Independent School District of Boise City

Biology **District Course #: 1221**

Updated: 6/2025

Course Description:

- Open to: Grade 9-12 (**One-Year Course**) Prerequisite: Physical Science
- Content: This course content is divided into four core areas, cellular structure and function, genetics, evolution and ecology, and is taught from the perspective of the interdependence of organisms, thus preparing students for future environmental courses. Emphasis on laboratory investigations encourages students to make observations not only in the classroom, but also in the field. This course satisfies both district and state graduation requirements.

Scales

- Semester 1
- Semester 2

Adopted Materials:

- Biology Textbook: Biology (Authors: Johnson and Raven Publisher: Holt)
- Idaho Science Content Standards

First Semester:

Unit	Learning Intentions	Success Criteria (I Can …)	Suggested Vocabulary
Unit 1: Biochemistry	1) I am learning how carbon, hydrogen, oxygen, phosphorus, and nitrogen are used in living organisms.	● I can identify the macromolecules and a basic function of each. ○ Lipids ○ Carbohydrates ○ Nucleic Acids ○ Proteins ● I can identify the parts of the water molecule. ● I can identify what enzymes do in reactions. ● I can explain various functions of each	Atoms, elements, compound, covalent, ionic, hydrogen bond, polar solvent, adhesion, cohesion,enzymes, monomers and polymers, lipids, carbohydrates, nucleic acid, proteins, catalyst, metabolism, denatured, active site, substrate

		macromolecule and what elements they are composed of. ● I can explain why water is a polar molecule. ● I can explain how enzymes act as a catalyst. ● Given a scenario I can apply my knowledge of how macromolecules and water function in living organisms.	
Unit 2: Cell Organization, Structure and Function	1) I am learning the differences between eukaryotic and prokaryotic cells and viruses. 2) I am learning how living things maintain a stable internal environment (Homeostasis).	● I can differentiate between prokaryotes and eukaryotes. ● I can differentiate between animal and plant cells. ● I can differentiate between cells and viruses. ● I can identify characteristics of living things. ● I can identify which cell is which, explain how I know by differentiating organelles, and can give an example of each cell. ● I can differentiate between the cell types by explaining how their functions differ. ● I can explain the structural and functional differences between cells and viruses. ● I can define homeostasis. ● I can differentiate between passive and active transport. ● I can identify the parts of the cell membrane. ● I can model how cells maintain homeostasis and explain its significance in living organisms using cellular transport. ● I can explain the role the cell membrane plays in homeostasis. ● I can model examples of feedback to	Homeostasis, heredity, prokaryotes, eukaryotes, domain, extremophiles, binary fission, conjugation, transformation, autotroph, heterotroph, lytic cycle, lysogenic cycle, capsid, protein coat, bacteriophage, phospholipids, osmosis, diffusion

		maintain homeostasis. ● I can explain why homeostasis requires energy.	
Unit 3: Cellular Energy	1) I am learning how plants transform light energy into chemical energy. 2) I am learning how cells convert chemical energy into energy for cellular processes	● I can identify the locations that photosynthesis takes place. ● I can identify the reactants and products of photosynthesis. ● I can model the two processes of photosynthesis using the chemical equation. ● I can identify the reactants and products of the two stages of photosynthesis. ● I can explain the connections between photosynthesis and cellular respiration. ● I can identify the locations that cellular respiration takes place. ● I can identify the reactants and products of cellular respiration. ● I can model the three processes of cellular respiration using the chemical equation. ● I can identify the reactants and products of the three stages of cellular respiration. ● I can explain the connections between cellular respiration and photosynthesis.	Photosynthesis, Chloroplast, Thylakoid, Stroma, Light Dependent Reactions, Calvin Cycle, Chlorophyll pigments, ATP, NADPH, FADH, Glucose, Carbon dioxide, Water, Oxygen, Vascular Tissue, Xylem, Phloem, Stomata, Transpiration, Concentration Gradient ATP, NADH, metabolism, aerobic, anaerobic, homeostasis, glycolysis, Krebs Cycle, Electron Transport Chain, Lactic Acid, Ethanol Fermentation, mitochondria, concentration gradient
Unit 4: Cell Division	1) I am learning about how and why eukaryotic somatic cells divide.	● I can identify the stages of the cell cycle. ○ Gap 1 Phase ○ Synthesis Phase ○ Gap 2 Phase ○ Mitosis ○ Cytokinesis ● I can identify the stages of mitosis. ○ Prophase ○ Metaphase	Daughter cells, chromosomes, homologous chromosomes, autosomes, sex chromosomes, sister chromatid, asexual, sexual reproduction, gametes, haploid (n), diploid (2n), karyotype, tetrad, crossing over, nondisjunction, spindle fibers, centrioles

	2) I am learning how and why gametes are produced through meiosis.	○ Anaphase ○ Telophase ● I can identify an example of a somatic cell. ● I can explain what is happening in each phase of the cell cycle. ● I can construct a model of the cell cycle. ● I can explain the outcome of mitosis in somatic cells. ● I can analyze and explain consequences of errors in the process. ● I can identify the two divisions of meiosis. ○ Meiosis 1 ○ Meiosis 2 ● I can identify homologous chromosomes in a karyotype. ● I can identify the similarities and differences between mitosis and meiosis. ○ Crossing over ○ Independent assortment ○ Haploid vs Diploid ● I can identify and explain the phases of meiosis. ● I can explain why meiosis is used for sexual reproduction and analyze consequences of errors in the process. ● I can give evidence which process (mitosis or meiosis) results in more genetic variation.	

Second Semester:

Unit	Learning Intentions	Success Criteria (I Can …)	Suggested Vocabulary
Unit 5: DNA and Protein Synthesis	1) I am learning how DNA replicates and is used in the process of protein synthesis.	● I can identify the components of nucleic acids. ○ DNA ○ RNA ● I can create an accurate model of DNA and RNA. ● I can differentiate between DNA and RNA. ● I can identify the outcome of ○ DNA Replication ○ Transcription ○ Translation ● I can differentiate between the types of RNA, and identify the role of each in transcription and translation. ○ tRNA ○ mRNA ○ rRNA ● I can explain and model the process of DNA replication. ● When given a DNA sequence, I can create the correct amino acid sequence of the resulting protein using Transcription, Translation and a Codon chart. ● I can explain how mutations may alter proteins.	Deoxyribose Nucleic Acid, Nucleotide, Nitrogenous bases (A T C G & U), Sugar Phosphate Backbone, Complementary Base Pairs, DNA Replication, Helicase, DNA Polymerase, Mutations, RNA, Protein Synthesis, Transcription, Translation, RNA Polymerase, Messenger RNA, Transfer RNA, Codon, Anticodon, Genetic Engineering, Leading and Lagging strands, Replication fork, Okazaki fragments

Unit 6: Heredity Genetics	1) I am learning about how traits from the parental generation are passed on to successive generations.	• I can complete a monohybrid cross and determine genotype and phenotype ratios.
		• I can define the following :
		  ○ Complete dominance
		  ○ Complex patterns of inheritance
		  ■ Incomplete dominance
		  ■ Sex-linked traits
		  ■ Codominance
		  ■ Multiple alleles
		• I can read a pedigree chart:
		  ○ Male/Female
		  ○ Homozygous/Heterozygous alleles
		  ○ Generations
		• I can use evidence to explain complex patterns of inheritance.
		• I can complete a dihybrid cross and determine phenotypic ratios.
		• I can interpret a pedigree chart to identify patterns of inheritance.
			Gametes, dominant, recessive, purebred, homozygous, hybrid, heterozygous, genotype, phenotype, Punnett square, monohybrid, alleles, offspring generations (P, F1, F2), pedigree, dihybrid cross, codominant, incomplete dominant, sex-linked, multiple alleles, autosomal chromosomes.

Unit 7: Evolution	1) I am learning about how living things change over time. (micro)	• I can identify an example of natural and artificial selection.
		• I can differentiate between variation and adaptation.
		• I can define:
		  ○ Mutation
		  ○ Variation
		  ○ Adaptation
		  ○ Natural selection
		  ○ Artificial selection
		  ○ Species
		  ○ Genetic biodiversity
		• I can explain natural selection.
		  ○ Variation
		  ○ Adaptation
		• I can explain the similarities and
			Evolution, Charles Darwin, Fitness, Structural Adaptations, Natural Selection, Homologous Structures, Vestigial Structures, analogous structures, Embryonic Development as Evidence, Fossils, DNA Analysis to Relatedness, Speciation, Reproductive Isolation, Geographic Isolation, Gene Pool, Genetic Drift, Gene Flow, Types of Selection, Reproductive Barriers, Gradualism, Punctuated Equilibrium, Taxonomy, Binomial Nomenclature, Phylogeny, Cladogram.

	2) I am learning about how new species are formed. (macro)	differences between artificial and natural selection. ● I can explain how genetic biodiversity leads to natural selection. ● I can define: ○ Isolation ○ Speciation ○ Extinction ○ Population ○ Homologous structure ○ Analogous structure ○ Phylogeny ○ Species biodiversity ● I can identify sources of evidence for evolution. ● I can provide examples of how new species form based on changes in the environment. ● I can draw conclusions about how changes in the environment can cause extinction of a species. ● I can interpret a phylogenetic tree. ● Using evidence I can explain: ○ Descent with modification (common ancestor). ○ How genetic biodiversity leads to species biodiversity.	
Unit 8: Ecology	1) I am learning about how matter and energy moves through ecosystems.	● I can define ○ Ecology ○ Habitat ○ Niche ○ Trophic levels ● I can identify abiotic & biotic factors in the environment. ● I can identify producers and consumers of various levels in the environment.	Ecology, biotic, abiotic, habitat, exponential and logistic growth curves, density dependent**,** density independent**,** carrying capacity, nitrogen, carbon, phosphorus, trophic, detritivores, biomass, pyramids, food web, biomes (terrestrial and aquatic), pioneer species, climax community, primary, secondary succession, commensalism, mutualism, parasitism,

	2) I am learning about the role of biodiversity in ecosystems.	● I can explain how biotic and abiotic factors interact in an ecosystem. (carbon, nitrogen, phosphorus and water) ● I can model the rule of 10% energy transfer. (Food webs and trophic pyramids) ● I can explain the niche of an organism in their habitat. ● I can explain how a change in an environment will impact the ecosystem. (ex. trophic cascade) ● I can define ○ Population ○ Community ○ Ecosystem ○ Biome ○ Limiting factors ○ Competition ○ I can identify an example of symbiotic relationship (commensalism, mutualism, parasitism, predator/prey) ● I can explain the role of limiting factors in competition. ● I can explain the role of competition in the niche formation. ● I can explain how populations interact in communities. ● I can explain the health of an ecosystem (Biodiversity). ● I can explain positive and negative human impacts on the health of ecosystems.	parasitoid, niche, carnivores, herbivores, omnivores, decomposers, predator/prey, competition, resource partitioning.

NGSS SCIENCE and ENGINEERING PRACTICES EXPLAINED:

Practice 1 Asking Questions and Defining Problems:
Students should be able to ask questions of each other about the texts they read, the features of the phenomena they observe, and the conclusions they draw from their models or scientific investigations. For engineering, they should ask questions to define the problem to be solved and to elicit ideas that lead to the constraints and specifications for its solution.

Practice 2 Developing and Using Models:
Modeling can begin in the earliest grades, with students' models progressing from concrete "pictures" and/or physical scale models (e.g., a toy car) to more abstract representations of relevant relationships in later grades, such as a diagram representing forces on a particular object in a system.

Practice 3 Planning and Carrying Out Investigations:
Students should have opportunities to plan and carry out several different kinds of investigations during their K-12 years. At all levels, they should engage in investigations that range from those structured by the teacher—in order to expose an issue or question that they would be unlikely to explore on their own (e.g., measuring specific properties of materials)—to those that emerge from students' own questions.

Practice 4 Analyzing and Interpreting Data:
Once collected, data must be presented in a form that can reveal any patterns and relationships, and that allows results to be communicated to others. Because raw data as such have little meaning, a major practice of scientists is to organize and interpret data through tabulating, graphing, or statistical analysis. Such analysis can bring out the meaning of data—and their relevance—so that they may be used as evidence. Engineers, too, make decisions based on evidence that a given design will work; they rarely rely on trial and error. Engineers often analyze a design by creating a model or prototype and collecting extensive data on how it performs, including under extreme conditions. Analysis of this kind of data not only informs design decisions and enables the prediction or assessment of performance, but also helps define or clarify problems, determine economic feasibility, evaluate alternatives, and investigate failures.

Practice 5 Using Mathematics and Computational Thinking:
Although there are differences in how mathematics and computational thinking are applied in science and in engineering, mathematics often brings these two fields together by enabling engineers to apply the mathematical form of scientific theories and by enabling scientists to use powerful information technologies designed by engineers. Both kinds of professionals can thereby accomplish investigations and analyses and build complex models, which might otherwise be out of the question.

Practice 6 Constructing Explanations and Designing Solutions:
"The goal of science is the construction of theories that provide explanatory accounts of the world. A theory becomes accepted when it has multiple lines of empirical evidence and greater explanatory power of phenomena than previous theories. Asking students to demonstrate their own understanding of the implications of a scientific idea by developing their own explanations of phenomena, whether based on observations they have made or models they have developed, engages them in an essential part of the process by which conceptual change can occur.

Practice 7 Engaging in Argument from Evidence:
The study of science and engineering should produce a sense of the process of argument necessary for advancing and defending a new idea or an explanation of a phenomenon and the norms for conducting such arguments. In that spirit, students should argue for the explanations they construct, defend their interpretations of the associated data, and advocate for the designs they propose.

Practice 8 Obtaining, Evaluating, and Communicating Information:
Any education in science and engineering needs to develop students' abilities to read and produce domain-specific text. As such, every science or engineering lesson is in part a language lesson, particularly reading and producing the genres of texts that are intrinsic to science and engineering.