners syndromes and the non-separation of chromosomes. • Students will be able to describe how chromosomes can be damaged. • Students will be able to summarize the information provided in a pedigree.
Essential Questions (Instructional Objective)	• Why are siblings that have the same parents not identical? • How is a sex cell produced? • What does a cell dividing through meiosis look like in each phase? • How did Mendel's work with peas help us understand inheritance? • Why do some traits "skip a generation"? (Principle of Segregation) • How can a Punnett square be used to predict future offspring? • How did Mendel create green wrinkled peas? (Principle of Independent Assortment) • How can a Punnett square be used to predict the combination of two traits? • What happened to the Sphinx cat's tail? (Regulatory genes) • What are some exceptions to Mendel's Principle of Dominance? (Multiple alleles and polygenic traits) • How does an individual get Type AB blood? • What are some exceptions to Mendel's Principle of Independent Assortment? • How can the environment affect our traits? • What does Morgan's work with fruit flies teach us about genetics? • Why is color-blindness more commonly found in males than females? (sex-linked traits) • How can a Punnett square be used to determine the likeliness of passing on a sex linked trait? • What happens if something goes wrong during meiosis? • How can a chromosome be used to diagnose a chromosome disorder? • How is a pedigree chart used to study the inheritance of a trait in a family?
Content (Subject Matter)	Chapter 9: • Meiosis functions in Sexual Reproduction • Meiosis increases Genetic Variation among offspring • Chapter 10 – Patterns of Inheritance • Genetics: Developed from Curiosity and Inheritance • Inheritance follows Rules of Chance • Variations of Inheritance Patterns • Meiosis explains Mendel's principles. • Sex-linked traits have unique inheritance patterns. Chapter 12

	• The nucleus contains an information rich genome. • Accidents affecting chromosomes can cause disorders • Mendel's principles apply to humans.
Skills/ Benchmarks (CCSS Standards)	• **5.3A Grade 12 CPI 04** -Distinguish between the processes of cellular growth (cell division) and development (differentiation). • **5.3D Grade 12 CPI 01** -Explain the value and potential applications of genome projects. • **5.3D Grade 12 CPI 02** -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. • **5.3D Grade 12 CPI 03** -Demonstrate through modeling how the sorting and recombination of genes during sexual reproduction has an effect on variation in offspring (meiosis, fertilization). • **5.3E Grade 12 CPI 01** -Account for the appearance of a novel trait that arose in a given population.
Materials and Resources	• Dragon Genetic Lab: coins, paper and markers • Ree-Bop lab: egg carton, pom-poms, colored eyes, pipe cleaners colored thumbtacks glue, paper chromosomes and feathers
Notes	

Grade: 9 **Subject:** Biology I Honors	**Unit 7: Frontiers of Genetics**
Big Idea/Rationale	• In this unit students will learn that the material that makes a particular person genetically unique, their DNA, can be revealed in a simple pattern of bands. They will learn that these bands are produced by a technique that compares the genomes of different individuals by separating fragments of their DNA. Variations on this technique provide many useful types of information about genes and genomes. • In this unit we will study these techniques in addition to topics relating to genetic technologies that are making today's news headlines. We will look at the advances in agriculture, medicine, and forensics that are based on techniques that isolate and manipulate DNA. This unit will build a framework of concepts that are needed to understand and interpret these news stories in order to be an informed citizen. • 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. . • 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 explain the use of bacteria in DNA technology • Students will be able to list and describe some recent research trends in recombinant DNA technology such as GMOs such as transgenic organisms, and clones.- including controversies. • Students will be able to explain the role of plasmids in engineering bacteria. • Students will be able to explain how biologists "cut and paste" DNA. • Students will be able to describe how biologists genetically modify plants and animals. • Students will be able to explain a technique used to clone animals. • Students will be able to they will simulate the production of transgenic bacteria by cutting and pasting human genes into bacterial plasmids and virtually clone a mouse. On-line • Students will be able to summarize the GMO controversy. • Students will be able to describe the procedure used in cloning a specific gene. • Students will be able to identify the usefulness of recombinant microorganisms • Students will be able to describe the technique that enables scientists to mass-produce specific segments of DNA in a test tube. • Students will be able 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 be able to describe the technique that enables scientists to mass-produce specific segments of DNA in a test tube. • Students will be able to describe a technique used to compare DNA samples. • Students will be able to describe a technique used to compare DNA samples. • Students will be able to explain how operons enable a prokaryote to respond to changes in its environment. • Students will be able to describe how transcription factors regulate genes in eukaryotes. • Students will be able to summarize the importance of cellular differentiation in the development of an egg into an organism. • Students will be able to identify the unique features of stem cells • Students will be able explain how gene therapy and stem cell research can be used to cure genetic disorders, such as but not limited to cystic fibrosis, 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)	• Why is E-coli a useful specimen to use in biotechnology? • How can a bacteria cell produce a human protein? • How can bacteria save your life? (Bacteria and recombinant DNA) • How are GM plants and animals produced? • Why are citizens concerned about GMOs? • How are clones produced? • Who's the thief? (Gel electrophoresis and DNA Fingerprinting) • What does CSI do if they have an extremely small sample of DNA? (PCR) • How are genes turned on and off? • Why are stem cells so important and so controversial? • How can stem cells be used to cure genetic disorders? • What are the different uses for the various types of stem cells used by scientists today?
Content (Subject Matter)	• Biotechnology past and present • Manipulating DNA • Biologically engineered bacteria • Genetically Engineered plants and Animals • The many technologies of DNA applications • Stem cells and stem cell research • Control mechanisms switch genes on and off.

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	• Insulin Factory lab : Blue, yellow and green copy paper for photocopies of genes and plasmid, scissors, tape • Computer lab for various on-line activities • Materials for who done it lab
Notes	

Grade: 9 **Subject:** Biology I Honors	**Unit 8: 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, Lamarck, Lyell , Hutton and Wallace. • Students will see that the earth and the kinds of organisms on Earth have changed over time, and the evidence that evolution has left to support this. • They will learn that different species have come and gone, and new species have emerged. But even as change is part of life, so is continuity. Scientific evidence suggests that all of life is united by descent from the first microbes that appeared on early Earth. In this unit, students will learn how life evolves through the process of natural selection. And explore the connection between different species. • Students will learn that sometimes, within a species differences between individuals 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 • 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. • In this unit students will learn about gene pools, their significance in understanding evolution and how the frequency of alleles in them can change due to genetic drift and/or natural selection. Furthermore they will observe these changes in the documentary, *Voyage to the Galapagos* and virtually in an on-line activity. • Students will compare and contrast convergent and divergent evolution.
Enduring Understanding (Mastery Objective)	• Students will be able to summarize ideas from Darwin's time that influenced his work. • Students will be able to identify key observations from Darwin's voyage that led to his theory. • Students will be able to describe the two main points of Darwin's theory. • Students will be able to describe information the fossil record contains about life on Earth. • Students will be able to tell how the geographic distribution of organisms relates to evolution. • Students will be able to explain how similarities in structure and development among different species are evidence for evolution.

	• Students will be able to describe molecular evidence for evolution • Students will be able to summarize Darwin's theory of natural selection. • Students will be able to compare and contrast artificial selection with natural selection. • Students will be able to relate pesticide resistance in insects to natural selection • Students will be able to explain the significance of gene pools in understanding evolution. • Students will be able to tell how genetic drift, gene flow, mutation, and natural selection contribute to changes in a gene pool. • 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 Galápagos Islands. • Students will be able to explain how natural selection causes the sickle cell allele to persist in some gene pools. • Students will be able to explain how antibiotic resistance may evolve in bacteria. • Students will be able to distinguish between microevolution and macroevolution. • Students will be able to list types of reproductive barriers between species. • Students will be able to explain how geographic isolation and adaptive radiation contribute to species diversity. • Students will be able to Read, interpret and produce a phylogenic tree. • Students will be able to explain how natural selection causes the sickle cell allele to persist in some gene pools. • Students will be able to explain how antibiotic resistance may evolve in bacteria.
Essential Questions (Instructional Objective)	• What experiences helped shape Darwin's theory of Evolution? • What scientists helped support Darwin's Theory of Evolution? • What is Natural Selection? • What evidence can be found to support evolution? • What can fossils tell us? • Where do variations in a species come from? • What factors are needed for a new species to form? • What conditions lead to evolution? • How does artificial selection reflect evolution? • Why does a specific pesticide become less effective over time? • What factors can change a gene pool? • How does genetic drift affect a population? • What is biological fitness? • How does microevolution occur? • How is convergent evolution different from Darwin's theory of

	evolution? • What information can you get from a phylogenic tree? • How do bacteria become resistant to medicine?
Content (Subject Matter)	• Darwin developed a theory of Evolution (14) • Evidence of Evolution (14) • Natural Selection (14) • Microevolution (14 & 15) • The diversity of life is based on the origin of new species (15) • Evolutionary biology's affect in health science (14)
Skills/ Benchmarks (CCSS Standards)	• **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. • **5.1.12.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	• Pre-made and counted "mouse" cards • Beans (black, red and white) • Tweezers • Spoons • Forks • Dice
Notes	

Grade: 9 **Subject:** Biology I Honors	**Unit 9: Classification /Taxonomy**
Big Idea/Rationale	• In this unit students will learn about a branch of biology called taxonomy, which involves the identification, naming, and classification of species. They will understand that assigning scientific names to species is an important part of studying the history of life. Although common names generally work well in everyday language, they can also cause confusion. Sometimes the same common name can even refer to very different organisms. • Students will see that to reduce this confusion in discussing organisms, one goal of taxonomy is to assign a universal scientific name to each known species. In this section students will learn about the beginnings of taxonomy, how it has evolved with our growing knowledge of science and the methods used by taxonomists to attempt to organize the diversity of life by classifying species into larger groups of related species and assigning each species a universal scientific name. • Students will also explore the characteristics of organisms grouped in each of the kingdoms.
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)	• 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 • How is the domain Eukarya different from the other domains? • How are bacteria helpful? How are they harmful?*?* • What characteristics are common to all fungi?? • What characteristics are common to all plants? • Where did land plants evolve from? • What characteristics are common to all animals? • Why is the kingdom Protista considered a dumping ground??
Content (Subject Matter)	
Skills/ Benchmarks (CCSS Standards)	**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.). **5.1.12.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
Notes	

Grade: 9 **Subject:** Biology I Honors	**Unit 10: Exploring Ecology**
Big Idea/Rationale	• In this unit students will learn that all animals and most plants depend on both other organisms and their environment to meet their basic needs. They will learn that Food is required for energy and building cellular materials. Organisms in an ecosystem have different ways of obtaining food, and some organisms obtain their food directly from other organisms. • Students will to making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of modeling and mathematics.
Enduring Understanding (Mastery Objective)	• The levels of Ecological study from individual to Biosphere. • The uneven distribution of energy from the sun and abiotic factors can create different biomes in the biosphere • The survival of organisms is affected by interactions with each other and their environment, and can be altered by human manipulation. • How is matter transferred and energy transferred/ transformed in living systems? • All organisms transfer matter and convert energy from one form to another. Both matter and energy are necessary to build and maintain structures within the organism • Measurement and observation tools are used to categorize, represent and interpret the natural world. • Global wind pattern, precipitation, solar energy and ocean currents affect climate. • How microclimates can differ from local climates • Describe the different patterns of growth. • Relate limiting factors to carrying capacity • Compare and contrast density-dependent and density-independent factors
Essential Questions (Instructional Objective)	• How are organisms dependent on each other? • How is matter transferred and energy transferred/ transformed in living systems? • Can two different species occupy the same niche at the same time? • What happens when two different species live close together? • How do populations grow? • How are life's key elements recycled in the ecosystem? • Are you really what you eat • What ecological factors are affected by the unequal distribution of solar

	energy from the sun? • How does an ecosystem recover after a natural disaster? • How can we build models that describe and explain the natural and designed world? • What factors of an ecosystem are affected by an increase in COZ?
Content (Subject Matter)	
Skills/ Benchmarks (CCSS Standards)	• **5.3.12.C.1 -**Analyze the interrelationships and interdependencies among different organisms, and explain how these relationships contribute to the stability of the ecosystem. • **5.3.12.C.2** -Model how natural and human-made changes in the environment will affect individual organisms and the dynamics of populations. • **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.3** Predict what would happen to an ecosystem if an energy source was removed. • **5.3.12.B.5** -Investigate and describe the complementary relationship (cycling of matter and flow of energy) between photosynthesis and cellular respiration. • **5.1.12.A.1** Refine interrelationships among concepts and patterns of evidence found in different central scientific explanations • 5**.1.12.C.1** -Reflect on and revise understandings as new evidence emerges. • **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	• **Owl pellet** : owl pellets, paper plates, bone charts, diagram of human skeleton, tweezers
Notes	