

COMMUNITY UNIT SCHOOL DISTRICT 200

Science Curriculum Philosophy

Science instruction focuses on the development of inquiry, process and application skills across the grade levels. As the grade levels increase, the student will encounter ascending levels of difficulty and complexity. Students will additionally experience the variety of scientific disciplines as they progress through the secondary grades.

Biology **High School** **Intermediate Level**

- 1. Subject Expectation (State Goal 11) Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments, and solve problems.**

Essential Learning 1 (Learning Standard 11A)	Know and apply the concepts, principles, and processes of scientific inquiry.
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| Critical Content | 11.A.4a | Make observations and formulate hypothesis referencing prior research and knowledge. <ul style="list-style-type: none">• conduct background research prior to formulating hypotheses• give examples of hypotheses that are based on prior research or knowledge• formulate a hypothesis using an if-then, cause-effect statement• predict an outcome in a hypothesis statement• investigate reports of research (e.g., periodicals, web pages) to formulate hypotheses |
| | 11.A.4b | Design and conduct controlled experiments or simulations to test hypotheses. <ul style="list-style-type: none">• describe experiment to demonstrate understanding of terms such as<ul style="list-style-type: none">– control– dependent and independent variables– experimental error• explain steps necessary to test one's stated hypothesis considering such factors as<ul style="list-style-type: none">– equipment availability– student familiarity• design and conduct an experiment with a test group and a control group to test a hypothesis |
| | 11.A.4c | Collect, organize, and analyze data accurately and precisely (metric system). <ul style="list-style-type: none">• distinguish appropriate instruments for gathering data• interpret data from collecting instruments• explain and organize data on a variety of tables, graphs, and charts |

- analyze data from different types of graphs or tables to present findings objectively
- 11.A.4d Apply statistical methods and analysis to the data to reach and support conclusions in a qualitative and quantitative manner using basic algebra and graphing techniques.
- analyze data using paper and pencil
 - graph data appropriately to show relation of variables in hypotheses (e.g., line graphs for change over time)
- 11.A.4e Formulate alternative hypothesis to explain results.
- explain and summarize possible sources of error while performing the experiment and formulate an alternative hypothesis
- 11.A.4f Use available technology to report, display, and defend conclusions.
- explain a report of the design, procedures, test results
 - available technology includes:
 - calculators
 - lab equipment
 - presentation tools
 - research resources
 - computers

2. Subject Expectation (State Goal 12) Understand the fundamental concepts, principles, and interconnections of life sciences.

Essential Learning 1 (Learning Standard 12A) Know and apply concepts that explain how living things function, adapt, and change.

- Critical Content 12.A.3a Know how cells function as “building blocks” or organisms and describe the requirements for cells to live.
- identify the many functions cells carry on to sustain life
 - explain how specialized cells perform specialized functions in multi-cellular organisms
 - investigate and discuss examples of cells working together to keep the organism alive (e.g. tissues, organs)
- 12.A.4a Explain how genetic combinations produce visible effects and variations among physical features and cellular functions of organisms.
- list and describe the phases of meiosis
 - distinguish the differences between Mendelian and Non-Mendelian genetics
 - monohybrid crosses
 - dihybrid crosses
 - multiple alleles
 - incomplete dominance
 - codominance
 - X-linkage

- chromosomal variation
 - describe how mutations occur and give examples
 - genetic diseases
 - chromosomal variations
 - compare DNA molecular structure (e.g. genes, chromosomes)
 - describe the structure and function of DNA
 - compare the genes of homologous chromosomes
 - use examples of genetic recombination (e.g., crossing over, non-disjunction) and gene mutation (e.g., point, substitution and deletion)
- 12.A.5a Explain changes within cells and organisms in response to stimuli and changing environmental conditions.
- homeostasis
 - dormancy
- 12.A.3b Know the characteristics of organisms produced from a singular parent (asexual) with those organisms produced by two parents (sexual).
- explain asexual and sexual reproduction
 - differentiate between characteristics of organisms produced by single parent and those produced by two parents
 - summarize how every organism requires a set of instructions for specifying its traits
- 12.A.4b Describe the structures and organization of cells and tissues that underlie basic life functions including nutrition, respiration, cellular transport, biosynthesis, and reproduction.
- describe the elements and compounds necessary for life
 - examine the role and importance of cellular respiration
 - describe how the cell uses active and passive transport, membrane channels, and endocytosis and exocytosis maintaining homeostasis, importing required molecules, and exporting products and wastes
 - explain the processes of protein synthesis and enzyme activity and their roles in the normal function of the cell.
 - explain the levels of organization
- 12.A.4c Describe processes by which organisms change over time using evidence from comparative anatomy and physiology, the fossil record, genetics, and biochemistry.
- give examples of how changes in form and structure are related to adaptations to changes in the environment

Essential Learning 2 (Learning Standard 12B)	Know and apply concepts that describe how living things interact with each other and with their environment.
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- Critical Content 12.B.4a Know how environmental interactions and interdependencies or organisms are influenced by its physical, ecological and behavioral factors.
- identify the differences between the biotic(living) and

- abiotic (nonliving) factors of an ecosystem
 - explain the flow of energy through an ecosystem using
 - food chains
 - food web
 - energy pyramid
 - analyze the concept of biodiversity and its impact on healthy ecosystems
- 12.B.4b Know the factors that influence the size and stability of populations within ecosystems.
- population genetics
 - field studies
 - sampling techniques
 - data collection

**3. Subject Expectation
(State Goal 13)**

Understand the relationships among science, technology, and society in historical and contemporary contexts.

**Essential Learning 1 Know and apply the accepted practices of science
(Learning Standard 13A)**

- Critical Content 13.A.4a Estimate and suggest ways to reduce the degree of risk in science activities.
- describe safety procedures associated with specific activities
 - demonstrate proper procedures while conducting a specific activity
 - safety contract
 - safety assessment
- 13.A.4b Assess the validity of lab results including sample size and potential sources of error as related to technology.
- demonstrate how keeping accurate data, comparing results with those of others and analyzing conclusions can improve the validity of scientific data
 - explain why sample set, sample size and misrepresentation of data can affect the validity of the results of an investigation
 - sample size
 - class sets of data
 - number of trials
 - awareness of limitations of measurement tools
- 13.A.4c Recognize that scientific knowledge may change with new information over time.
- explain how changes in technology, changes in public opinion, research, and cultural development can improve over time
 - describe how a technological advance has improved the quality of life

- 13.A.4d Explain how peer review helps to assure the accurate use of data and improves the scientific process.
- explain different points of view determined by historic, cultural, economic, and intellectual factors and how they influence the scientific process
 - group work
 - discuss, present, or debate a problem or question
 - select a peer review process to assure quality of data and conclusions drawn from an investigation

Essential Learning 2 (Learning Standard 13B)	Know and apply concepts that describe the interaction between science, technology, and society.
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- Critical Content
- 13.B.4a Compare and contrast scientific inquiry and technological design as pure and applied sciences.
- explain why scientific inquiry is a process and tech design is an application
- 13.B.5b Analyze and describe the processes and effects of scientific and technological breakthroughs.
- provide examples of the role that perseverance plays in scientific discovery
 - explain how the relationships between science and technology impact and advance one another