Name of Course: AP Biology

Course Overview:
Course Overview: This course is aligned with the College Board AP Biology learning objectives, and emphasizes the components of all life, from the molecular level to the biosphere. The coursework is all designed to be at the same level as a college level introductory biology course for biology majors. We will explore the characteristics and diversity of life, the scientific method, cellular structure and function, systems of the human body, genetics, evolution, ecology, and climate change. Through reading, writing, inquiry-based assignments, reviews of current research, lab activities, class discussions, and projects, students investigate these topics and how they are relevant to their own health, heredity, and the environment we live in. We will also look at current biological advances and technology throughout each unit. In May, the expectation is that students will take the AP Biology exam. **Link to Learning Objectives (on course website):** https://sites.google.com/a/wocsd.org/whs-ap-biology/home/ap-biology-learning-objectives

Unit of Study	Essential Question(s)	Content/Skill/Concept	Instructional Strategies
Unit 1: Introduction to Principles of Biology	What are the pieces of evidence Darwin used to support his theory? How do we classify life, from the molecular level to ecological level?	Data collection and analysis; Classification of life; Evaluation of evidence for evolution; properties of water; pH and the impacts on life	Lab activities (water properties lab); direct instruction; evidence for evolution activity
Unit 2: Biochemistry and Introduction to the Cell	How does the structure of the different macromolecules relate to their function? What is the importance of the macromolecules in cell structure? How does the structure of a cell membrane relate to its function?	Structure of macromolecules; properties of phospholipids; understanding how macromolecule monomers form polymers; protein structure; understanding the dynamics of diffusion and osmosis involving a cell membrane Compare/contrast prokaryotic and eukaryotic cells	Lab activities (diffusion and osmosis: http://media.collegeboard.com/digitalServices/pdf/ap/bio-manual/Bio_Lab4-DiffusionandOsmosis.pdf): molecular modeling lab; bond types and their properties; direct instruction and practice problems involving water potential; Secret Life of the Cell video; Practicing biology problems
Unit 3: Cellular Energy and Related Processes	What is the importance of oxygen in the process of ATP production in relation to the electron transport chain and chemiosmosis? What are the similarities and differences	Structure and function of the mitochondria and chloroplast; glycolysis, fermentation and aerobic ATP production pathways; enzymatic reaction rates based on enzyme concentration; enzyme structure	Direct instruction; modeling of chloroplast and mitochondria with explanation of components; Enzymatic rate lab, with analysis of catalase amino acid sequence differences between organisms; Get

	concerning the components and processes in cell respiration and photosynthesis? What is the role of enzymes in cell processes, and how do they perform the role of a catalyst?	and influence of environment on enzyme function	A Five tutorials; ROVTYU's:(ReadOutlineVocabTestYourUnderstanding assignments) with post assignment discussion; Practicing Biology review
Unit 4: Cell Communication and the Cell Cycle	What are the major cell signaling pathways, and how do they control cell processes? What are the roles of cyclin, cdk, and p53 in controlling the cell cycle? How are protoncogenes and tumor supressor genes related to cancerous cells?	Relating cell signaling to cancer; knowing what processes take place in each phase of mitosis; importance of tumor supressor genes; understanding the process of generating a signal amplification; relating the importance of proteins to cell signaling	Cell signaling diagram explanations; direct instruction; Biozone content; cell cycle animated tutorials; Cancer: the Emperor of all Maladies-treatment option and choices patients must make: discussion; HHMI interactive site assignment:https://www.hhmi.org/biointeractive/eukaryotic-cell-cycle-and-cancer
Unit 5: Genetic Basis of Life	How did early experiments (Mendel) demonstrate the process of inheritance? What are some of the chromosomal disorders, and how do they connect to the process of meiosis?	Meiosis: oogenesis and spermatogenesis; using punnett squares to predict genotypic and phenotypic ratios; P, F1 and F2 generations- how traits can reappear in future generations; co- and incomplete dominance; chromosomal mutations	Direct instruction; Karyotype Analysis with "letter to the parents"; Mutation analysis; chi square analysis problems; Genetics of Drosophila lab; active modeling of the process of synapsis, crossing over, and independent assortment
Unit 6: Gene Activity and Biotechnology	What are the steps in the process of going from gene to protein? How is gene expression controlled in prokaryotes and eukaryotes? What are the steps in extracting, amplifying and analyzing a DNA sample?	Lab skills used during the transformation and gene extraction lab;; interpreting diagrams; describing the pathway from DNA to protein; understanding and explaining how inducible and repressible operons work; outlining how eukaryotic gene control is achieved	Direct instruction/discussion based on videos, animations (https://www.dnalc.org/resources/3d/central-dogma.html) and notes; modeling the operon; lab work Bacterial transformation lab (http://www.bio-rad.com/webroot/web/pdf/lse/literature/1660033.pdf) ACE gene extraction/analysis lab (Jackson Lab equipment/protocols)
Unit 7: **Evolution and Classification of Life**	What are the Darwinian and modern pieces of evidence supporting the theory of evolution? How can you mathematically determine if evolution is taking place in a population? How are organisms classified, and how can BLAST be used to determine evolutionary relationships between organisms?	Analysis of data using Hardy-Weinberg equation; comparing measurement data between hominid skull features; natural selection and the story of Darwin; process of speciation; cladograms; using BLAST to determine phylogenetic relationships; abiogenesis.	Allele frequency change activity https://www.radford.edu/~rsheehy/Gen_flash/popgen/; Hardy-Weinberg equations use practice; BLAST AP lab; measuring diagrams of primate features; cladogram activity; direct instruction-understanding geologic time (eras, periods), natural selection lab.

Unit 8: Diversity in the Biological World: Organism Form and Function	How does the body maintain homeostasis using feedback loops? How do the circulatory, renal and endocrine systems work together to maintain homeostasis? What is the pathway for specific immune responses involving B and T lymphocytes? What are the structure/function relationships related to nervous system functions? How do plants transport water, ions and sugars? How do plants use photoperiodism and tropisms to maintain homeostasis?	Using blood pressure as a measure of cardiovascular dynamics; understanding system interactions to produce a homeostatic outcome; applying knowledge of plant hormones to plant responses, including photoperiodism and tropisms; challenges to homeostasis, including autoimmune diseases and external threats such as disease causing bacteria and viruses.	Khan Academy; cardiovascular inquiry lab; Get A Fives; direct instruction; Bozeman Science, Biozone, animated tutorials.
Unit 9: Ecology	What are the characteristics of the different biomes on the earth? How do abiotic and biotic factors interact to support life? What is the relationship between the carbon cycle and climate change? How do humans impact the environment, leading to environmental issues for organisms, as well as humanity?	Analysis of data sets; research and presentation skills; understanding food webs and trophic levels; predicting consequences of rapid environmental change; understanding the environmental role of the nitrogen, phosphorous, water, and carbon cycles.	Direct instruction; Khan Academy; Get A Fives; student led presentations/discussions
