

# 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**

### **Regular 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 | <p>11.A.4a Make observations and formulate hypothesis referencing prior research and knowledge.</p> <ul style="list-style-type: none"> <li>• conduct background research prior to formulating hypotheses</li> <li>• formulate a hypothesis using an if-then, cause-effect statement</li> <li>• predict an outcome in a hypothesis statement</li> </ul> <p>11.A.4b Design and conduct controlled experiments or simulations to test hypotheses.</p> <ul style="list-style-type: none"> <li>• describe and conduct experiments to demonstrate understanding of terms such as               <ul style="list-style-type: none"> <li>– control</li> <li>– dependent and independent variables</li> <li>– experimental error</li> </ul> </li> </ul> <p>11.A.4c Collect, organize, and analyze data accurately and precisely (metric system).</p> <ul style="list-style-type: none"> <li>• distinguish appropriate instruments for gathering data</li> <li>• interpret data from collecting instruments</li> <li>• explain and organize data on a variety of tables, graphs and charts</li> <li>• analyze data from different types of graphs or tables to present findings objectively</li> </ul> <p>11.A.4d Apply statistical methods and analysis to the data to reach and support conclusions in a qualitative manner, using simple relationships and charts.</p> <ul style="list-style-type: none"> <li>• analyze data using paper and pencil</li> <li>• graph data appropriately to show relation of variables in hypotheses (e.g., line graphs for change over time)</li> </ul> |
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- 11.A.4e Formulate alternative hypothesis to explain results.
- 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 explain how cells work 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
  - explain the difference between Mendelian and non-Mendelian genetics
    - monohybrid crosses
    - multiple alleles
    - incomplete dominance
    - codominance
    - X-linkage
  - describe how mutations can occur
    - genetic diseases
    - chromosomal variations
  - explain the principal function of DNA
  - describe the structure of DNA
  - summarize the process of protein synthesis
- 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.
- discuss the elements and compounds necessary for life
  - biomolecules
  - examine cellular energy, metabolism, and processes
    - biochemistry of photosynthesis and respiration
  - 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.**

- Critical Content      12.B.4a Know how environmental interactions and interdependencies of organisms are influenced by its physical, ecological and behavioral factors.
- identify the biotic and abiotic factors of an ecosystem
  - explain the flow of energy through an ecosystem using
    - food chains,
    - food web
    - energy pyramid
  - analyze how the ecological health of an ecosystem is determined by the extent of its biodiversity
- 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 (Learning Standard 13A) Know and apply the accepted practices of science.**

Critical Content	13.A.4a	Estimate and suggest ways to reduce the degree of risk in science activities. <ul style="list-style-type: none"> <li>• describe safety procedures associated with specific activities</li> <li>• demonstrate proper procedures while conducting a specific activity</li> </ul>
	13.A.4b	Assess the validity of lab results including sample size and potential sources of error as related to technology. <ul style="list-style-type: none"> <li>• explain why sample set, sample size and misrepresentation of data can affect the validity of the results of an investigation</li> <li>• demonstrate how keeping accurate data, comparing results and analyzing conclusions can improve validity of data</li> </ul>
	13.A.4c	Recognize that scientific knowledge may change with new information over time. <ul style="list-style-type: none"> <li>• explain how changes in technology, changes in public opinion, research and cultural development can improve over time</li> <li>• describe how a technological advance has improved the quality of life</li> </ul>
	13.A.4d	Explain how peer review helps to assure the accurate use of data and improves the scientific process. <ul style="list-style-type: none"> <li>• explain different points of view determined by historic, cultural, economic and intellectual factors and how they influence the scientific process</li> <li>• select a peer review process to assure quality of data and conclusions drawn from an investigation</li> </ul>

<b>Essential Learning 2 (Learning Standard 13B)</b>	<b>Know and apply concepts that describe the interaction between science, technology, and society.</b>
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Critical Content	13.B.3a	Recognize the impact of science and technology on society.
	13.B.3b	Identify important contributions to science and technology that have been made by individuals and groups from various cultures.
	13.B.3c	Describe how occupations use scientific and technological knowledge and skills.