Biology 1

Course Standards/Objectives with Activities and Labs

Course Code: 3221

Course Description

This introductory laboratory-based course is designed to familiarize the college preparatory student with the major concepts of biological science: the cell; molecular basis of heredity; biological evolution; interdependence of organisms; matter, energy, and organization in living systems; and behavior and regulation. This course provides numerous opportunities for students to develop science process skills, critical thinking, and an appreciation for the nature of science through inquiry-based learning experiences. Investigative, hands-on lab activities that address the high school inquiry standards are an integral part of this course.

Prerequisites: Successful completion of physical science is recommended.

Special Notes

- Use proper lab safety techniques to include use of living tissue or organisms.
- Strategies and activities on this document are meant as *suggestions;* teachers are encouraged to use materials from a variety of resources, including teacher-made materials, as long as these materials address the standard or objective.
- There are several general suggestions that could apply to all the standards or objectives: graphic organizers, internet assignments, independent research projects including science fair projects, interdisciplinary assignments, outside readings, and creative projects.

Key to Notes in S.C. Standards

- H = History of Science
- N = Nature of Science
- P = Science in Social and Personal Perspectives
- T = Technology

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II. Life Science

A. The Cell

1. Cells have particular structures that underlie their function. Inside the cell is a concentrated mixture of thousands of different molecules which form a variety of specialized structures that carry out such cell functions as energy production, transport of molecules, waste disposal, synthesis of new molecules, and the storage of genetic material.

S.C. Standard	**Performance Objectives (Competencies)**	**Suggested Strategies, Activities, and Labs**
a. Compare prokaryotic and eukaryotic cells.	• Compare and contrast prokaryotes and eukaryotes.	• Introduction to the microscope (review of basic techniques). • Show pictures of various organisms and have students classify as either prokaryotic or eukaryotic and defend their choices (microviewers or videomicroscopes could be used for this).
b. Identify and explain the functions of the cellular structures that are responsible for energy production, waste disposal, molecular synthesis, storage of genetic material, and cell movement and active and passive transport.	• Identify and describe the basic structure and functions of organelles found in the eukaryotic cell. Major structures and functions to include: nucleus, nucleolus, mitochondria, chloroplast, lysosome, vacuoles, vesicles, ribosomes, ER, Golgi, cilia, flagella, chromatin, cell membrane, nuclear membrane, cell wall, and	• Analogies of cell organelles. • Osmosis with Anacharis[1] (observe th effects of hypertonic and hypotonic solutions on Anacharis; may use onion cells for this as well). • Osmosis and diffusion (use dialysis tubing, eggs, cheap baggies, etc.). • Compare models of plant and animal

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	cytoplasm. • Describe the phospholipid layer of a membrane • Describe the processes of passive, active, and bulk transport.	cells; be able to draw and identify the organelles of plant and animal cells. • Play review "Cell Wheel" game. Create six wheels of different pie-shaped colors that have cell functions on them. Write the name of the various cell organelles on clothespins along with a symbol. Put the matchin symbol on the back of the wheel corresponding to the function of a particular organelle. The team that matches all of the functions first wins
c. Trace the development of the Cell Theory. (H)	• State the three parts of the Cell Theory. • Evaluate the contributions of Hooke, Schwann, Schleiden, and Virchow.	• Create a timeline of the development of the Cell Theory by the various scientists. • Microscope lab: Students will view samples of cork (Robert Hooke's "little boxes"), microbes (Anton von Leewenhoek's "animalcules"), onion (Mathias Schleiden's plant cells), their own cheek cells* (Theodor Schwann's animal cells), and metaphase and anaphase mitotic slide (Rudolph Virchow's "cells from othe cells"). * *Use universal precautions.*
d. Discuss uses of technologies that enable in-depth studies of the cell such as microscopes, ultracentrifuge techniques, and radioscopy studies. (T)	• Comparing light microscopes with transmission and scanning electron microscopes in terms of magnification, resolution, and usage.	• Teacher could show micrographs of various images taken using a TEM and SEM. Students will be able to visualize from the micrographs

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	• Discuss the preparation of specimens for both the TEM and SEM. • Evaluate how the ultracentrifuge, SEM, TEM, and radioscopic studies have advanced our knowledge of the cell	whether the image is flat or 3-D. Determine which microscope would work best under different circumstances.

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II. Life Science

A. The Cell

2. Most cell functions involve chemical reactions. Food molecules taken into the cell react to provide the chemical constituents needed to synthesize other molecules. Both breakdown and synthesis are made possible by a large set of protein catalysts called enzymes. The breakdown of some of the food molecules enables the cell to store energy in specific chemicals that are used to carry out the many functions of the cell.

S.C. Standard	Performance Objectives (Competencies)	Suggested Strategies, Activities, and Labs
a. Demonstrate an understanding of the role of enzymes in chemical reactions within the cell (catalyst).	• Explain how enzymes lower the activation energy of chemical reactions.	• Toothpick Biochemistry[2] (available from most science catalogues). • Catalase lab: Use an inorganic catalyst (manganese dioxide) and a unknown organic catalase (liver) to break down hydrogen peroxide (a b product of cell metabolism). • Design an experiment to determine properties of enzymes.
b. Differentiate the functions of carbohydrates, proteins, lipids, and nucleic acids in the cell.	• Compare and contrast the structures and functions of the four principal kinds of macromolecules found in living cells.	• Identification of organic compound (lab activity testing for organic molecules): One possible source fo this lab is "Chemistry of Carbohydrates" and "Chemistry of Fats and Proteins" from *Laboratory*

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		Biology: Investigating Living Syste by Kaskel, Hummer, Kennedy, and Oram (Merrill), New York, 1996.[3] • Design and build a model of DNA (could be done with standard II.A.3.a.).

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II. Life Science

A. The Cell

3. Cells store and use information to guide their functions. The genetic information stored in DNA is used to direct the synthesis of the thousands of proteins each cell requires.

S.C. Standard	Performance Objectives (Competencies)	Suggested Strategies, Activi and Labs
a. Compare DNA and RNA.	• Evaluate the three distinguishing traits of both DNA and RNA: ▪ Sugar differences ▪ Base differences ▪ Double vs. single stranded	• Draw models of DNA and RN molecules. • Design and create paper mode DNA and RNA. • DNA extraction from bananas onions.[4]
b. Illustrate the steps of protein synthesis and explain the role of the triplet codon in protein synthesis.[5]	• Relate the DNA base codes to the twenty amino acids that make up proteins. • Describe how RNA is copied from DNA by transcription • Draw, label, and explain the process of transcription and translation. Include the roles of DNA, mRNA, tRNA and rRNA.	• Teach students how to read a chart and to determine the am acids in a particular protein m so that students can build a p given the DNA sequence. • Protein synthesis lab. • Create a secret code for famil places in your state, and the st must break the code using co that code for a particular amic that in turn stands for a letter

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		alphabet. • Transcription and translation activitiesfrom various lab manuals/texts.

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II. Life Science

A. The Cell

4. Cell functions are regulated. Regulation occurs through changes in the activity of the functions performed by proteins and by the selective expression of certain genes. This regulation allows cells to respond to their environment and to control and coordinate cell growth and division.

S.C. Standard	Performance Objectives (Competencies)	Suggested Strategies and Labs
a. Demonstrate an understanding of the importance of DNA and proteins in cell regulation.	• Discuss that enzymes are proteins, proteins are coded for by DNA, and that enzymes control regulatory functions within the cell (such as the cell cycle and stimulus response. ▪	• Sci Fly Encounter—A • Create a flow chart of pathway, illustrating h enzyme is used at each pathway due to their s • Model enzyme specifi puzzle pieces.
b. Discuss mishaps in cell regulation (e.g., tumors). (P)	• Explain the cell cycle to include cytokinesis and mitosis, G_1, S phase, and G_2. • Discuss cancer as cell division out of control. • Relate the role of carcinogens in the onset of cancer	• Cancer research proje • Students view prepare various tissues with tu compare them to slide tissue.

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II. Life Science

A. The Cell

5. Cells can differentiate and complex multicellular organisms are formed as a highly organized arrangement of differentiated cells. In the development of these multicellular organisms, the progeny from a single cell form an embryo in which the cells multiply and differentiate to form the many specialized cells, tissues, and organs that comprise the final organism. This differentiation is regulated through the expression of different genes.

S.C. Standard	Performance Objectives (Competencies)	Suggested Strategies, A and Labs
a. Demonstrate the understanding that cells can differentiate and form complex multicellular organisms that are a highly organized arrangement of differentiated cells (e.g., illustrate the development of both an animal and a plant multicellular organism (cells, specialized cells, tissues, organs, organ systems, and organisms).	• Discuss cell differentiation into specialized cells.	• Design a flow chart of th development of organism to tissues to organs, orga and finally the entire org
b. Determine how organs and systems in both plants and animals function as a physiological unit. (Note: This concept has been taught at a previous grade level.)	• Relate animal and plant representative examples of structure to function for various organs and organ systems.	• Explain how the structur designed to enhance pho • Explain how lungs are d enhance respiration. • Relate the organs structu function.
c. Evaluate how a degenerative disease involves the deterioration of the organs or tissues.[8]	• Discuss degenerative diseases involved in the deterioration of tissues and organs.	• Research project: Desig information brochure de degenerative disease.

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		• View videos on auto-im as available.

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II. Life Science

B. The Molecular Basis of Heredity

1. In all organisms, the instructions for specifying the characteristics of the organism are carried in DNA, a large polymer formed from subunits of four kinds (A, T, G, and C). The chemical and structural properties of DNA explain how the genetic information that underlies heredity is both encoded in genes (as a string of molecular "letters") and replicated (by a templating mechanism). Each DNA molecule in a cell forms a single chromosome.

S.C. Standard	**Performance Objectives (Competencies)**	**Suggested Strategie and Lab**
a. Demonstrate an understanding of the key features of DNA, genes, and chromosomes and the relationships that exist among them.	• Describe the organization of DNA into chromosomes.	• Use a pop-bead neckla how genes make up a (gene = segment of DN genes = chromosome).
b. Analyze the chemical structure of DNA and explain how DNA replication occurs.	• Determine the difference between purines and pyrimidines. • Construct a model of DNA. • Illustrate the process of DNA replication.	• Design and build a cor model of DNA. • Molecular model of D replication
c. Evaluate the impact of DNA technology on society (e.g., bioengineering, genetics, genome project, DNA fingerprinting.)	• Explain and compare the impact of polymerase chain reaction (PCR),[9] Southern Blot, DNA fingerprinting, and the Human Genome Project.	• Debate/discuss whethe be allowed to bioengin • DNA fingerprinting ac • Research the latest dev

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		genetics.

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II. Life Science

B. The Molecular Basis of Heredity

2. Most of the cells in a human contain two copies of each of twenty-two different chromosomes. In addition, there is a pair of chromosomes that determines sex: a female contains two X chromosomes and a male contains one X and one Y chromosome. Transmission of genetic information to offspring occurs through egg and sperm cells that contain only one representative from each chromosome pair. An egg and sperm unite to form a new individual. The fact that the human body is formed from cells that contain two copies of each chromosome—and therefore two copies of each gene—explains many features of human heredity, such as how variations that are hidden in one generation can be expressed in the next.

S.C. Standard	**Performance Objectives (Competencies)**	**Suggested Stra and**
a. Compare the key features and differences between meiosis and mitosis.	• Identify and sequence the steps of meiosis, oo-genesis, and spermatogenesis. • Identify and sequence the steps of mitosis.	• Develop a flip cl one diagram of c description.
b. Make predictions concerning inheritance based on Gregor Mendel's laws of heredity.	• Work problems using Punnett squares to illustrate the following inheritance patterns and laws of heredity: monohybrids, dihybrids, and the Laws of Segregation and Independent Assortment. • Compare and contrast the Law of	• "Marshmellow M Soderberg, The S November 1992, • Dihybrid cross s • Using blood type paternity. • Practice working

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	Segregation with the Law of Independent Assortment.	problems concer disorders.
c. Discuss significant advancements in the study of heredity since Mendel, including the chromosome theory. (H)	• Examine gene linkage. • Work problems and discuss other inheritance patterns to include sex-linked, sex-limited, multiple alleles, codominance and incomplete dominance.	• Visit (or invite a Greenwood Gen genetics counsel

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II. Life Science

B. The Molecular Basis of Heredity

3. Changes in DNA (mutations) occur spontaneously at low rates. Some of these changes make no difference to the organism, whereas others can change cells and organisms. Only mutations in germ cells can create the variation that changes an organism's offspring.

S.C. Standard	Performance Objectives (Competencies)	Suggested Str an
a. Demonstrate an understanding of the characteristics and implications of both chromosomal and gene mutations (e.g., the occurrence of genetic disorders such as sickle cell anemia, Tay-Sachs disorder, cystic fibrosis, and hemophilia).	• Give examples of both chromosomal and gene mutationsto include sickle-cell anemia, Tay Sachs, Cystic Fibrosis, Hemphilia, and Huntingtons. • Discuss possible causes of mutations to include natural (random), environmentally induced (chemical Agent Orange, biological warfare, cigarettes, pesticides, etc.), and ionizing forms of radiation. • Differentiate between lethal alleles and and inborn errors of metabolism.	• Amino acid su how the deletio amino acid car • Using slides ill genetic conditi classify them a point mutation • Read karyotyp chromosomal r occurred. • Genetic disord result in tri-fol brochure about • Invite speakers about the frequ birth defects in (e.g., neonatal counselor)

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b. Demonstrate an understanding of how mutations contribute to genetic diversity.	• Distinguish between a mutation in a somatic cell and one in a sex cell.	• Students resea of mutations re environmental mutation.
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II. Life Science

C. Biological Evolution

1. Species evolve over time. Evolution is the consequence of the interactions of (1) the potential for a species to increase its numbers, (2) the genetic variability of offspring due to mutation and recombination of genes, (3) a finite supply of the resources required for life, and (4) the ensuing selection by the environment of those offspring better able to survive and leave offspring.

S.C. Standard	**Performance Objectives (Competencies)**	**Suggested**
a. Demonstrate an understanding of the factors that affect evolution such as the number of offspring, genetic variability, finite supply of resources, and environmental factors.	• Define genetic variability. • Explain/discuss factors that increase genetic variability to include sexual reproduction, mutation, and genetic recombination during crossing-over. • Define carrying capacity and evaluate its role as a limiting factor.	• Island Biog (activity us Archipelag of Woodro on Evolutio • "Oh Deer" activity sho and resourc time). • "How Man Forest?" (P
b. Demonstrate an understanding of the scientific evidence that establishes that change occurs over time.	• Distinguish between microevolution and macroevolution. • Compare and contrast analogous, homologous, and vestigial structures and their role in determining evolutionary relationships.	• How do fos several exa illustrate cl • Amino acid evolutionar

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	• Analyze how fossils provide geological evidence of change over time. • Understand how analysis of DNA base sequences and amino acid sequence in proteins can provide biochemical evidence of change over time. • Discuss how examination of embryological features can provide evidence of common ancestry and change over time.	• Bacterial re • Patterns of in size and groups of l hand sizes,

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II. Life Science

C. Biological Evolution

2. Natural selection and its evolutionary consequences provide a scientific explanation for the fossil record of ancient life forms, as well as for the striking molecular similarities observed among the diverse species of living organisms.

S.C. Standard	Performance Objectives (Competencies)	Su
a. Demonstrate an understanding of the process of natural selection and its consequences.	• Explain that natural selection is the process responsible for evolution. • Compare directional, stabilizing, and disruptive natural selection. • Account for why traits that do not confer an advantage may or may not disappear over time.	• "Ol acti • Am evo • "Fi We Wil Ger
b. Infer how the fossil record can reveal evolutionary changes over time.	• Discuss the process by which fossils are created. • Demonstrate an understanding of why fossil remains do not leave a complete record of evolution.	• Ho • Ma • Inv evi
c. Discuss the various lines of scientific evidence that underlie our understanding of the evolution and diversification of life over time.	• Compare and contrast homologous and analogous structures in organisms. • List and explain vestigial structures. • Compare similarities and embryonic	• Vie con • Co ske

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	development. • Compare similarities in macromolecules.	• Vie wit • ww • Per lab.
d. Describe how carbon dating is utilized in the study of evolution. (H, T)	• Explain radioactive decay and half-life, discuss limitations of C-14.[12] • Calculate the age of a fossil using C-14 data.	• Hal
e. Discuss Charles Darwin's contribution to the study of evolution. (H)	• Explain the uniqueness of islands (like the Galapagos) and the data they yield (i.e., sites of primary succession). • Assess the significance of *The Origin of Species.*	• Vid stu wil • Pre spil Isla

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II. Life Science

C. Biological Evolution

3. Biological classifications are based on how organisms are related.

S.C. Standard	Performance Objectives (Competencies)	
a. Investigate the modern kingdom classification system which is based on fossil record interpretation and similarities in structural and chemical make-up.	• Name the five kingdoms most commonly used for classification, and describe the basic characteristics of each. • Review the establishment of Archaebacteria and Eubacteria as separate kingdoms based on molecular information. • Create a phylogenetic tree representing the five kingdoms, showing evolutionary revolutionary relationships.	• •
b. Demonstrate an understanding of how to classify organisms on the basis of structural adaptations, physiology, nutritional strategies, biochemical similarities, genetic similarities, embryological similarities, and methods of reproduction.[13]	• Discuss some of the difficulties in establishing taxonomic relationships. • Evaluate how an understanding of evolutionary relationships aids in classification.	• •

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c. Develop a working definition of "living things," and justify why many scientists group viruses in a category separate from living things.	• Compare and contrast viruses and cells.	•

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II. Life Science

D. Interdependence of Organisms

1. The atoms and molecules on the earth cycle among the living and nonliving components of the biosphere.

S.C. Standard	Performance Objectives (Competencies)
a. Demonstrate an understanding of how organisms interact with the biosphere as part of the geochemical cycles (carbon, nitrogen, phosphorus, and water cycles). b. Identify important nutrient cycle and evaluate how they affect ecosystems.	• Describe what occurs during the carbon cycle to include the relationship between producers, consumers, decomposers, photosynthesis, and cellular respiration. • State the ways in which human activities have affected the carbon cycle and the results of such activities (e.g., global warming). • Describe what occurs during the nitrogen cycle to include nitrification, ammonification, assimilation, and denitrification. • Explain the role of nitrogen-fixing organisms in the nitrogen cycle. • Describe what occurs during the phosphorus cycle. • Explain how phosphorus from human activities has affected the ecosystem. • Describe what occurs during the water cycle to include the role of plants and photosynthesis.

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II. Life Science

D. Interdependence of Organisms

2. Energy flows through ecosystems in one direction, from photosynthetic organisms to herbivores to carnivores and decomposers.

S.C. Standard	Performance Objectives (Competencies)
a. Demonstrate an understanding of the flow of energy, beginning with the sun, through various trophic levels.	• Determine that the Sun is the ultimate source o energy on Earth. • Explain the role of producers (autotrophs) and consumers (heterotrophs, carnivores, herbivores, omnivores) in the ecosystem (food chains and food webs). • Differentiate food chains and food webs. • Relate the trophic levels in the ecosystem to pyramids of energy, numbers, and biomass. • Explain the flow of energy within a food chain and why energy transfer is not 100%. • Tell why there are limits to the number of consumers in a food chain. • Explain why the producer level contains more biomass/unit area than consumers and why this is necessary. • Tell why biological magnification is seen at the top of the food chain and the significance this has to organisms in the ecosystem (effects of DDT, for example).

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b. Assess the value of the carbon cycle to the flow of energy through the ecosystems.	• Determine that the energy flowing through the food chain is the direct result of the carbon cycle. • Predict what will happen to any part of the food chain if the carbon cycle is interrupted.

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II. Life Science

D. Interdependence of Organisms

3. Organisms both cooperate and compete in ecosystems. The interrelationships and interdependencies of these organisms may generate ecosystems that are stable for hundreds or thousands of years.

S.C. Standard	Performance Objectives (Competencies)
a. Relate the terms cooperation and competition to organisms within an ecosystem.	• Determine the difference between interspecific and intraspecific competiti • Discriminate between cooperation and competition within an ecosystem.
b. Evaluate how interrelationships and interdependencies of living things contribute to the homeostasis of organisms.	• Explain how organisms cooperate with each other to ensure ecosystem stability • Explain that no two organisms can occu the same niche at the same time. Use te such as niche and niche overlap (fundamental vs. realized niche).
c. Demonstrate an understanding of how living things maintain their high level of order at the expense of increasing the disorder of their physical surroundings.	• Discuss the effects of the physical environment of organisms' maintain their high level order of existence. • Define Entropy • State the 2nd Law of Thermodynami and how it applies to living things a their surroundings.

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II. Life Science

D. Interdependence of Organisms

4. Living organisms have the capacity to produce populations of infinite size, but environments and resources are finite. This fundamental tension has profound effects on the interactions between organisms.

S.C. Standard	Performance Objectives (Competencies)
a. Describe and give examples of demographic characteristics of populations (e.g., birth and death rates, age structure, and sex ratio).	• Illustrate how birth and death rates affe population growth. • Explain why the age structure of a population is important to the reproduct success of a population. • Tell why the sex ratio of any given population can affect the growth rate of population.
b. Give examples and explain how limiting factors such as water, food, oxygen, and living space play a role in the stability of ecosystems.	• Discuss the difference between the biot and abiotic factors. • Tell how each of the abiotic factors influences the balance in the ecosystem water, sunlight, salinity, soil type, temperature, pH. • Compare and contrast density-depender and density-independent limiting factor Give examples of how each influence

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	members of the ecosystem. • Relate biotic and abiotic factors to dens dependent and density-independent limiting factors.
c. Predict how interactions among organisms, such as predation, competition, and parasitism, affect population growth.	• Define and discuss symbiosis and the th types of symbiosis-parasitism, commensalism, and mutualism, and giv examples of each. • Investigate how biotic and abiotic facto density-dependent and density-independent factors influence symbiotic relationships.
d. Demonstrate an understanding of the characteristics, stages, and implications of succession on terrestrial ecosystems.	• Define succession and give explanation for each step in the process using the following terms: pioneer species, clima community, primary succession, secondary succession. • Differentiate primary and secondary succession and state what determines whether succession is primary or secondary.
	•
e. Evaluate dynamic equilibrium as a result of checks and balances within populations, communities, and ecosystems.	• Explain the effects of immigration and emigration on a population. • Explain the relationship of carrying capacity to birth and death rates.

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	• Explain the effect of climate on carryin capacity. • Distinguish between renewable and nonrenewable resources. • Support the idea that dynamic equilibri a result of checks and balances within populations, communities, and ecosystems.

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II. Life Science

D. Interdependence of Organisms

5. Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.

S.C. Standard	**Performance Objectives (Competencies)**
a. Identify events that lead to awareness of environmental concerns such as fish kills, destruction of the ozone layer, global warming, and decline of the bald eagle.	• Describe what happens when new proc enter the environment with little resear performed on the effects of such introduction (e.g., the use of DDT and effect on bird eggs). • Explain how human use of fossil fuels contributed to global warming. • Evaluate the effects of CFCs on the destruction of the ozone layer.
b. Discuss the conflicts that could occur between land developers and conservationists.	• Determine the events that can occur wl land management issues arise (include zoning regulations, use issues, water ru off, relocation of protected species, etc

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c. Describe the effects of human overpopulation and activities on the survival of other species	• Analyze the effects of human overpopulation on survival of species s as salmon, buffalo, shellfish, marine fi wolves, etc.
d.Debate the consequences of extinction and introduction of species within ecosystem.	• Investigate what can happen when an a species (a species that is not indigenou that ecosystem) is introduced into a ne ecosystem. • Analyze the effect on an ecosystem wh species becomes extinct.
e.Assess the consequences of acid rain on ecosystems.	• Understand acid rain in terms of pH an give sources of acid rain.
f.Give examples of how technology has advanced the study of environmental science.[18]	• Relate the ability of planes and space c to photograph and use infrared to disco environmental problems. • Describe the information provided by computer simulation.

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II. Life Science

E. Matter, Energy, and Organization in Living Systems

1. The energy for life primarily derives from the sun. Plants capture energy by absorbing light and using it to form strong (covalent) chemical bonds between the atoms of carbon-containing (organic) molecules. These molecules can be used to assemble larger molecules with biological activity (including proteins, DNA, sugars, and fats). In addition, the energy stored in bonds between the atoms (chemical energy) can be used as sources of energy for life processes.

S.C. Standard	**Performance Objective (Competencies)**
a. Summarize the basic process by which photosynthesis converts solar energy into chemical energy (food molecules).	• Define energy. • Write the overall equation for photosynthesis and show where reactant atom ends up on the pr side. • Describe what happens to the e chlorophyll electrons as they cy through the photosynthetic pro • Summarize the events of the lig dark reactions. • Explain why the dark reactions dependent on the products of th reactions. • State the role of chlorophyll an chloroplast in the photosynthet to include what happens in the and stroma. • Explain the significance of the

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	water. • State the role of electron carrie photosynthesis.
b. Summarize the basic aerobic and anaerobic processes by which cellular respiration breaks down food molecule into energy that can be used by cells.	• Write the overall equation for c respiration, identifying the proc reactants. • Distinguish between aerobic ar anaerobic respiration and state conditions under which each oc • Describe the role of the mitoch aerobic respiration. • Define glycolysis and tell why in all organisms. • Differentiate alcohol and lactic fermentation. • Describe the overall process of cycle. • Describe what happens during electron transport chain. • Summarize the production of N $FADH_2$, and ATP. • Explain why O_2 has to be the fi electron acceptor in the electro chain. • Relate respiration to photosynt

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II. Life Science

E. Matter, Energy, and Organization in Living Systems

2. The chemical bonds of food molecules contain energy. Energy is released when the bonds of food molecules are broken and new compounds with lower energy bonds are formed. Cells usually store this energy temporarily in phosphate bonds of a small high-energy compound called ATP.

S.C. Standard	**Performance Objecti (Competencies)**
a. Analyze bond energy as it relates to food molecules.	• Review covalent bonding an how energy is stored and rele these bonds are formed and b respectively. Relate covalent foods which are organic com • Tell the approximate number (food calories) in a gram of c protein, and fat. • Explain why there are more f in a gram of fat than in a gra carbohydrate or protein.
b. Discuss the importance of ATP and how it is cycled.	• Identify the three parts of AT ribose, and three phosphate g Identify the high energy bon • Write the equation for the hy ATP and show how ADP is r ATP. • Discuss the role of ATP in th

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	energy economy. • Analyze the cycle of ATP as mechanism controlled by sev (e.g., presence of O_2, presen glucose, amount of ADP pres

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II. Life Science

E. Matter, Energy, and Organization in Living Systems

3. The complexity and organization of organisms accommodates the need for obtaining, transforming, transporting, releasing, and eliminating the matter and energy used to sustain the organism.

S.C. Standard	Performance Obj (Competencie
a. Demonstrate an understanding of the factors involved in obtaining and processing matter and energy for the development, growth, and maintenance of organisms.	• Explain that ATP provide necessary for the metabol within living systems. • Define catalysts and enzy • Explain the importance o catalysts in metabolic rea • Explain the consequences failure. • List and describe the facto influence enzyme activity temperature). • Explain how enzyme con substrate concentration af rates. • List and describe various disorders as they relate to processes. • Explain how enzymes are control the metabolic acti ▪ Allosteric enzymes ▪ Feedback inhibition

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b. Demonstrate an understanding of homeostasis and the effect of an energy deficit on homeostasis.	• Define homeostasis and • Describe the consequen enough energy for meta

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II. Life Science

E. Matter, Energy, and Organization in Living Systems

4. As matter and energy flow(s) through different levels of organization of living systems—cells, organs, organisms, communities—and between living systems and the physical environment, chemical elements are recombined in different ways. Each recombination results in storage and dissipation of energy into the environment as heat. Matter and energy are conserved in each change.

S.C. Standard	**Performance C (Compete**
a. Demonstrate an understanding of the dynamics of energy and entropy as they apply to biological systems.	• State the first and sec thermodynamics and • Explain the first law c as it relates to photosy respiration. • Define entropy and re energy in the biosphe • Contrast open system systems as they relat of thermodynamics ar living thing is an oper
b. Analyze energy in biological systems in terms of transformation, conservation, and efficiency.	• Using food chains and as examples, discuss l the dynamics of energ systems.

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II. Life Science

F. Behavior and Regulation

1. Multicellular animals have nervous systems that generate behavior. Nervous systems are formed from specialized cells that conduct signals rapidly through the long cell extensions that make up nerves. The nerve cells communicate with each other by secreting specific excitatory and inhibitory molecules. In sense organs, specialized cells detect light, sound, and specific chemicals and enable animals to monitor what is going on in the world around them.

S.C. Standard	**Performance C (Compete**
a. Demonstrate an understanding of how cells of multicellular animals communicate by signals conducted through a nervous system.	• Demonstrate how nerv communication within a • Trace from sponges (sir to vertebrates (complex occurs. • Explain how the verteb structured to transmit ar • Describe the transmissi impulse along the axon • Describe what happens
b. Demonstrate an understanding of the adaptive value of the reflexes, such as blinking of the eye, opening of the iris, responses to hot and cold.	• List and describe the fiv • Construct an experimen five senses are integrate adaptive response. • Describe the reflex arc.

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c. Give examples of specialized cells in sense organs that detect stimuli (e.g., taste buds, touch receptors, rods and cones).	• Use a variety of animal explain how their respe stimuli.

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II. Life Science

F. Behavior and Regulation

2. Organisms have behavioral responses to internal change and external stimuli. Responses to external stimuli can result from interactions with the organism's own species and others, as well as environmental changes; these responses can be either innate or learned. The broad patterns of behavior exhibited by animals have evolved to ensure reproductive success. Animals often live in unpredictable environments, and so their behavior must be flexible enough to deal with uncertainty and change. Plants also respond to stimuli.

S.C. Standard	**Performa (Com**
a. Investigate how different organisms maintain homeostasis.[19]	• Compare how di humans and one each kingdom, m
b. Give examples of feedback mechanisms.	• Define positive a loops and give ex humans. (blood g water balance, ar thyroid function, progesterone inte

[19] Are there no objectives with this standard?They have now been added

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c. Identify pathogens and understand how organisms react to them.	• Explain the huma include primary a • Differentiate the (active/passive, r • Tell what a vacci • Explain how and occurs. • Explain how othe (including plants
d. Assess both the positive and negative effects of introducing chemical substances into the body.	• Explain that all c the body can hav especially if over includes overdos chemicals. • Explain how alco the short and lon abuse. • Explain the short tobacco use in al
e. Give examples of innate behavior and learned behavior.	• Describe various infer these behav organism's (spec • Describe various infer these behav organism's (speci

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f. Demonstrate an understanding of tropisms in plants as responses to external stimuli.	• Explain that altho to external stimul the actual trigger and response to l • Discuss geotropi thigmotropism, a

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II. Life Science

F. Behavior and Regulation

3. Like other aspects of an organism's biology, behaviors have evolved through natural selection. Behaviors often have an adaptive logic when viewed in terms of evolutionary principles. (Optional)

S.C. Standard	Perfor (C
a. Give examples of common behavioral responses in organisms that maximize their fitness and success, such as waggle dancing, courtship, and nesting behaviors.	• Define fitne success. • Discuss how the organism success.
b. Evaluate how computer technology has been instrumental in collecting and analyzing data in the study of animal behavior.	• Participate i computers t • Discuss the and analyzi

[20] What type of resource is this (book, video, etc.)?This is a web site

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II. Life Science

F. Behavior and Regulation

4. Behavioral biology has implications for humans, as it provides links to psychology, sociology, and anthropology. *(Optional)*

S.C. Standard	Perf
a. Describe classical studies of learned behavior, such as B. F. Skinner, Jane Goodall, and Dian Fossey.[21] b. Give examples of how these classical studies relate to human behavior.	• Describe behavior. • Give exar learned be human be

[21] Are there no objectives with these standards?

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