SANTA ROSA CITY SCHOOLS
HIGH SCHOOL SCIENCE CONTENT AND PERFORMANCE STANDARDS
BIOLOGY/LIFE SCIENCES

Cell Biology:

Enduring Understanding	EXAMPLES/ILLUSTRATIONS
10.1 The student will understand that fundamental life processes of living organisms depend on a variety of chemical reactions that are carried out in specialized areas of the organism's cells. 10.1.6 The student will describe how usable energy is captured from sunlight by chloroplasts, and stored via the synthesis of sugar from carbon dioxide, and how the mitochondria make stored chemical energy available to cells by completing the breakdown of glucose to carbon dioxide.	Students may demonstrate these performance standards by: ▪ Creating models to represent macromolecules. ▪ Measuring the rate of enzymatic reaction under different environmental conditions (pH, temperature, etc.) ▪ Identifying and illustrating the unique features of prokaryotic and eukaryotic cells magnified with a compound light microscope. ▪ Predicting and testing the effects of hypertonic, hypotonic, and isotonic solutions on elodea cells. ▪ Diagramming the functions of the endoplasmic reticulum and Golgi apparatus. ▪ Designing an experiment to show the relationship between autotrophs and heterotrophs in the production and use of carbon dioxide under various environmental conditions (light, temperature, etc.).
Important to Know and Do	
10.1.1 The student will state that macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors. 10.1.2 The student will identify that enzymes are proteins which catalyze biochemical reactions without altering the reaction equilibrium and describe the effects of temperature, ionic conditions, and pH of the surroundings on the activity of enzymes. 10.1.3 The student will explain how prokaryotic cells, eukaryotic cells (including those from plants and animals), and viruses differ in complexity and general structure. 10.1.4 The student will explain how cells are enclosed within semi-permeable membranes that regulate their interaction with their surroundings.	
Worth Being Familiar With	
10.1.5 The student will describe how the endoplasmic reticulum and Golgi apparatus function in the secretion of proteins.	

Genetics:

Enduring Understanding	EXAMPLES/ILLUSTRATIONS
10.2 The student will understand that mutation and sexual reproduction lead to genetic variation in a population. 10.2.4 The student will discuss how new combinations of alleles may be generated in a zygote through fusion of male and female gametes (fertilization). 10.2.5 The student will model the role of chromosomes in six determination. 10.2.6 The student will show, using a Punnett square, how it is possible to predict combinations of alleles in a zygote from the genetic makeup of the parents.	Students may demonstrate these performance standards by: ▪ Identifying, illustrating and annotating chromosomes to determine sex and phenotypes of possible disorders in any or all of the following ways: ▪ Slides/posters/charts ▪ Karyotyping ▪ Models ▪ Illustrations ▪ Coin toss/random samplings.
Important to Know and Do	
10.2.1 The student will explain that meiosis is an early step in sexual reproduction in which pairs of chromosomes separate and segregate randomly during cell division to produce gametes containing one chromosome of each type. 10.2.2 The student will cite examples of cells in multi-cellular organisms that undergo meiosis. 10.2.3 The student will model chromosome segregation, explaining the probability that a particular allele will be in a gamete.	
Worth Being Familiar With	

Genetics:

Enduring Understanding	EXAMPLES/ILLUSTRATIONS
10.3 The student will understand that multi-cellular organism develops from a single zygote, and its phenotype depends on its genotype, which is established at fertilization.	Students may demonstrate these performance standards by: ▪ Analyzing a pedigree to determine the mode of inheritance ▪ Collecting and examining information and data about genetic diseases. ▪ Predicting probable outcomes between predictable and observable outcomes. ▪ Using Punnett squares to determine probable outcomes.
Important to Know and Do	
10.3.1 The student will predict the probable outcome of phenotypes in a genetic cross from the genotypes of the parents and mode of inheritance (autosomal or X-linked, dominant or recessive). 10.3.2 The student will use Mendel's laws of segregation and independent assortment to explain heterozygous and homozygous genotypes. 10.3.3 The student will predict the probable mode of inheritance from a pedigree drawing showing phenotypes.	
Worth Being Familiar With	

Genetics:

Enduring Understanding	EXAMPLES/ILLUSTRATIONS
10.4 The student will understand that genes are a set of instructions, encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism.	Students may demonstrate these performance standards by: ▪ Constructing, DNA models. ▪ Conducting a genetic research project. ▪ Performing DNA extraction. ▪ Designing/illustrating/building a model of DNA

Important to Know and Do	
10.4.1 The student will diagram and explain the general pathway by which ribosomes synthesize proteins, using tRNSs to translate genetic information in mRNA. 10.4.2 The student will predict, using the genetic coding rules, the sequence of amino acids from a sequence of condons in mRNA. 10.4.3 The student will identify various causes of gene mutations, showing the effect on gene expression or the sequence of amino acids in an encoded protein. 10.4.5 The student will explain, using examples, that proteins can differ from one another in the number and sequence of amino acids.	
Worth Being Familiar With	
10.4.4 The student will discuss the effect of gene expression on the specialization of cells. 10.4.6 The student will explain why proteins having different amino acid sequences typically have different shapes and properties.	

Genetics:

Enduring Understanding	EXAMPLES/ILLUSTRATIONS
10.5 The student will understand that the genetic composition of cells can be altered by incorporation of exogenous DNA into the cells. 10.5.3 The student will give examples of ways in which genetic engineering (biotechnology) is used to produce biomedical and agricultural products.	Students may demonstrate these performance standards by: ▪ Given one half of a DNA strand, predicting the complementary base sequence of the other half. ▪ Performing a bacterial transformation, inserting foreign plasmids into a bacterial cell. ▪ Researching one biomedical or one agricultural use of biotechnology, emphasizing the risks and benefits of this technology.
Important to Know and Do	
10.5.1 The student will compare the general structure and function of DNA, RNA and proteins. 10.5.2 The student will illustrate how to apply base-pairing rules to explain precise copying of DNA during semi-conservative replication and transcription of information from DNA to RNA.	

Worth Being Familiar With	

Evolution:

Enduring Understanding	EXAMPLES/ILLUSTRATIONS
10.6.1 The student will explain why natural selection acts on a phenotype rather than the genotype.	Students may demonstrate these performance standards by: ▪ Conducting an investigation in simulating natural selection. ▪ Graphing the surviving populations. ▪ Explaining the factors that are important in survival. ▪ Simulating the effects of a lethal homozygous (i.e., aa or AA) gene combination. ▪ Constructing models of how point mutations can cause frameshift mutations in a nucleotide sequence. ▪ Constructing diagrams of how chromosomal mutations occur. ▪ Writing an essay that explains the origins of mutations in a gene pool. ▪ Discussing why known antibiotics are in danger of failing to cure current/future diseases.
Important to Know and Do	
10.6 The student will understand that the frequency in a gene pool of a population depends on many factors, and may be stable or unstable over time. 10.6.2 The student will explain why alleles that are lethal in a homozygous individual may be carried in a heterozygote and thus maintained in a population. 10.6.3 The student will explain how mutations are constantly being generated in a gene pool. 10.6.4 The student will investigate how variation within a species increases the likelihood that at least some of the members of a species will survive under changed environmental conditions.	
Worth Being Familiar With	

Evolution:

Enduring Understanding	EXAMPLES/ILLUSTRATIONS
10.7 The student will understand that evolution is the result of genetic changes that occur in constantly changing environments. 10.7.2 The student will explain how a great diversity of species increases the chance that at least some organisms survive large environmental changes.	Students may demonstrate these performance standards by: ▪ Conducting an investigation in a lab simulating natural selection. ▪ Hypothesizing and predicting what would happen if there existed a small diversity of species during a large environmental change. ▪ Investigating the effects of a small population on changes in gene frequency using models. ▪ Describing examples of the effects of genetic drift in certain human populations and explaining why they occur. ▪ Explain how reproductive or geographic isolation affects speciation in a particular species under specific environmental condition. ▪ Examine a variety of hominid skulls and compare them.
Important to Know and Do	
10.7.1 The student will state and give examples of how natural selection determines the differential survival of groups of organisms. 10.7.6 The student will describe how reproductive or geographic isolation affects speciation.	
Worth Being Familiar With	
10.7.3 The student will describe the effect of genetic drift on the diversity of organisms in a population. 10.7.7 The student will analyze fossil evidence with regard to biological diversity, episodic speciation and mass extinction.	

Ecology:

Enduring Understanding	EXAMPLES/ILLUSTRATIONS
10.8 The student will understand that stability in an ecosystem is a balance between competing effects. 10.8.3 The student will define biodiversity and give examples of ways in which biodiversity is affected by alterations of habitat.	Students may demonstrate these performance standards by: ▪ Collecting and organizing data about animals or plant specie diversity by making a systematic inventory of a familiar habitat.

Important to Know and Do	
10.8.4 The student will predict and evaluate changes in an ecosystem resulting from changes in climate, human activity, introduction of non-native species, or changes in population size. 10.8.5 The student will measure and predict the effect of relative rates of birth, immigration, emigration, and death on fluctuations in population size in an ecosystem. 10.8.6 The student will diagram and outline the water, carbon, and nitrogen cycles between abiotic resources and organic matter in the ecosystem and explain how oxygen cycles vis photosynthesis and respiration. 10.8.7 The student will discuss and give examples of the importance of producers and decomposers to the stability of an ecosystem. 10.8.8 The student will explain how energy is stored in newly-made structures at each link in a food web and how much of the energy is dissipated into the environment using illustrated and annotated examples of food pyramids.	▪ Classifying the school's life zone. ▪ Outlining examples of local or global issues of human impact causing damage to an ecosystem or the biosphere. ▪ Designing a preserve to protect a threatened or endangered species. ▪ Defining and explaining the importance of carrying capacity. ▪ Drawing the water cycle in a terrestrial ecosystem.. ▪ Explaining the role of decomposers in returning chemicals to the environment in an inorganic form. ▪ Explaining the differences in photosynthetic efficiency between tropical forests, temperate forests, deserts and polar ecosystems. ▪ Tracing the flow of energy from sunlight on a corn plant to a baseball batter who is hitting a home run, identifying and explaining energy transformations.
Worth Being Familiar With	

Investigation and Experimentation:

Enduring Understanding	EXAMPLES/ILLUSTRATIONS
10.9 **The student will understand that scientific progress is made by asking meaningful questions and constructing careful investigations.** 10.9.1 The student will select and use appropriate tools and technology to perform tests, collect data, analyze relationships and display data. 10.9.4 The student will distinguish between hypothesis and theory as scientific terms. 10.9.5 The student will recognize the use and limitations of models and theories as scientific representations of reality.	Students may demonstrate these performance standards by: ▪ Checking graphs to see that they correctly represent results by suing appropriate scales and by specifying axes clearly. ▪ Examining information and data about factors that contribute to global warming and formulating and discussing the conclusions. ▪ Using a microscope, thermometer, and stopwatch to determine the relationship between heart rate and temperature in *Daphnia.* ▪ Devising a series of simple tests to distinguish a group of unknown

Important to Know and Do	
10.9.2 The student will identify and communicate sources of unavoidable error. 10.9.3 The student will identify possible reasons for inconsistent results, such as sources or effort or uncontrolled conditions. 10.9.8 The student will recognize the cumulative nature of scientific evidence, analyze situations and solve problems that require combining and applying concepts from more than one area of science. 10.9.9 The student will investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. 10.9.10 The student will understand that when an observation does not agree with an accepted scientific theory, sometimes the observation is mistaken or fraudulent.	substances and using them to identify an unlabeled sample of one of the substances. ▪ Comparing the accuracy of data obtained with different equipment and explaining sources of error. ▪ Doing the same experiment five times and comparing the data before mathematically describing the extent of variation. ▪ Evaluating the accuracy of the reported data, given examples of experiments and results.
Worth Being Familiar With	
10.9.6 The student will read and interpret topographic and geologic maps. 10.9.7 The student will analyze the locations, sequences or time intervals of natural phenomena.	