**NACA Yearlong UbD Template**

**UbD Curriculum Template 2.0**

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| **Stage 1 Desired Results** | | | |
| **Directions:** Choose multiple CCSS (or other standards), copy and paste them here, and unpack them for big ideas and assessment verbs by highlighting.  **Strand I: Scientific Thinking and Practice**  **Standard I:** Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.  **Benchmark I:** Use accepted scientific methods to collect, analyze, and interpret data and observations and to design and conduct scientific investigations and communicate results.  1. Describe the essential components of an investigation, including appropriate methodologies, proper equipment, and safety precautions.  2. Design and conduct scientific investigations that include:  • testable hypotheses  • controls and variables  • methods to collect, analyze, and interpret data  • results that address hypotheses being investigated  • predictions based on results  • Re-evaluation of hypotheses and additional experimentation as necessary error analysis.  3. Use appropriate technologies to collect, analyze, and communicate scientific data (e.g., computers, calculators, balances, microscopes).  4. Convey results of investigations using scientific concepts, methodologies, and expressions, including:  • scientific language and symbols  • diagrams, charts, and other data displays  • mathematical expressions and processes (e.g., mean, median, slope, proportionality  • clear, logical, and concise communication  • reasoned arguments.  5. Understand how scientific theories are used to explain and predict natural phenomena  **Benchmark II:** Understand that scientific processes produce scientific knowledge that is continually evaluated, validated, revised, or rejected.  1. Understand how scientific processes produce valid, reliable results, including:  • consistency of explanations with data and observations  • openness to peer review  • full disclosure and examination of assumptions  • testability of hypotheses  • Repeatability of experiments and reproducibility of results.  2. Use scientific reasoning and valid logic to recognize:  • faulty logic  • cause and effect  • the difference between observation and unsubstantiated inferences and conclusions  • Potential bias.  3. Understand how new data and observations can result in new scientific knowledge.  4. Critically analyze an accepted explanation by reviewing current scientific knowledge.  5. Examine investigations of current interest in science (e.g., superconductivity, molecular machines, age of the universe).  6. Examine the scientific processes and logic used in investigations of past events (e.g., using data from crime scenes, fossils), investigations that can be planned in advance but are only done once (e.g., expensive or time-consuming experiments such as Medical clinical trials), and investigations of phenomena that can be repeated easily and frequently.  **Benchmark III:** Use mathematical concepts, principles, and expressions to analyze data, develop models, understand patterns and relationships, evaluate findings, and draw conclusions.  1. Create multiple displays of data to analyze and explain the relationships in scientific investigations.  2. Use mathematical models to describe, explain, and predict natural phenomena.  3. Use technologies to quantify relationships in scientific hypotheses (e.g., calculators, computer spreadsheets and databases, graphing software, simulations, modeling).  4. Identify and apply measurement techniques and consider possible effects of measurement errors.  5. Use mathematics to express and establish scientific relationships (e.g., scientific notation, vectors, dimensional analysis).  **Strand II: The Content of Science**  **Standard II (Life Science):** Understand the properties, structures, and processes of living things and the interdependence of living things and their environments.  **Benchmark I**: Understand how the survival of species depends on biodiversity and on complex interactions, including the cycling of matter and the flow of energy.  Ecosystems  1. Know that an ecosystem is complex and may exhibit fluctuations around a steady state or may evolve over time.  2. Describe how organisms cooperate and compete in ecosystems (e.g., producers, decomposers, herbivores, carnivores, omnivores, predator-prey, symbiosis, and mutualism).  3. Understand and describe how available resources limit the amount of life an ecosystem can support (e.g., energy, water, oxygen, nutrients).  4. Critically analyze how humans modify and change ecosystems (e.g., harvesting, pollution, population growth, technology).  Energy Flow in the Environment  5. Explain how matter and energy flow through biological systems (e.g., organisms, communities, ecosystems), and how the total amount of matter and energy is conserved but some energy is always released as heat to the environment.  6. Describe how energy flows from the sun through plants to herbivores to carnivores and decomposers.  7. Understand and explain the principles of photosynthesis (i.e., chloroplasts in plants convert light energy, carbon dioxide, and water into chemical energy).  Biodiversity  8. Understand and explain the hierarchical classification scheme (i.e., domain, kingdom, phylum, class, order, family, genus, species),  including:  • classification of an organism into a category  • similarity inferred from molecular structure (DNA) closely matching classification based on anatomical similarities  • Similarities of organisms reflecting evolutionary relationships.  9. Understand variation within and among species, including:  • mutations and genetic drift  • factors affecting the survival of an organism  • Natural selection.  **Benchmark II:** Understand the genetic basis for inheritance and the basic concepts of biological evolution.  Genetics  1. Know how DNA carries all genetic information in the units of heredity called genes, including:  • the structure of DNA(e.g., subunits A, G, C, T)  • information-preserving replication of DNA  • Alteration of genes by inserting, deleting, or substituting parts of DNA.  2. Use appropriate vocabulary to describe inheritable traits (i.e., genotype, phenotype).  3. Explain the concepts of segregation, independent assortment, and dominant/recessive alleles.  4. Identify traits that can and cannot be inherited.  5. Know how genetic variability results from the recombination and mutation of genes, including:  • sorting and recombination of genes in sexual reproduction result in a change in DNA that is passed on to offspring  • Radiation or chemical substances can cause mutations in cells, resulting in a permanent change in DNA.  6. Understand the principles of sexual and asexual reproduction, including meiosis and mitosis.  7. Know that most cells in the human body contain 23 pairs of chromosomes including one pair that determines sex, and that human females have two X chromosomes and human males have an X and a Y chromosome.  Biological Evolution  8. Describe the evidence for the first appearance of life on Earth as one-celled organisms, over 3.5 billion years ago, and for the later appearance of a diversity of multicellular organisms over millions of years.  9. Critically analyze the data and observations supporting the conclusion that the species living on Earth today are related by descent from the ancestral one-celled organisms.  10. Understand the data, observations, and logic supporting the conclusion that species today evolved from earlier, distinctly different species, originating from the ancestral one-celled organisms.  11. Understand that evolution is a consequence of many factors, including the ability of organisms to reproduce, genetic variability, the effect of limited resources, and natural selection.  12. Explain how natural selection favors individuals who are better able to survive, reproduce, and leave offspring.  13. Analyze how evolution by natural selection and other mechanisms explains many phenomena including the fossil record of ancient life forms and similarities (both physical and molecular) among different species.  **Benchmark III: Understand the characteristics, structures, and functions of cells.**  **Structure and Function**  1. Know that cells are made of proteins composed of combinations of amino acids.  2. Know that specialized structures inside cells in most organisms carry out different functions, including:  • parts of a cell and their functions (e.g., nucleus, chromosomes, plasma, and mitochondria)  • storage of genetic material in DNA  • similarities and differences between plant and animal cells  • Prokaryotic and eukaryotic cells.  3. Describe the mechanisms for cellular processes (e.g., energy production and storage, transport of molecules, waste disposal, and synthesis of new molecules).  4. Know how the cell membrane controls which ions and molecules enter and leave the cell based on membrane permeability and transport (i.e., osmosis, diffusion, active transport, passive transport).  5. Explain how cells differentiate and specialize during the growth of an organism, including:  • differentiation, regulated through the selected expression of different genes  • Specialized cells, response to stimuli (e.g., nerve cells, sense organs).  6. Know that DNA directs protein building (e.g., role of RNA).  Biochemical Mechanisms  7. Describe how most cell functions involve chemical reactions, including:  • promotion or inhibition of biochemical reactions by enzymes  • processes of respiration (e.g., energy production, ATP)  • Communication from cell to cell by secretion of a variety of chemicals (e.g., hormones).  **Strand II: The Content of Science**  **Standard III (Earth and Space Science):** Understand the structure of Earth, the solar system, and the universe, the interconnections among them, and the processes and interactions of Earth’s systems.  **Benchmark I:** Examine the scientific theories of the origin, structure, contents, and evolution of the solar system and the universe, and their interconnections.  Structure and Function  1. Understand the scale and contents of the universe, including:  • range of structures from atoms through astronomical objects to the universe  • Objects in the universe such as planets, stars, galaxies, and nebulae.  2. Predict changes in the positions and appearances of objects in the sky (e.g., moon, sun) based on knowledge of current positions and patterns of movements (e.g., lunar cycles, seasons).  3. Understand how knowledge about the universe comes from evidence collected from advanced technology (e.g., telescopes, satellites, images, computer models).  4. Describe the key observations that led to the acceptance of the Big Bang theory and that the age of the universe is over 10 billion years.  5. Explain how objects in the universe emit different electromagnetic radiation and how this information is used.  6. Describe how stars are powered by nuclear fusion, how luminosity and temperature indicate their age, and how stellar processes create heavier and stable elements that are found throughout the universe.  7. Examine the role that New Mexico research facilities play in current space exploration (e.g., Very Large Array, Goddard Space Center).  **Strand II: The Content of Science**  **Standard III (Earth and Space Science):** Understand the structure of Earth, the solar system, and the universe, the interconnections among them, and the processes and interactions of Earth’s systems.  **Benchmark II:** Examine the scientific theories of the origin, structure, energy, and evolution of Earth and its atmosphere, and their interconnections.  Characteristics and Evolution of Earth  1. Describe the characteristics and the evolution of Earth in terms of the geosphere, the hydrosphere, the atmosphere, and the biosphere.  2. Recognize that radiometric data indicate that Earth is at least 4 billion years old and that Earth has changed during that period.  3. Describe the internal structure of Earth (e.g., core, mantle, crust) and the structure of Earth’s plates.  4. Understand the changes in Earth’s past and the investigative methods used to determine geologic time, including:  • rock sequences, relative dating, fossil correlation, and radiometric dating  • Geologic time scales, historic changes in life forms, and the evidence for absolute ages (e.g., radiometric methods, tree rings, paleo magnetism).  5. Explain plate tectonic theory and understand the evidence that supports it.  Energy in Earth’s System  6. Know that Earth’s systems are driven by internal (i.e., radioactive decay and gravitational energy) and external (i.e., the sun) sources of energy.  7. Describe convection as the mechanism for moving heat energy from deep within Earth to the surface and discuss how this process  results in plate tectonics, including:  • geological manifestations (e.g., earthquakes, volcanoes, mountain building) that occur at plate boundaries  • Impact of plate motions on societies and the environment (e.g., earthquakes, volcanoes).  8. Describe the patterns and relationships in the circulation of air and water driven by the sun’s radiant energy, including:  • patterns in weather systems related to the transfer of energy  • differences between climate and weather  • global climate, global warming, and the greenhouse effect  • El Niño, La Niña, and other climatic trends.  Geochemical Cycles  9. Know that Earth’s system contains a fixed amount of natural resources that cycle among land, water, the atmosphere, and living things (e.g., carbon and nitrogen cycles, rock cycle, water cycle, ground water, aquifers).  10. Describe the composition and structure of Earth’s materials, including:  • the major rock types (i.e., sedimentary, igneous, metamorphic) and their formation  • Natural resources (e.g., minerals, petroleum) and their formation.  11. Explain how layers of the atmosphere (e.g., ozone, ionosphere) change naturally and artificially.  12. Explain how the availability of ground water through aquifers can fluctuate based on multiple factors (i.e., rate of use, rate of replenishment, surface changes, and changes in temperature).  **Strand III: Science and Society**  **Standard I:** Understand how scientific discoveries, inventions, practices, and knowledge influence, and are influenced by, individuals and societies.  **Benchmark I:** Examine and analyze how scientific discoveries and their applications affect the world, and explain how societies influence scientific investigations and applications.  Science and Technology  1. Know how science enables technology but also constrains it, and recognize the difference between real technology and science fiction (e.g., rockets vs. antigravity machines; nuclear reactors vs. perpetual-motion machines; medical X-rays vs. Star-Trek tricorders).  2. Understand how advances in technology enable further advances in science (e.g., microscopes and cellular structure; telescopes and understanding of the universe).  3. Evaluate the influences of technology on society (e.g., communications, petroleum, transportation, nuclear energy, computers, medicine, and genetic engineering) including both desired and undesired effects, and including some historical examples (e.g., the wheel, the plow, the printing press, and the lightning rod).  4. Understand the scientific foundations of common technologies (e.g., kitchen appliances, radio, television, aircraft, rockets, computers, medical X-rays, selective breeding, fertilizers and pesticides, agricultural equipment).  5. Understand that applications of genetics can meet human needs and can create new problems (e.g., agriculture, medicine, cloning).  6. Analyze the impact of digital technologies on the availability, creation, and dissemination of information.  7. Describe how human activities have affected ozone in the upper atmosphere and how it affects health and the environment.  8. Describe uses of radioactivity (e.g., nuclear power, nuclear medicine, radiometric dating).  Science and Society  9. Describe how scientific knowledge helps decision makers with local, national, and global challenges (e.g., Waste Isolation Pilot  Project [WIPP], mining, drought, population growth, alternative energy, climate change).  10. Describe major historical changes in scientific perspectives (e.g., atomic theory, germs, cosmology, relativity, plate tectonics, and evolution) and the experimental observations that triggered them.  11. Know that societal factors can promote or constrain scientific discovery (e.g., government funding, laws and regulations about human cloning and genetically modified organisms, gender and ethnic bias, AIDS research, alternative-energy research).  12. Explain how societies can change ecosystems and how these changes can be reversible or irreversible.  13. Describe how environmental, economic, and political interests impact resource management and use in New Mexico.  14. Describe New Mexico’s role in nuclear science (e.g., Manhattan Project, WIPP, national laboratories).  Science and Individuals  15. Identify how science has produced knowledge that is relevant to individual health and material prosperity.  16. Understand that reasonable people may disagree about some issues that are of interest to both science and religion (e.g., the origin of life on Earth, the cause of the Big Bang, the future of Earth).  17. Identify important questions that science cannot answer (e.g., questions that are beyond today’s science, decisions that science can only help to make, questions that are inherently outside of the realm of science).  18. Understand that scientists have characteristics in common with other individuals (e.g., employment and career needs, curiosity, desire to perform public service, greed, preconceptions and biases, temptation to be unethical, core values including honesty and openness).  19. Know that science plays a role in many different kinds of careers and activities (e.g., public service, volunteers, public office holders, researchers, teachers, doctors, nurses, technicians, farmers, ranchers).  **Next Generations Science Standards:**  **Disciplinary Core Ideas**  **LS1.A: Structure and Function**  **•Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)**  **•All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1) (Note: This Disciplinary Core Idea is also addressed by HS-LS3-1.)**  **•Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)**  **•Feedback mechanisms maintain a living system’s internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3)**  **LS1.B: Growth and Development of Organisms**  **•In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4)**  **LS1.C: Organization for Matter and Energy Flow in Organisms**  **•The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (HS-LS1-5)**  **•The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells. (HS-LS1-6)**  **•As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. (HS-LS1-6),(HS-LS1-7)**  **•As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new compounds are formed that can transport energy to muscles. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment. (HS-LS1-7)**  **LS3.A: Inheritance of Traits**  **•Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species’ characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (HS-LS3-1)**  **LS3.B: Variation of Traits**  **•In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. (HS-LS3-2)**  **•Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors. (HS-LS3-2),(HS-LS3-3)**  **LS4.A: Evidence of Common Ancestry and Diversity**  **•Genetic information, like the fossil record, provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence. (HS-LS4-1)**  **LS4.B: Natural Selection**  **•Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. (HS-LS4-2), (HS-LS4-3)**  **•The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. (HS-LS4-3)**  **LS4.C: Adaptation**  **•Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment’s limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment. (HS-LS4-2)**  **•Natural selection leads to adaptation that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. (HS-LS4-3), (HS-LS4-4)**  **•Adaptation also means that the distribution of traits in a population can change when conditions change. (HS-LS4-3)**  **•Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species. (HS-LS4-5), (HS-LS4-6)**  **•Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species’ evolution is lost. (HS-LS4-5)**  **LS4.D: Biodiversity and Humans**  **•Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (HS-LS4-6)**  **ETS1.B: Developing Possible Solutions**  **•When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (Secondary to HS-LS4-6)**  **•Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (Secondary to HS-LS4-6)** | | | |
| **Other than the big ideas explicitly in the standards you chose, what big ideas might frame this yearlong curriculum?**   * Science involves a particular way of knowing that includes relying on empirical evidence, logical arguments, skepticism, and peer review. Scientific ideas are revised over time as new evidence becomes available. * Benefits and costs of scientific research and technological innovation include consequences that are long-term as well as short-term, and indirect as well as direct. * Scientific inquiry involves asking scientifically oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying explanations. * Matter has properties related to its structure that can be measured and used to identify, classify and describe substances or objects. * Energy occurs in different forms and is necessary to do work or to cause change. * All organisms share similar characteristics and basic needs, but they also have differences that allow people to identify, describe and classify them. * The Earth System is composed of and part of a multitude of systems, which cycle and interact resulting in dynamic equilibrium. | | | |
| CHOSEN BIG IDEAS(S):  Biology is the study of relationships between  structure and function in  Organisms and the interaction of cells and organisms with each other and their environments.   1. The Science of Life 2. Systems and Interactions | ***Transfer*** | | |
| **Students will be able to independently use their learning to:**  **Demonstrate the ability to analyze biological issues and make decisions regarding required knowledge to move forward in sciences.**   * **reflect broad conceptual knowledge and adaptive skills in Biology** * **reflect essential knowledge, skills or attitudes;** * **focus on results of the learning experiences;** * **reflect the desired end of the learning experience, the means or the process;** * **represent and advocate for the need of science** * **Answer the question, "Why and how things work in Science?”** | | |
| ***Meaning*** | | |
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| **UNDERSTANDINGS**  Students will understand that…   * Science is different from other disciplines in the way it approaches questions. * Science and technology has affected the quality of life. * People use the process of science to investigate questions about the natural world. * Living things come from living things. * Cells are the basic units of life. * Matter is the basic makeup up living things and non-living things. * Energy is power derived from the utilization of physical or chemical resources, especially to provide light and heat. * Energy interacts with matter to cause change and do work. * All living things can be similar, and they can different. * Earth’s systems interact with living and non-living things. | | **ESSENTIAL QUESTIONS**   * What types of questions and hypotheses can be answered by science? * What levels of design are critical in conducting a scientific investigation? * What makes science different from other disciplines like math? * How can we ensure that scientific investigations are both safe and consistent with standard scientific practice? * Is there always only one answer in science? * What is life? How are all living things the same, and how are they different? * How does a single‐cell become a complex organism in which different cells have different structures and perform highly specialized functions? * How do living organisms maintain relatively constant internal conditions despite significant variation in external environmental conditions? * How information is passed from one generation to the next so that offspring resemble their parents, but are not exactly the same as their parents? * What does science tell us about evolutionary biology, the unity and diversity of organisms on Earth, and how present populations are changing? * How is light energy from the sun transformed into energy usable by plants, and how do all organisms use stored chemical energy to perform the functions necessary for life (building and breaking down macromolecules, regulating the internal environment, etc.)? * How do biotic and abiotic factors interact to influence the composition of ecosystems? * How have science and technology affected the quality of life? |
| ***Acquisition*** | | |
| ***Students will know…***   * **Unit 1:** **Introduction to Biology/ Part I** * Necessities for the study of Biology. * **Introduction to Biology/Part II** * How Biology classifies organisms to be alive. * **Unit 2: Cells/Cell Structure/Part I** * Parts of the cell. * **Cells/Cell Function/Part I** * How cells function. * **Unit 3:** **Nucleic Acids** * Nucleic acids are needed in the cell. * **Unit 4: DNA Technology** * DNA technology is applied in forensics, medicine, and agriculture?   **Unit 5: Mendelian Genetics and Meiosis/Mitosis**   * How do we look different if we are all made from the same stuff? * **Unit 6:** **Classification** * Characteristics used to identify and group organisms. * Organisms cycle energy through photosynthesis and respiration.   **Unit 7: Evolution**   * The key processes of evolution. * **Unit 8: Ecology** * Abiotic and biotic factors interact on earth? | | ***Students will be skilled at…***   * **Unit 1 Introduction to Biology** * Evaluating the importance of curiosity, honesty, openness, and skepticism in science. * Understanding standard safety practices for all classroom laboratory and field investigations. * Identifying and investigating problems scientifically. * Using tools and instruments for observing, measuring, and manipulating scientific equipment and materials. * Demonstrating the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations. * Communicating scientific investigations and information clearly. * Analyzing how scientific knowledge is developed. * Understanding important features of the process of scientific inquiry. * **Introduction to Biology/Part II** * **Analyzing the nature of the relationships between structures and functions in living cells.** * cell organelles, cell types, * cell membrane, homeostasis, * cell reproduction * enzymes * macromolecule * water and transport * **Students will analyze how biological traits are passed on to successive generations.** * DNA vs RNA * DNA structure and function * asexual vs sexual reproduction * **Deriving the relationship between single-celled and multi-celled organisms and the increasing complexity of systems.** * 6 kingdoms * viruses vs living organisms * **Assessing the dependence of all organisms on one another**   **and the flow of energy and matter within their ecosystems**   * ecological levels of organization * **Unit 2: Cell Structure** * **Analyzing how scientific knowledge is developed.** * **Analyzing the nature of the relationships between structures and functions in living cells.** * cell organelles, cell types, cell membrane, homeostasis, cell reproduction * **Analyzing the nature of the relationships between structures and functions in living cells.** * Cell organelles, cell types, cell membrane, homeostasis, cell reproduction. * water and transport * **Analyzing how biological traits are passed on to successive generations** * sexual vs asexual reproduction * **Unit 3:** * **Analyzing how scientific knowledge is developed.** * **Analyzing how biological traits are passed on to successive generations.** * DNA vs RNA. * DNA structure and function. * DNA Mutations * **Unit 4:** * **Analyzing how biological traits are passed on to successive generations.** * DNA mutations, DNA technology in forensics, medicine, and * agriculture * **Unit 5:** * **Analyzing how biological traits are passed on to successive generations**. * Mendel’s Laws * sexual vs asexual reproduction   **Unit 6:**   * **Deriving the relationship between single-celled and multi-celled organisms and the increasing complexity of systems.** * six kingdoms * Classification systems. * **Deriving the relationship between single-celled and multicelled organisms and the increasing complexity of systems.** * Photosynthesis and respiration   **Unit 7:**   * **Assessing the dependence of all organisms on one another and the flow of energy and matter within their ecosystems.** * Plant adaptations * Animal adaptations * **Evaluating the role of natural selection in the development of the theory of evolution.** * History of the theory. * Biodiversity, ancestry, and the rates of evolution. * fossil and biochemical evidence * natural selection * biological resistance   **Unit 8:**   * **Assessing the dependence of all organisms on one another and the flow of energy and matter within their ecosystems.** * Ecological levels of organization * Energy flow  1. Food Wed 2. Food Chain 3. Energy pyramids 4. Nutrient cycles  * Succession * Human impact on the environment. * Plant adaptations. * Animal adaptations * **Deriving the relationship between single-celled and multi-celled organisms and the increasing complexity of systems.** * Photosynthesis and respiration. |
| **Stage 2 – Evidence** | | | |
| **Evaluative Criteria** | | **Assessment Evidence** | |
| Standards-based A+ Rubric in Student-friendly Language   |  |  |  | | --- | --- | --- | | Performance Assessment Criteria and Standard Alignment | Complete | Needs Revision | | *Ex. CCSS.ELA-LITERACY.W.8.1.B*  *I can use relevant, accurate information to support a claim.* |  |  | | Student is thorough, and can provide evidence and defend biology answers. |  |  | | Student can question, describe and write so that comparative relationships between experimental variables are clearly stated. |  |  | | Student can hypothesize and discuss explanatory statements.  Student predictions are specific and tightly connected with research questions and hypothesis.  Students’ can graph statistics, and other measurements.  Students’ can defend data and clearly describe and provide compelling evidential support for experimental outcome.  Students can illustrate by using pictures, descriptions, and general observations to clearly describe and provide compelling evidential support for experimental outcomes.  Executive Skills, Organizational or good mental health. |  |  | | | PERFORMANCE TASK(S): Projects, dialogue, labs, and Peer Review, and advocating.    What (cognitive verb + big idea):  Student will understand that Biology is the study of relationships between structure and function in organisms and interactions of cells and organisms create systems and the science life.    Why (copied and pasted EUs from Stage 1):   * Science is different from other disciplines in the way it approaches questions. * Science and technology has affected the quality of life. * People use the process of science to investigate questions about the natural world. * Living things come from living things. * Cells are the basic units of life. * Matter is the basic makeup up living things and non-living things. * Energy is power derived from the utilization of physical or chemical resources, especially to provide light and heat. * Energy interacts with matter to cause change and do work. * All living things can be similar, and they can different. * Earth’s systems interact with living and non-living things.   How (GRASPS, written to and for students):  **Goal: Students will understand that science is the way of knowing- a way of explaining the natural world through observation, questions, and experiments. Students will create a brochure to NACA to explain that science is a living adventure story, aimed at understanding indigenous cultures and the world around us. They must include where their story begins with the relationship between matter that forms our bodies and the energy that powers life’s processes.**  **Role: The must advocate for life processes and the respect for all life.**  **Audience: Native American Community Academy Administration**  **Situation: Use everything you know about science to advocate the importance of preserving life.**  **Product, Performance, and Purpose:**  **Final brochure, Presentation for peers, and advocating.**  **Standards and Criteria for Success:**  **Using Voice to be heard.** | |
| <type here> | | OTHER EVIDENCE: | |
| |  | | --- | | **Stage 3 – Learning Plan** *What units will you teach, and what skills will students master, as a result of this yearlong curriculum?* |   \_\_\_2015\_\_\_\_\_\_ - \_\_2016\_\_\_\_\_\_\_\_ Academic Year Curriculum Map Template   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Unit Big Idea (Title) | Unit Essential Question(s) | Unit Standard(s) | Assessment(s) | Time Frame | | What big idea anchors this unit? | What EQ will anchor conceptual, critical thinking related to the big idea? | What core standard(s) anchors this unit, and therefore what observable skills will you evaluate? | What summative assessment will provide you evidence of skills and understanding? | What is the approximate time frame for the teaching and learning in this unit? | | 1. Unit 1   Necessities for the study of Biology. | What are standard classroom lab safety practices?  How do we investigate, observe and make predictions? | Standard I  Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.  Students will communicate scientific investigations and information clearly.  Students analyze how scientific knowledge is developed.  Students will understand important features of the process of scientific inquiry. | Formative:  Quizzes  Catalyst  Exit Slips  Alien Experiment  Gummy Bear Lab or Bubble Gum Lab/Peer Review of Presentation/Rap song Power Point/Movie  Informational/Technical  Foldable  Interactive Notebook Binder  Summative:  Unit Test | August 2015 | | Unit 1  Classifying organisms as being alive. | How is chemistry related to living organisms?  What characteristics do living organisms share?  How are living things organized? | Standard III  Students will analyze the nature of the relationships between structures and functions in living cells.  Students will analyze how biological traits are passed on to successive generations.  Students will derive the relationship between single-celled and multicelled organisms and the increasing complexity of systems  Students will assess the dependence of all organisms on one another and the flow of energy and matter within their ecosystem.  LS1.A: Structure and Function  •Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1) | Formative:  Graphic organizers, put images in order from least complex to most complex.  Identify macromolecule based on characteristics  Macromolecule foldable/booklet  Informational/Text-Based Writing  Constructed response evaluate an enzyme graph and explain activation energy  Constructed Response- Identify the source, monomers, and functions of a macromolecule  Enzyme Lab with cow livers  Bursting Bhullar’s Biology Jeopardy game.  Summative:  Unit Test  Lab follow up and interpretation questions  Interactive notebook check for understanding | August to September 2015  6 weeks | | 1. Unit 2I:   Cell structures. | Who contributed to the cell theory?  What are the characteristics of the different types of cells?  What are the structures and functions of eukaryotic cell organelles? | Standard III, Standard IV  Students analyze how scientific knowledge is developed.  Students will analyze the nature of the relationships between structures and functions in living cells.  Cell organelles, cell types, cell membrane, homeostasis, and cell reproduction.  LS1.A: Structure and Function  •Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2) | Formative:  Quizzes  STEM/ Microscopes- Onion or Cheek Lab  STEM/ Promethean simulation  Discovery Timeline Activity  Formative assessment questions   * Label cell parts * Is this a prokaryote or eukaryote * Plant or animal cell * Organelle and function -matching   Persuasive writing assignment- which cell organelle is the most important to the cell  Cell City Analogy  Cell Organelles Stations:   * Plant and Animal cell labeling * Prokaryotes Critical Reading and Labeling with Venn Diagrams * Design your own crossword puzzles * Foldables   Summative:  Unit Test  Lab follow- up constructed response questions- which cell has a nucleus and how can you tell?  Which of the images is of a plant cell?  Defend your answer with evidence from the lab | September 2015  4 weeks. | | 1. Unit 2II:   Cell  Function | What is homeostasis?  Why is it important?  How do cells reproduce asexually? | Standard III  Students will analyze the nature of the relationships between structures and functions in living cells.  Cell organelles, cell types, cell membrane, homeostasis, cell reproduction water and transport  Students will analyze how biological traits are passed on to successive generations.  Sexual vs asexual reproduction  LS1.A: Structure and Function  •Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)  •All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells.  LS1.B: Growth and Development of Organisms  •In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4) | Formative:  Egg Lab  Onion Osmosis  Osmosis practice problems and images  Mitosis illustration with construction paper, label phases.  Constructed Response: Cell Transport  Quizzes  Formative assessment questions  Graphic Organizer: Students demonstrate their knowledge by placing information in an organized chart   * To show the different types of osmotic solutions * Cell cycle/ mitosis * Word vocabulary foldable   Summative:  Unit Test  Constructed Responses questions- Lab Follow-ups | September –October 2015  8 weeks | | 1. Unit 3:   Nucleic Acids in the Cell. | Who contributed to DNA discovery?  What is the molecular structure of DNA?  How does DNA make a copy of itself?  What are the differences and similarities between DNA and RNA?  How do cells use DNA to make protein?    How do gene mutations affect organisms? | Standard II Benchmark II  Students analyze how scientific knowledge is developed.  Students will analyze how biological traits are passed on to successive generations.  DNA vs RNA, DNA structure and function and DNA Mutations.  LS1.C: Organization for Matter and Energy Flow in Organisms  •The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (HS-LS1-5)  •The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells. (HS-LS1-6)  •As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. (HS-LS1-6), (HS-LS1-7)  •As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new compounds are formed that can transport energy to muscles. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment. (HS-LS1-7) | Formative:  Promethean and Laptop simulations with clickers  Common Assessments/Labs Worksheets  Quizzes  Exit Tickets out the Door:  DNA extraction using cheek cells: Students use their own cells to extract DNA which has application in medicine, forensics and agriculture.  DNA Paper Model Group Construction Activity  Informational/Text-Based Writing  DNA/ RNA constructed response question  Codon Bingo  Protein Synthesis Video  Protein Synthesis Simulation-Room is the cell, teacher desk is the ribosome, students are t-RNA….  Mutations Labs with Cow liver  Foldables  Summative:  Unit Test  Follow up Lab questions Constructed Response IN INTERACTIVE NOTEBOOKS   * DNA extraction questions * Protein synthesis explanation from picture or video | October-November 2015  8 weeks or more | | 1. Unit 4:   DNA Technology | What modern technologies are used in selective breeding as compared to  Mendel’s time?  How do scientists manipulate DNA?  How do scientists use DNA fingerprinting?  What is genetic engineering and how is it beneficial?  How an organism cloned and what is the purpose of cloning? | Strand III Benchmark I  Students will analyze how biological traits are passed on to successive generations.  DNA mutations, DNA technology in forensics, medicine, and agriculture.  Connections to Nature of Science  Science is a Human Endeavor  •Technological advances have influenced the progress of science and science has influenced advances in technology. (HS-LS3-3)  •Science and engineering are influenced by society and society is influenced by science and engineering. (HS-LS3-3) | Formative:  Results from First Semester 9-weeks  Bellringers  Quizzes  Emphasize Stem Cell Research  Cloning project  DNA fingerprinting  Promethean video on cloning | November 2015 | | 1. Unit 5:   Mendelian Genetics/  Mitosis and  Meiosis: | What is the purpose of meiosis in reproduction?  Why do we have mitosis and meiosis?  What did Mendel’s work teach us about inheritance?  What have we learned since Mendel’s work about inheritance? | Benchmark II and III  Students will analyze how biological traits are passed on to successive generations.   * Mendel’s Laws * Sexual vs asexual reproduction   LS3.A: Inheritance of Traits  •Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species’ characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (HS-LS3-1)  LS3.B: Variation of Traits  •In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. (HS-LS3-2)  •Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors. (HS-LS3-2), (HS-LS3-3) | Formative:  SpongeBob Punnett Squares  Design your creature or animal using Genetic Rules  Create a baby lab/ Superhero Lab  Genotype Friday  Sponge Bob Genetics  Meiosis Square Dance Video or rap it out loud  Mendel/ Cell Scientist Video on Promethean  Co-dominance with chickens  Incomplete dominance with flowers  Indian corn Lab/Dihybrid/Potatoes  Blood Types with Food Coloring (optional)  Pedigrees- reading and creating  Summative:  Unit Test  Constructed lab response Compare and Contrast in INTERACTIVE NOTEBOOK  Mitosis and Meiosis understanding through pipe cleaners, verbal dialogue with Mrs. Bhullar. | November –December 2015 | | 1. Unit 6:   Classification   1. Unit 7 Evolution 2. Unit 8:   Ecology | How do scientists organize living organisms?  What characteristics are shared by all members of a Kingdom?  How are classification tools used to group and identify organisms?  Explain the process of Photosynthesis and cellular respiration and why they are important?  Which organisms perform photosynthesis?  Which ones perform cellular respiration?  What scientists contributed to the theory of evolution?  Why do some organisms survive and other organisms do not?  How does natural selection influence evolution?  What evidence do scientists use to explain evolution?  How do organisms develop resistance?  How does energy flow through the environment?  How do organisms interact in negative and positive ways?  What is ecological succession?  How do plants and animals adapt to their unique environments?  How have humans impacted the environment?  Why are biogeochemical cycles important to living organisms?  How are living organisms and their surrounding environment organized? | Strand II Benchmark II  Students will derive the relationship between single-celled and multicelled organisms and the increasing complexity of systems.   * Six kingdoms * Classification systems.   Students will derive the relationship between single-celled and multicelled organisms and the increasing complexity of systems.   * Photosynthesis and respiration.   LS4.A: Evidence of Common Ancestry and Diversity  •Genetic information, like the fossil record, provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence. (HS-LS4-1)  Strand II Benchmark II: Understand the genetic basis for inheritance and the basic concepts of biological evolution.  LS4.B: Natural Selection  •Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. (HS-LS4-2), (HS-LS4-3)  •The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. (HS-LS4-3)  Standard II Benchmark II  Students will assess the dependence of all organisms on one another and the flow of energy and matter within their ecosystems.   * Plant adaptations * Animal adaptations   Students will evaluate the role of natural selection in the development of the theory of evolution history of the theory.   * Biodiversity, ancestry, and the rates of evolution. * Fossil and biochemical evidence natural selection * Biological resistance   Students will assess the dependence of all organisms on one another and the flow of energy and matter within their ecosystems.   * Ecological levels of organization * Energy flow * Food Wed * Food Chain * Energy pyramids * Nutrient cycles * Succession * Human impact on the environment. * Plant adaptations. * Animal adaptations   Students will derive the relationship between single-celled and multicelled organisms and the increasing complexity of systems.   * Photosynthesis and respiration   LS4.B: Natural Selection  •Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. (HS-LS4-2), (HS-LS4-3)  •The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. (HS-LS4-3)  LS4.C: Adaptation  •Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment’s limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment. (HS-LS4-2)  •Natural selection leads to adaptation that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. (HS-LS4-3), (HS-LS4-4)  •Adaptation also means that the distribution of traits in a population can change when conditions change. (HS-LS4-3)  •Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species. (HS-LS4-5), (HS-LS4-6)  •Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species’ evolution is lost. (HS-LS4-5)  LS4.D: Biodiversity and Humans  •Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (HS-LS4-6)  ETS1.B: Developing Possible Solutions  •When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (Secondary to HS-LS4-6)  •Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (Secondary to HS-LS4-6) | Formative:  Quizzes  Dichotomous Keys  Kingdom Wheel/ graphic organizer  Bellringers  Foldables  Lab exercise/ activating activity for Identification of Kingdom  Kingdoms Chart-Venn diagrams  Create Dichotomous Key using Girls in the class room.  Create Dichotomous Key for nature walk.  Summative:  Unit Test  Lab follow up- constructed response in INTERACTIVE NOTEBOOK  Justify why viruses should or should not be considered alive essay.  Formative:  Promethean, Laptops Natural Selection Simulation  Quizzes  Peppered Moth Simulations and Worksheets  Fossils  Embryology Chart/ Ontogeny recapitulates phylogeny (Controversial)  Homologous/ Analogous/ vestigial structures  Galapagos Video  Noodle Lab in UNM grassy field  Foldables  Darwinism/Finches  Harry Potter Quitag game  Adapt organism to survive harsh environment (Advanced Topic)  Golden Toad/ Bring back out of extinction and guarantee survival.  Summative:  Unit Test  Lab follow up / constructed response for natural selection lab in INTERACTIVE NOTEBOOKS  Formative:  Water Quality lab/Duck Pond UNM  NATURE WALK UNM: fungi hunt, tropisms  Trophic Level Pyramids origami  Rice Germination vs mystery seed  Bellringers  Foldables  Exit Slips  Quizzes  Photosynthesis/Respiration Equations. Hitting this hard!!!!  EOC PREPERATION!!  Aerobic/Anaerobic/Venn Diagrams  Food Chains/Food Webs/ Pyramids  What’s for Dinner? Food Brochure  Energy Cycling Diagrams  Tropisms Videos  Succession- examples, walk, Promethean  Human Impact Graphic Organizer  Make your own sunscreen/lab   * Global warming/ greenhouse effect * Acid rain * Deforestation * Ozone depletion   Biome of the Day project  Geocaching/Critical thinking skills if lost in biome of choice  Emphasis on Desert environment New Mexico/reservation and Native lands  Interactions among organisms   * Predator/ prey * Competition * Symbiosis * Mutualism * Commensalism   Noodle Lab/Grassy area UNM  Golden Toad article/Introduction of species  Planet Earth/ Life/ Blue Seas DVD on Promethean  Summative:  Unit Test  EOCs/Preparation  Labs/INTERACTIVE NOTEBOOK  FINAL EXAMS | January 2016  January-February 2016  February-May 2016 | | | | |