

CURRICULUM

GUIDE

Biology

Providence
Schools

Background

Providence Schools teachers and administrators worked collaboratively with consultants from the Charles A. Dana Center at the University of Texas at Austin to develop the mathematics and science curriculum frameworks. The curriculum frameworks encompass two critical questions:

- Content Standards that establish clearly defined expectations for all students, helping to answer the question, ***What do students have to learn?***
- Performance Standards that determine performance expectations for content standards, helping to answer the question, ***How well do the students have to learn it?***

The curriculum framework provides a work plan that directs the instruction delivered in every classroom in every school in the district. Instruction—the way the curriculum is presented to students—will focus on the needs of students.

Purpose and Use of Curriculum Guides

Curriculum Guides for the curriculum for each grade and subject outline the approximate number of days that each unit in the curriculum will be taught; describe the content to be learned; and list the essential questions that students should be able to answer by the end of the unit.

Parents should become familiar with the Curriculum Guides. You should know when your child is being taught different topics. You should also know the essential questions that your child should be able to answer by the end of each unit.

It is important that you understand that you do not have to be familiar with the content that your child is learning in order to help them with their studies. There are basic questions that you can ask to determine if your child understands the content.

Ask your child what she is learning in each subject
Does she understand the topic? Is the unit exciting or boring?
What specifically does she like or dislike about the topic?
Does she understand how the topic relates to the real world?

You know your child better than anyone. You will be able to tell if she or he is benefiting from the instruction and understanding the content of the material by the way they answer you. Speak to your child's teacher if you suspect there is a problem.

Ask your child about his assignments

What is the required work? Has he finished the work on time? Is he having difficulty? If he is having difficulty, why?

Encourage your child to talk to her teachers if she is having difficulty understanding a concept or completing an assignment. If your child continues to experience difficulty, speak to the teacher yourself so that the two of you can work together to support your child.

Even if you do not understand the content that your child is learning, the fact that you are showing interest in his or her school work and believe that it is important that he or she does well sends a powerful message.

Sharon Contreras
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QUARTER I

Content students will be learning

Essential questions students should be able to answer by end of unit

Unit 1.1 - Ecosystems (12 Days)

- Understand the relationship between photosynthesis, cellular respiration, and the transfer of energy in an ecosystem.
- Understand how changes in an ecosystem can affect the amount of energy at each trophic level.
- Analyze the flow of matter and energy through trophic levels and between organisms.

- » How would the removal of a predator in an ecosystem change the available amount of energy at each trophic level?
- » How do energy and matter move through the biogeochemical cycles?
- » How do the processes of photosynthesis and cellular respiration work together to cycle matter through an ecosystem?
- » How does widespread flooding or extreme drought affect the cycling of matter and the flow of energy in an ecosystem?

Unit 1.2 - Evolution of Ecosystems (10 Days)

- Determine that the locations of mountain ranges, recent earthquakes, and volcanic eruptions can be used to identify patterns in earth systems.
- Understand that natural events can lead to changes in an ecosystem.
- Identify a climax community and understand how an ecosystem maintains equilibrium.
- Examine environmental disruptions and relate them to primary & secondary succession.
- Illustrate the relationships between environmental disruptions and natural selection/ evolution.

- » What is the relationship of volcanic activity, earthquakes, and plate tectonics to the location of mountain ranges?
- » How can succession within an ecosystem be affected by a catastrophic event such as a volcanic eruption or an earthquake?
- » How can an ecosystem regain equilibrium after a catastrophic event?
- » How can environmental disruptions result in the extinction of some populations and evolution of organisms?

Unit 1.3 - Collecting Data from Ecosystems (10 Days)

- Understand that valid and relevant evidence is needed to identify potential biases in media sources.
- Understand that logical arguments about environmental issues depend on the appropriate use and interpretation of scientific data.
- Recognize that human events and activities can affect the flow of energy or cycling of matter in an ecosystem.

- » What are some human activities that affect the equilibrium of an ecosystem as it relates to soil, water, and air quality?
- » How can data be used to develop logical arguments concerning environmental issues?
- » How do human activities such as population growth, habitat disruption, agricultural practices, industrialization, and use of energy technologies affect ecosystems?

Unit 1.4 - Humans and the Ecosystem (7 Days)

- Understand that human demands on an ecosystem (ecological footprint) have an impact on all living organisms.
- Recognize that sustainability of organisms depends on the survival of diverse ecosystems.

- » How do humans affect the environment and the organisms in it?
- » What is the relationship between a gradual increase in global temperatures and climate change?
- » How can new technologies minimize some environmental problems that could affect our world?
- » What are the signs and sources of global warming?

QUARTER 2

Content students will be learning

Essential questions students should be able to answer by end of unit

Unit 2.1 - Specialized Structures in a Cell (12 Days)

- Describe the structures and functions of cell organelles found in prokaryotic and eukaryotic cells.
- Investigate and identify cellular processes that maintain a stable condition (homeostasis).
- Understand how the structures of cellular organelles complement their functions.

- » What is the relationship between the structure of an organelle and its function?
- » Why are cells with membrane-bound organelles able to carry on many more functions than cells without membrane-bound organelles?
- » What would be the effect on homeostasis if the semi-permeable membranes surrounding the organelles became impermeable?
- » How does the plasma (cell) membrane maintain the integrity of the cell both structurally and functionally?

Unit 2.2 - Unicellular and Multicellular Specialization (9 Days)

- Recognize that unicellular organisms have subcellular structures that perform functions that enable them to survive and reproduce.
- Understand that multicellular organisms have specialized cells that perform functions that enable the organism to survive and reproduce.
- Understand that unicellular organisms have subcellular structures that perform functions similar to the function of specialized cells in multicellular organisms.
- Recognize the importance of specialization of cells to the survival of multicellular organisms.

- » How does cell specialization benefit a multicellular organism?
- » How does a unicellular organism survive when an individual cell from a multicellular organism cannot?
- » How do the subcellular structures in a unicellular organism compare to the specialized cells in multicellular organisms?

Unit 2.3 - Cell Cycle (9 Days)

- Describe the stages of mitosis and their relationship to the cell cycle.
- Understand the significance of mitosis to unicellular and multicellular organisms.
- Describe the stages of meiosis.
- Understand the significance of meiosis in contributing to genetic variation of offspring.

- » What is the evolutionary significance of the genetic variation that results from meiosis?
- » Why do complex organisms like humans undergo both mitosis and meiosis?
- » What are the advantages and disadvantages of reproduction by mitosis?

Unit 2.4 - Factors that Affect Homeostasis (9 Days)

- Understand that the human body systems—nervous, immune, and endocrine—interact to maintain homeostasis.
- Understand that homeostasis in humans is affected by external and internal environmental changes.
- Recognize that feedback mechanisms work to maintain homeostasis in the human body.
- Recognize that a disruption of homeostasis in human body systems can be a cause of human disease.

- » How do the endocrine, nervous, and immune systems work together to maintain homeostasis in the human body?
- » How do external and internal environmental factors impact homeostasis of the human body? What are some ways that the human body responds to changes in external temperature?
- » What are some ways that the human body responds to internal changes such the presence of excess salt?
- » How are negative feedback loops different from positive feedback loops?

QUARTER 3

Content students will be learning

Essential questions students should be able to answer by end of unit

Unit 3.1 - Classical Genetics (11 Days)

- Understand the mechanisms that allow genetic information to be passed from parent to offspring.
- Make predictions using models about phenotypes and genotypes from genetic crosses.
- Understand and explain how meiosis can produce gametes that are genetically different from the parent cells.

- » How does the information provided by Punnett squares explain variation in offspring?
- » What happens during the process of meiosis that results in the formation of gametes that are genetically different from the parent cells?
- » Why is meiosis so evolutionarily important?

Unit 3.2 - DNA Structure (10 Days)

- Recognize components of DNA and understand how the information for specifying the traits of an organism is carried in the DNA.
- Use models of DNA to explain replication.
- Understand that chromosomes are made up of genes that are determined by the sequence of bases in DNA.

- » How does complementary base pairing contribute to the production of a copy of DNA that can be passed from parent to daughter cell?
- » Why do the chromosomes need to be relaxed during replication but coiled up during cell division?
- » What are the similarities and differences between genes, chromosomes, and histones?
- » What is the relationship between DNA replication and the cell cycle?

Unit 3.3 - Protein Synthesis (9 Days)

- Understand the processes (transcription and translation) that result in the production of proteins.
- Understand that our current understanding of gene expression is the result of multiple scientific discoveries.

- » How have advances in technology advanced our understanding of the inheritance of traits?
- » How are proteins created by the cell?
- » What is meant when we say, “genes are expressed”?

Unit 3.4 - Mutations (7 Days)

- Understand that a change in the genetic code (mutations) can have varying effects on an organism’s phenotype.
- Recognize how some environmental factors cause changes in the DNA sequence.

- » How can a change in an organism’s environment cause a mutation in its DNA?
- » Why don’t all genetic mutations contribute to genetic variations?

Unit 3.5 - Genetic Engineering and Selective Breeding (10 Days)

- Understand that changes in traits can be the result of selective breeding and genetic engineering.
- Understand that selective breeding and genetic engineering of food products can be beneficial or detrimental to the environment, personal health, and the economy.

- » How has our understanding of genetics changed our source of food from subsistence farming to corporate farming?
- » How do the benefits gained from genetically modifying foods compare to their disadvantages?

QUARTER 4

Content students will be learning

Essential questions students should be able to answer by end of unit

Unit 4.1 - Evolution: History and Evidence (11 Days)

- Understand that the diversity of organisms on Earth is the result of natural selection and evolution.
- Recognize that the modern theory of evolution is based on the contributions of scientists who worked in various scientific disciplines.
- Recognize that data and technology have enhanced our understanding of plate tectonics, which provides further evidence of evolution.

- » How can the geographic location of a species be a contributing factor in natural selection and evolution?
- » How can geographic isolation and adaptive radiation be used to support the theory of evolution?
- » How has the work of scientists in geology, biology, and ecology contributed to our current understanding of evolution?
- » How has the understanding of plate tectonics provided evidence for the theory of evolution?

Unit 4.2 - Evolution: Mechanisms (8 Days)

- Understand that microevolution and macroevolution can account for speciation and extinction.
- Recognize that sudden or gradual changes in the environment affect the rate of the evolution of a species or population.
- Understand that a change in an environment will cause a range (advantage, disadvantage, or no impact) of adaptive pressures on an organism.

- » How do variation, selection pressures (biotic and abiotic), and relative reproductive success lead to evolution of a species?
- » How does punctuated equilibrium differ from a more gradual model of evolution?
- » How can a change in an organism's environment alter its relative fitness?
- » How do scientists justify the statement that populations rather than individuals evolve?

Unit 4.3 - Evolution: Classification (11 Days)

- Recognize that organisms can be organized into a hierarchy of groups and subgroups based on evolutionary relationships.
- Understand how to use taxonomic keys to analyze evolutionary relationships among organisms.
- Recognize the patterns found in molecular and fossil evidence used to explain natural selection and its evolutionary consequences.

- » How do the patterns found in molecular and fossil evidence support our current understanding of natural selection and evolution?
- » What are some advantages of placing organisms into a hierarchy of groups and subgroups based on their evolutionary relationships?
- » How can taxonomic keys reveal relationships between organisms?



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